Midwest Vegetable Production Guide for Commercial Growers 2021

Illinois

University of Illinois Extension Bulletin C1373-20
extension.cropsciences.illinois.edu/

Indiana

Purdue Extension Bulletin ID-56
ag.purdue.edu/hla/extension/

Iowa

Iowa State University Extension Bulletin FG 0600
extension.iastate.edu/

Kansas

Kansas State University Extension Bulletin MF3279
ksre.k-state.edu/

Michigan

Michigan State University Extension Bulletin E0312
canr.msu.edu/agriculture/

Minnesota

University of Minnesota Extension Bulletin BU-07094-S
https://extension.umn.edu/

Missouri

University of Missouri Extension Bulletin MX384
https://extension.missouri.edu/
Lincoln University of Missouri Cooperative Extension Bulletin LUCER 01-2020
lincolnu.edu/web/extension-and-research/lucer

Ohio

The Ohio State University Extension Bulletin 948
u.osu.edu/vegnetnews/

The guide is new and improved online!
For the most up-to-date version of this publication, visit www.mwvguide.org.
Changes will be made throughout the year as they are received.
Acknowledgments and Disclaimers

The guide was supported by the USDA National Institute of Food and Agriculture, Crop Protection and Pest Management Program through the North Central IPM Center (2018-70006-28883), MSU Extension, and donations from the Michigan Vegetable Council, the Indiana Vegetable Growers Association, and the Kansas Vegetable Growers Association. For full print version see http://mwveguide.org/guide. The management practices, products, and cultivars discussed in this publication are the research- and experience-based recommendations of the institutions associated with the contributing editors and authors. These recommendations are not exhaustive and other practices and products not mentioned in this guide might also be effective. Read and follow label instructions before using any pesticide product.

Insect, disease, and weed control recommendations in this publication are valid only for 2021. If registration for any of the chemicals suggested is changed during the year since the time of publication (December 2020), we will inform all area and county Extension staff. If in doubt about the use of any chemical, check with your Extension agent or chemical company representative.

The information presented in this publication is believed to be accurate but is in no way guaranteed. The authors, reviewers, publishers, and their institutions assume no liability in connection with any use for the products discussed and make no warranty (expressed or implied) in that respect. Nor can it be assumed that all safety measures are indicated herein or that additional measures may be required. The user, therefore, must assume full responsibility, both as to persons and as to property, for the use of these materials including any that might be covered by patent. Always refer to the pesticide labels before each application. If the label information is different than the information presented in this guide, always follow the label.

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**Letter to Readers**

What a year to take over as Executive Editor of this guide! Dan Egel has been the executive editor all these years, and I fully appreciate his efforts managing this massive production every fall. Thanks, Dan!

Now that the pandemic has effectively canceled in-person winter meetings for 2021, so it has also cancelled all the best opportunities to sell the printed guide. So, we are not printing a big run this year.

We have the database-driven digital guide now at [www.mwveguide.org](http://www.mwveguide.org) that gives you an opportunity to make specific queries of crops, pests and controls online. There is also a function that allows you to export and print a pdf of that specific query.

Our programmer wrote up a script to query our database to basically string the printed guide together this year, and we are offering it as something that can be printed by chapter, or in whole as downloadable pdfs at [www.mwveguide.org/guide](http://www.mwveguide.org/guide).

Don’t have a printer? No problem. We are experimenting with print on demand services this winter. If you want to have it printed and bound, you can bring the file to a local printer on a thumb drive and have it put together for you there. Alternatively, you can mail order on-demand spiral-bound copies at [www.thebookpatch.com/bookstore](http://www.thebookpatch.com/bookstore) and searching “midwest vegetable”.

I wish you a safe winter and 2021 season.

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<td>231-873-2129</td>
<td><a href="mailto:werlingb@msu.edu">werlingb@msu.edu</a></td>
</tr>
<tr>
<td>Michael Reinke</td>
<td>Integrated Pest Management</td>
<td>Statewide</td>
<td>573-239-0808</td>
<td><a href="mailto:reinkem2@msu.edu">reinkem2@msu.edu</a></td>
</tr>
<tr>
<td>Phil Tocco</td>
<td>Food Safety</td>
<td>Statewide</td>
<td>517-788-4292</td>
<td><a href="mailto:tocco@msu.edu">tocco@msu.edu</a></td>
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<tr>
<td>Michigan Campus Staff</td>
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<tr>
<td>Dan Brainard</td>
<td>Horticulture</td>
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<td>517-353-0417</td>
<td><a href="mailto:brainar9@msu.edu">brainar9@msu.edu</a></td>
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<tr>
<td>Mary Hausbeck</td>
<td>Plant Pathology</td>
<td>Statewide</td>
<td>517-355-4534</td>
<td><a href="mailto:hausbec1@msu.edu">hausbec1@msu.edu</a></td>
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<tr>
<td>Zachary Hayden</td>
<td>Soil Science</td>
<td>Statewide</td>
<td>517-353-0410</td>
<td><a href="mailto:haydenza@msu.edu">haydenza@msu.edu</a></td>
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<tr>
<td>Vikki Morrone</td>
<td>Organic Farming</td>
<td>Statewide</td>
<td>517-282-3557</td>
<td><a href="mailto:sorrone@msu.edu">sorrone@msu.edu</a></td>
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<tr>
<td>Marisol Quintanilla</td>
<td>Nematology</td>
<td>Statewide</td>
<td>517-884-2058</td>
<td><a href="mailto:marisol@msu.edu">marisol@msu.edu</a></td>
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<tr>
<td>Zsofia Szendrei</td>
<td>Entomology</td>
<td>Statewide</td>
<td>517-974-8610</td>
<td><a href="mailto:szendrei@msu.edu">szendrei@msu.edu</a></td>
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<tr>
<td>Sushila Chaudhari</td>
<td>Weed Science</td>
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<td>517-353-0447</td>
<td><a href="mailto:sushilac@msu.edu">sushilac@msu.edu</a></td>
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<tr>
<td>Michigan Services</td>
<td>Address</td>
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<tr>
<td>Plant Pest Clinic</td>
<td>578 Wilson Rd., Rm. 107,</td>
<td>517-355-4536</td>
<td><a href="mailto:pestid@msu.edu">pestid@msu.edu</a></td>
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<tr>
<td>Soil Testing Lab</td>
<td>1066 Bogue St., Rm. A81,</td>
<td>517-355-0218</td>
<td><a href="mailto:spnlab@msu.edu">spnlab@msu.edu</a></td>
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<tr>
<td>Anthony Hanson</td>
<td>Field Crops IPM</td>
<td>Statewide</td>
<td>320-589-1711</td>
<td><a href="mailto:hans4022@umn.edu">hans4022@umn.edu</a></td>
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<tr>
<td>Natalie Hoidal</td>
<td>Fruit and Vegetable</td>
<td>Statewide</td>
<td>612-625-9111</td>
<td><a href="mailto:hoida016@umn.edu">hoida016@umn.edu</a></td>
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<tr>
<td>Annie Klodd</td>
<td>Fruit and Vegetable</td>
<td>Statewide</td>
<td>651-480-7723</td>
<td><a href="mailto:kloddahn@umn.edu">kloddahn@umn.edu</a></td>
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<tr>
<td>Marissa Schuh</td>
<td>Fruit and Vegetable IPM</td>
<td>Statewide</td>
<td>651-480-7732</td>
<td><a href="mailto:mschuh@umn.edu">mschuh@umn.edu</a></td>
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<tr>
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<tr>
<td>Roger Becker</td>
<td>Agronomy, Weed Science</td>
<td>Statewide</td>
<td>612-625-5753</td>
<td><a href="mailto:becke003@umn.edu">becke003@umn.edu</a></td>
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<tr>
<td>Eric Burkness</td>
<td>Integrated Pest Management</td>
<td>Statewide</td>
<td>612-624-9292</td>
<td><a href="mailto:burkn001@umn.edu">burkn001@umn.edu</a></td>
</tr>
<tr>
<td>Vince Fritz</td>
<td>Horticulture</td>
<td>Statewide</td>
<td>507-835-3620</td>
<td><a href="mailto:vafritz@umn.edu">vafritz@umn.edu</a></td>
</tr>
<tr>
<td>Bill Hutchison</td>
<td>Entomology</td>
<td>Statewide</td>
<td>612-624-5282</td>
<td><a href="mailto:hutch002@umn.edu">hutch002@umn.edu</a></td>
</tr>
<tr>
<td>Carl Rosen</td>
<td>Soil Science, Horticulture</td>
<td>Statewide</td>
<td>612-625-8114</td>
<td><a href="mailto:crosen@umn.edu">crosen@umn.edu</a></td>
</tr>
<tr>
<td>Cindy Tong</td>
<td>Post-Harvest Science</td>
<td>Statewide</td>
<td>612-624-3419</td>
<td><a href="mailto:ctong@umn.edu">ctong@umn.edu</a></td>
</tr>
<tr>
<td>Minnesota Services</td>
<td>Address</td>
<td>Phone</td>
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<tr>
<td>Plant Pest Clinic</td>
<td>1991 Upper Buford Crl., Rm 495, St. Paul, MN 55108</td>
<td>612-625-1275</td>
<td><a href="mailto:pdc@umn.edu">pdc@umn.edu</a></td>
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<tr>
<td></td>
<td>St. Paul, MN 55108</td>
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<tr>
<td>Soil Testing Lab</td>
<td>1902 Dudley Ave., Rm. 135,</td>
<td>612-625-3101</td>
<td><a href="mailto:soiltest@umn.edu">soiltest@umn.edu</a></td>
<td></td>
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<td>Missouri Field Staff</td>
<td>Role/Focus</td>
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<td>Phone</td>
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</tr>
<tr>
<td>Ramón Arancibia</td>
<td>Vegetable Production</td>
<td>West Central</td>
<td>660-679-4167</td>
<td><a href="mailto:ra522@missouri.edu">ra522@missouri.edu</a></td>
</tr>
<tr>
<td>Donna Aufdenberg</td>
<td>Horticulture</td>
<td>Southeast</td>
<td>573-243-3581</td>
<td><a href="mailto:aufdenbergd@missouri.edu">aufdenbergd@missouri.edu</a></td>
</tr>
<tr>
<td>Robert Balek</td>
<td>Horticulture</td>
<td>Southwest</td>
<td>417-358-2158</td>
<td><a href="mailto:balekr@missouri.edu">balekr@missouri.edu</a></td>
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<tr>
<td>Patrick Byers</td>
<td>Horticulture</td>
<td>Southwest</td>
<td>417-859-2044</td>
<td><a href="mailto:byerspl@missouri.edu">byerspl@missouri.edu</a></td>
</tr>
<tr>
<td>Nahshon Bishop</td>
<td>Vegetable Production</td>
<td>Southwest</td>
<td>417-846-3948</td>
<td><a href="mailto:bishopn@lincoln.edu">bishopn@lincoln.edu</a></td>
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<tr>
<td>Name</td>
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<tr>
<td>Michael Crowden</td>
<td>Vegetable Production</td>
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<td>573-225-2440</td>
<td><a href="mailto:crowdenm@lincolnu.edu">crowdenm@lincolnu.edu</a></td>
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<tr>
<td>Sarah Denkle</td>
<td>Horticulture</td>
<td>Southeast</td>
<td>573-686-8064</td>
<td><a href="mailto:denklers@lincolnu.edu">denklers@lincolnu.edu</a></td>
</tr>
<tr>
<td>Miranda Duschack</td>
<td>Vegetable Production</td>
<td>East Central</td>
<td>314-604-3403</td>
<td><a href="mailto:duschackm@lincolnu.edu">duschackm@lincolnu.edu</a></td>
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<tr>
<td>Tom Fowler</td>
<td>Horticulture</td>
<td>Northwest</td>
<td>816-279-1691</td>
<td><a href="mailto:fowlett@missouri.edu">fowlett@missouri.edu</a></td>
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<tr>
<td>Margo Jakobi</td>
<td>Vegetable Production</td>
<td>Central</td>
<td>573-833-0767</td>
<td><a href="mailto:jakobim@lincolnu.edu">jakobim@lincolnu.edu</a></td>
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<tr>
<td>Susan Jaster</td>
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<td>West Central</td>
<td>816-589-4725</td>
<td><a href="mailto:jasters@lincolnu.edu">jasters@lincolnu.edu</a></td>
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<tr>
<td>Kate Kammler</td>
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<td><a href="mailto:kammlerk@missouri.edu">kammlerk@missouri.edu</a></td>
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<tr>
<td>Debi Kelly</td>
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<td>636-797-5391</td>
<td><a href="mailto:kellyd@missouri.edu">kellyd@missouri.edu</a></td>
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<tr>
<td>Kathi Mecham</td>
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<td>660-542-1792</td>
<td><a href="mailto:mechamk@missouri.edu">mechamk@missouri.edu</a></td>
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<tr>
<td>David Middleton</td>
<td>Vegetable Production</td>
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<td>417-466-8056</td>
<td><a href="mailto:middletond@lincolnu.edu">middletond@lincolnu.edu</a></td>
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<tr>
<td>Jennifer Schutter</td>
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<td>660-665-9866</td>
<td><a href="mailto:schutterjl@missouri.edu">schutterjl@missouri.edu</a></td>
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<tr>
<td>Tamra Reall</td>
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<td>Urban</td>
<td>816-252-5051</td>
<td><a href="mailto:reallt@missouri.edu">reallt@missouri.edu</a></td>
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<tr>
<td>Jim Shepard</td>
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<tr>
<td>Clement Akotsen-Mensah</td>
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<td>Touria Eaton</td>
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<td>Tunsisa Hurissot</td>
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<tr>
<td>Londa Nwadike</td>
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<td><a href="mailto:nwadike@missouri.edu">nwadike@missouri.edu</a></td>
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<td>Jaimin Patel</td>
<td>Plant Pathology</td>
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<td><a href="mailto:patelj@lincolnu.edu">patelj@lincolnu.edu</a></td>
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<tr>
<td>David Trinklein</td>
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<tr>
<td>Luis Cañas</td>
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<td><a href="mailto:canas.4@osu.edu">canas.4@osu.edu</a></td>
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<td>Doug Doohan</td>
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<tr>
<td>Matt Kleinhenz</td>
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<tr>
<td>Sally Miller</td>
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<td>330-263-3678</td>
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<tr>
<td>Celeste Welty</td>
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<td>614-292-2803</td>
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**Missouri Services**

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<td><a href="mailto:soiltestingservices@missouri.edu">soiltestingservices@missouri.edu</a></td>
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**Ohio Field Staff**

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<tr>
<td>Eric Barrett</td>
<td>Horticulture</td>
<td>Northeast</td>
<td>330-533-5538</td>
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<tr>
<td>Brad Bergefurd</td>
<td>Horticulture</td>
<td>Southeast</td>
<td>800-860-7232</td>
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<tr>
<td>Erik Draper</td>
<td>Horticulture</td>
<td>Northeast</td>
<td>440-834-4656</td>
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<tr>
<td>Jim Jasinski</td>
<td>Integrated Pest Management</td>
<td>Southwest</td>
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**Ohio Campus Staff**

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**Ohio Services**

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<tr>
<td>Plant Pest Clinic</td>
<td>8995 E. Main St., Bldg. 23, Reynoldsburg, OH 43068</td>
<td>614-292-5006</td>
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</table>
Pesticide Safety

Pesticide Poisoning
For humans, call the Nationwide Emergency Number at 800-222-1222.
This number will automatically connect you to the poison center nearest you. Personnel at this number will give first aid instructions and direct callers to treatment centers. For immediate emergency treatment or ambulance service, always call 911.

For pets, call the Animal Poison Control Center at 888-426-4435, or the Pet Poison Helpline at 800-213-6680. A consultation fee may apply.

Pesticide Spills
For information about cleaning up or otherwise dealing with non-emergency pesticide spills, you can contact the National Pesticide Information Center at 800-858-7378 and the pesticide manufacturer for SDS and label information.

For emergency pesticide spills, pesticide fires, or pesticide transportation accidents first call 911, then call your state agency who handles spill response.

- Illinois Emergency Management Agency
  800-782-7860
- Indiana Department of Environmental Management
  888-233-7745
- Iowa Department of Natural Resources
  515-725-8694
- Kansas Department of Health and Environment
  785-291-3333
- Michigan Department of Agriculture and Rural Development
  800-405-0101
- Minnesota Duty Officer
  800-422-0798
- Missouri Department of Natural Resources
  573-634-2436
- Ohio Environmental Protection Agency
  800-282-9378

When federal notification is required, call the National Response Center at 800-424-8802.

Pesticide Use and Greenhouses, Chemigation, and Respirators
Before using any pesticide, always read the product label for mention of greenhouse, chemigation, and respirator restrictions. See the tables for Fungicides, Herbicides, Insecticides, and Nematicides.

Labels
For complete label and Safety Data Sheet (SDS) information, search one of the following databases.
http://www.cdms.net/Label-Database
https://www.agrian.com/labelcenter/results.cfm
https://www.greenbook.net/advance-search

To check if a pesticide is registered at the federal level, search this database.
https://iaspub.epa.gov/apex/pesticides/?p=PPLS

To check if a pesticide is registered for your state, search one of the following databases. Most states require a federally registered pesticide to also be registered by the state as well.

IA, IN, KS, MN, MO:
https://kellysolutions.com

IA, IN, MI, MN, OH:
http://npirspublic.ceris.purdue.edu/state/

IL:
https://www2.illinois.gov/sites/agr/Pesticides/Pages/Pesticide-Product-Registration.aspx
**Fungicide Table**

This table includes selected information about the fungicides recommended in this guide. The products are listed alphabetically by **Active Ingredient**, with a selection of **Trade Names**.

* = indicates that some formulations may be Restricted Use Pesticides (RUP) and require a certification to purchase and use
† = indicates that some formulations may be listed by the Organic Materials Research Institute (OMRI) and may be allowed in organic production

The **Signal Word** is an indication of the human health hazard of the product.

The **Greenhouse Use** and **Chemigation Use** columns have one of four listings:

- **yes** = the product label explicitly allows the use
- **some** = the product label explicitly allows the use for certain crops (see the label for details), or certain Trade Names allow complete or partial use
- **no** = the product label explicitly prohibits the use
- **silent** = the product label does not mention the use — states decide if such uses are allowed

The **Respirator Use** column has one of the following listings:

- **no** = a respirator is not required PPE
- **yes** = a respirator is required for some part of the process (see label for details)
- **some** = certain Trade Names may require respirators, but others may not

The **Bee Precaution** column uses the following listings:

- **I** = Do not apply to plants that are flowering, or water puddles
- **II** = Do not apply to plants that are flowering, or water puddles, except at dusk
- **III** = No bee precaution, except when required by the pesticide label or regulations
- **a** = Toxic to honey bee brood
- **b** = Toxic to other bee species

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<th>Active Ingredients</th>
<th>Trade Names</th>
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<th>Respirator Use</th>
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<td>1,3-dichloropropene</td>
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<td>yes</td>
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<tr>
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<td>zoxamide, chlorothalonil</td>
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### Fungicide Efficacy Table for Cucurbits

This table includes efficacy information about the fungicides recommended in this guide, based on research and experience of authors. The products are listed alphabetically by **Trade Names**.

G=good  
F=fair  
P=poor  
S=suppression

**MOA or FRAC code:** fungicides with a number as the MOA code should be tank-mixed or alternated with a different MOA code according to the label.

<table>
<thead>
<tr>
<th>Trade Names (REI/PHI)</th>
<th>Active Ingredients</th>
<th>Alternaria leaf blight</th>
<th>Anthracnose</th>
<th>Bacterial leaf &amp; fruit</th>
<th>Bacterial leaf blight</th>
<th>Powdery mildew</th>
<th>Gummy stem blight</th>
<th>Phytophthora blight</th>
<th>Powdery mildew</th>
<th>Scab</th>
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<td>Actigard (12h/0d)</td>
<td>acibenzolar-S-methyl (P1)</td>
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</table>
Fungicide Efficacy Table for Fruiting Veg

This table includes efficacy information about the fungicides recommended in this guide, based on research and experience of authors. The products are listed alphabetically by **Trade Names**.

VG=very good  
G=good  
F=fair  
P=poor  
S=suppression

<table>
<thead>
<tr>
<th>Trade Names</th>
<th>Active Ingredients</th>
<th>Anthracnose (tomato)</th>
<th>Anthracnose (pepper)</th>
<th>Angular Blight</th>
<th>Bacterial Canker</th>
<th>Bacterial Spot/Speck</th>
<th>Botrytis Gray Mold</th>
<th>Bacterial Gray Mold</th>
<th>Bacterial Gray Spot</th>
<th>Buckeye Rot</th>
<th>Early Blight</th>
<th>Septoria Leaf Blight</th>
<th>Late Blight (tomato)</th>
<th>Phytophthora Blight (pepper)</th>
<th>Leaf Mold</th>
<th>White Mold</th>
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<td>Actigard (12h/14d)</td>
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</table>
**Herbicide Table**

This table includes selected information about the herbicides recommended in this guide. The products are listed alphabetically by **Active Ingredient**, with a selection of **Trade Names**.

* = indicates that some formulations may be Restricted Use Pesticides (RUP) and require a certification to purchase and use
† = indicates that some formulations may be listed by the Organic Materials Research Institute (OMRI) and may be allowed in organic production

The **Signal Word** is an indication of the human health hazard of the product.

The **Leaching Risk** and **Runoff Risk** columns have one of four listings:
- **v. low** = the product is not likely to move with water
- **low** = the product has a low likelihood of moving with water
- **med** = the product has an intermediate likelihood of moving with water
- **high** = the product has a high likelihood of moving with water

The **Respirator Use** column has one of the following listings:
- **no** = you do not need to use a respirator
- **yes** = you do need some sort of respirator for some part of the process (see label for details)
- **some** = certain Trade Names may require respirators, but others may not

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<th>Active Ingredients</th>
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<th>Runoff Risk</th>
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## Herbicide Efficacy Table for Vegetables

Herbicide efficacy information for the crops in this guide. The products are listed alphabetically by Active Ingredient, with their common Placement relative to weeds. Weed control will vary with soil type and weather. Italics indicates the rating occurred in the MSU E0433 bulletin. Non-italics indicates the rating is original to the Midwest Veg Guide.

- **E=excellent, G=good, F=fair, P=poor, N=none**

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<th>Goosegrass</th>
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16 | Midwest Veg Guide 2021 |
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</table>
Corn Herbicide Rotation Restrictions

This is rotational restriction information for corn herbicides. The products are listed alphabetically by Trade Name(s), with the Number of Months you must wait to plant different vegetables after applying that herbicide.

AT=anytime herbicide labeled for the crop or no rotation restriction exists
FB= field bioassay required before planting the crop
NNY= not next year, the crop cannot be planted the following year
NY=the crop can be planted the year after application
V=variable, intervals vary by crop variety or other conditions specified on label
*Transplanted tomatoes only

<table>
<thead>
<tr>
<th>Trade Names</th>
<th>Number of Months</th>
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<tbody>
<tr>
<td></td>
<td>Tomato</td>
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<tr>
<td>Aatrex and others</td>
<td>NNY</td>
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<tr>
<td>Accent, soil pH &lt; 6.5</td>
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<td>Accent, soil pH &gt; 6.5</td>
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<td>Acuron</td>
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<td>Anthem, Anthem ATZ</td>
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<tr>
<td>Balance Pro</td>
<td>18V</td>
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<tr>
<td>Basis</td>
<td>1</td>
</tr>
<tr>
<td>Beacon</td>
<td>18</td>
</tr>
<tr>
<td>Bicep II Magnum</td>
<td>NNY</td>
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<tr>
<td>Callisto</td>
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<tr>
<td>Camix</td>
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<tr>
<td>Celebrity Plus</td>
<td>10-18V</td>
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<td>Define</td>
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<td>Harness Xtra</td>
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<td>Hornet</td>
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<td>Impact</td>
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<td>Lariat, Bullet</td>
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<td>Leadoff</td>
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<td>Lumax, Lexar</td>
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<td>Marksman</td>
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<td>Northstar</td>
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<td>Permit</td>
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<td>Steadfast</td>
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<td>Surestart</td>
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<td>Surpass, TopNotch, FulTime</td>
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<td>Zidua</td>
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Soybean Herbicide Rotation Restrictions

This is rotational restriction information for soybean herbicides. The products are listed alphabetically by Trade Name(s), with the Number of Months you must wait to plant different vegetables after applying that herbicide.

AT=anytime herbicide labeled for the crop or no rotation restriction exists
FB= field bioassay required before planting the crop
NNY= not next year, the crop cannot be planted the following year
NY=the crop can be planted the year after application
V=variable, intervals vary by crop variety or other conditions specified on label
*Transplanted tomatoes only
**In Indiana only, 18m for transplanted tomatoes and peppers, cabbage, melons, and cucumbers

<table>
<thead>
<tr>
<th>Trade Names</th>
<th>Tomato</th>
<th>Pea</th>
<th>Snap Bean</th>
<th>Sweet Corn</th>
<th>Cucurbits</th>
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<tr>
<td>Authority Assist</td>
<td>30+FB</td>
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<td>Authority First, Sonic</td>
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<td>9-12-30+FB,V</td>
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<td>18</td>
<td>30+FB</td>
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<td>4</td>
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<td>Canopy, Canopy EX</td>
<td>9-10²</td>
<td>9-12</td>
<td>9-12</td>
<td>18</td>
<td>18-30V</td>
<td>18-30</td>
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<td>Classic</td>
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<td>18-30V</td>
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<td>Pursuit**</td>
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<td>18-30</td>
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<td>3-12+FB</td>
<td>3-12+FB</td>
<td>3-12+FB4</td>
<td>12+FB</td>
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</tbody>
</table>
Insecticide Table

This table includes selected information about the insecticides recommended in this guide. The products are listed alphabetically by 
Active Ingredient, with a selection of Trade Names.

* = indicates that some formulations may be Restricted Use Pesticides (RUP) and require a certification to purchase and use
† = indicates that some formulations may be listed by the Organic Materials Research Institute (OMRI) and may be allowed in organic production

The Signal Word is an indication of the human health hazard of the product.

The Greenhouse Use and Chemigation Use columns have one of four listings:
yes = the product label explicitly allows the use
some = the product label explicitly allows the use for certain crops (see the label for details), or certain Trade Names allow complete or partial use
no = the product label explicitly prohibits the use
silent = the product label does not mention the use — states decide if such uses are allowed

The Respirator Use column has one of the following listings:
no = a respirator is not required PPE
yes = a respirator is required for some part of the process (see label for details)
some = certain Trade Names may require respirators, but others may not

The Bee Precaution column uses the following listings:
I = Do not apply to plants that are flowering, or water puddles
II = Do not apply to plants that are flowering, or water puddles, except at dusk
III = No bee precaution, except when required by the pesticide label or regulations
a = Toxic to honey bee brood
b = Toxic to other bee species

<table>
<thead>
<tr>
<th>Active Ingredients</th>
<th>Trade Names</th>
<th>Signal Word</th>
<th>Greenhouse Use</th>
<th>Chemigation Use</th>
<th>Respirator Use</th>
<th>Bee Precaution</th>
</tr>
</thead>
<tbody>
<tr>
<td>*1,3-dichloropropene</td>
<td>Telone II, Telone EC</td>
<td>warning, danger</td>
<td>no</td>
<td>some</td>
<td>yes</td>
<td>II a</td>
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<tr>
<td>*1,3-dichloropropene, chloropicrin</td>
<td>Telone C-17, Telone C-35</td>
<td>danger</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>II a</td>
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<tr>
<td>*abamectin</td>
<td>Agri-Mek SC</td>
<td>warning</td>
<td>some</td>
<td>no</td>
<td>no</td>
<td>I b</td>
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<tr>
<td>acephate</td>
<td>Bracket 97, Orthene 97</td>
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<td>no</td>
<td>some</td>
<td>yes</td>
<td>I b</td>
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<td>acequinocyl</td>
<td>Kanemite 15SC, Shuttle 15SC</td>
<td>caution</td>
<td>some</td>
<td>no</td>
<td>no</td>
<td>III</td>
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<td>acetamiprid</td>
<td>Assail 30SG, Assail 70WP, Tristar 8.5SL</td>
<td>caution</td>
<td>some</td>
<td>some</td>
<td>some</td>
<td>II b</td>
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<tr>
<td>afidopyropen</td>
<td>Sefina Inscalis, Versys Inscalis</td>
<td>caution</td>
<td>no</td>
<td>some</td>
<td>no</td>
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<td>†azadirachtin</td>
<td>Aza-Direct, AzaGuard, AzaSol, Azatin O, Azatrol EC, Ecozin Plus 1.2 ME, Molt-X</td>
<td>caution</td>
<td>yes</td>
<td>some</td>
<td>no</td>
<td>II</td>
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<tr>
<td>†azadirachtin, pyrethrins</td>
<td>Azera</td>
<td>caution</td>
<td>yes</td>
<td>some</td>
<td>yes</td>
<td>I b</td>
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<tr>
<td>†Bacillus thuringiensis kurstaki strain ABTS-351</td>
<td>Biobit HP, DiPel DF, DiPel ES, LEAP ES</td>
<td>caution</td>
<td>some</td>
<td>some</td>
<td>yes</td>
<td>III</td>
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<td>Bacillus thuringiensis tenebrionis strain NB-176</td>
<td>Novodor FC</td>
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<td>caution</td>
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<td>*beta-cyfluthrin</td>
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<td>Active Ingredients</td>
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<td>Bifenture EC, Brigade WSB, Capture LFR, Sniper</td>
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<td>some</td>
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<td>no</td>
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<td>Ethos 3D</td>
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<td>no</td>
<td>yes</td>
<td>I b</td>
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<td>*bifenthrin, *zeta-cypermethrin</td>
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<td>caution, warning</td>
<td>silent</td>
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<td>Majestene, Venerate</td>
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<td>Govern, Hatchet, Lorsban, Nufos, Saurus, Vulcan, WhirlWind, Warhawk</td>
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<td>clothianidin</td>
<td>Belay, Poncho</td>
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<td>*esfenvalerate</td>
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</table>
Nematicide Table

This table includes selected information about the nematicides recommended in this guide. The products are listed alphabetically by Active Ingredient, with a selection of Trade Names.

*= indicates that some formulations may be Restricted Use Pesticides (RUP) and require a certification to purchase and use
†= indicates that some formulations may be listed by the Organic Materials Research Institute (OMRI) and may be allowed in organic production

The Signal Word is an indication of the human health hazard of the product.

The Chemigation Use columns have one of four listings:
yes = the product label explicitly allows the use
some = the product label explicitly allows the use for certain crops (see the label for details), or certain Trade Names allow complete or partial use
no = the product label explicitly prohibits the use
silent = the product label does not mention the use — states decide if such uses are allowed

The Leaching Risk and Runoff Risk columns have one of four listings:
v. low = the product is not likely to move with water
low = the product has a low likelihood of moving with water
med = the product has an intermediate likelihood of moving with water
high = the product has a high likelihood of moving with water

The Respirator Use column has one of the following listings:
no = a respirator is not required PPE
yes = a respirator is required for some part of the process (see label for details)
some = certain Trade Names may require respirators, but others may not

<table>
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<tr>
<th>Active Ingredients</th>
<th>Trade Names</th>
<th>Signal Word</th>
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Asian Vegetables - Horticulture

Reviewed by Ben Phillips, Liz Maynard – Oct 2020

Crop Description

U.S. demand for ethnic vegetables is increasing rapidly—from a growing ethnic Asian population and from other consumers seeking variety.

Asian vegetables are those that have originated from East Asia (China, Japan, and Korea) and Southeast Asia (Indonesia, Laos, the Philippines, Singapore, Thailand, Vietnam, etc.), as well as South Asia (India and Pakistan). The crops listed here are adapted to production in the Midwest. The short-season crops might be suitable in double crop situations, such as following wheat or an early cabbage or sweet corn crop.

The information below should be considered an introduction to Asian vegetables. More detailed information can be found in the resources section. General pest management recommendations for the crop families described below can be found in the corresponding crop chapters in this Guide. Although not all of the specific crops mentioned in this chapter will be associated with pesticides in the crop chapters of this guide, pesticide labels will list crops on which specific products may be used.

Asian vegetables have different names in different languages. You must properly identify the crop to market it properly and to select the appropriate pest control measures. Below are descriptions and horticultural information for some of these crops that are not otherwise discussed in other chapters.

Brassica Leafy Greens

Chinese cabbage (Brassica rapa), and Mustard greens (Brassica juncea) are grown as salad or braising greens or as heading crops. Their leaves are not waxy, and most of them are Asian in origin. They can be grown as components of a salad mix. Crops in this group are more susceptible to damage from flea beetles but tend to be less attractive to caterpillars than cole crops such as broccoli. Chinese cabbage is especially sensitive to bolting in response to cold temperatures and other stressful conditions.

Chinese cabbage: Chinese cabbage has been grown in Asia since the fifth century. It is a cool-season annual vegetable. It grows best with short days and moderate to cool temperatures (60° to 70° F). Its cultural requirements are similar to those of cabbage and lettuce. Chinese cabbage is fairly quick to mature. It varies from 40 days from sowing to harvest for some cultivars to 75 days for the longer-maturing ones. Chinese cabbage is a term applied to a wide range of types and varieties. The main types and varieties of Chinese cabbage are:

Group I: Napa cabbage
Napa cabbages form broad-leaved, compact heads of layered leaves and are also known as pe-tsai, perstai, hsin pei tsai, celery cabbage, Chinese white cabbage, Peking cabbage, won bok, nappa (Japanese), hakusai (Japanese), and pao. There are two types, Chihili and Che-foo.

Chihili types of Napa cabbage form a cylindrical head 18 inches long and 6 inches in diameter, with an erect, upright growing habit. Some varieties of this form are Chihili, Michihli, Market Pride, Shantung, and Shaho Tsai.

Che-foo types form a compact, round head of green-bladed, white-petioled leaves. Some varieties in this group are Che-foo, Tropical Pride, and Oriental King.

Recommended spacing for Napa cabbage is 18 inches within the rows and 24 inches between rows.

Group II: Bok choy
Bok choy is a non-heading form of Chinese cabbage, with several thick white leafstalks. The smooth, glossy, dark green leaf blades form a celery-like cluster. The most commonly accepted designations are bok choy or pak choy. Many refer to it as Chinese mustard. There are not as many varieties of bok choy as there are of the Napa cabbage. Bok choy varieties include Canton Choice and Long White Petiole.

Recommended spacing for Bok choy is 8 to 12 inches within the row and 24 inches between rows.

Mustard and other greens: Other brassica greens, such as mizuna, mibuna, tatsoi, komatsuna, and mustard are usually direct seeded. Some varieties are prone to premature flowering, which is enhanced by cold temperatures in the spring. Transplanting, which is less common than direct seeding, can also increase premature flowering in the spring due to increased plant stress. Plant populations vary tremendously and should be geared toward the intended harvest age and size.

Stem and Leafy Vegetables (Non-Brassica)

Celtuce (Lactuca sativa var. asparagina): This vegetable is closely related to standard head lettuces, with similar cultivation practices. But, celtuce is grown for its thick stem. Plants are cut at the base when the stem is 8 to 10 inches long, and all the leaves are removed except at the tip.

Garlic scapes (Allium sativum): In the production of hard neck garlic, a flower shoot, called a “scape”, is produced. The scapes must be clipped off to maximize bulb size, and can be bunched or bagged for sale.

Malabar spinach (Basella alba): This vegetable is not related to spinach, but has a similar flavor, and can be grown in the hot summer months. In its native range of Southeast Asia it grows as a perennial. But it can be seeded as a frost-killed annual in the midwestern United States. It grows as a vine, and should be trellised like peas or runner beans.

Pea shoots and leaves (Pisum sativum): Before, during, and after pod formation on pea plants, young shoots from the middle and top sections of the plant can be clipped 3 to 4 inches from the growing tip for bunching or bagging.
**Sweet potato vines and leaves (Ipomoea batatas):** This vegetable is grown all over the world for its sweet storage roots. But the leaves are commonly consumed in Asia too. Harvest the top 10 inches of vines for bunching or bagged loose leaf.

**Cucurbit Vegetables**

**Bittermelon (Mormodica charantia):** This vegetable is native to India. Like cucumbers and squashes, bittermelon is a member of the Cucurbit family. It is a warm-season vegetable. It is usually grown on a trellis system and its fruit is about the size of a summer squash. The trellis should be 6-feet high and 4 to 6 feet apart. The seeds can be planted directly in the field or grown as seedlings and then transplanted to a field spacing of 1-1/2 to 2 feet between plants and 3 to 5 feet between rows. Bittermelon is harvested green before there is any color change. Bright orange fruits are saved for seed collection.

**Calabash (Lagenaria siceraria):** Also known as snake gourd, bottle gourd, or opo. This vegetable is grown like winter squash for the ornamental hard-shelled mature fruit and used for making food and drink utensils and vessels, and instruments. In Asia, fruits are also harvested young and tender for eating, like a summer squash.

**Smooth luffa (Luffa cylindrica) and angled luffa (Luffa acutangula):** These vegetables originated in India and were later taken to China. It is mainly grown for the young squash-like edible fruits. If left to mature on the plant, both smooth and angled luffa gourds produce the familiar “luffa sponge” found in stores, but smooth luffas make a better-quality sponge. Some of the smooth luffa cultivars are Smooth Boy, Smooth Beauty, and Southern Winner. Some angled luffa cultivars are Hybrid Green Glory, Hybrid Asian Pride, Lucky Boy, and Summer Long. Luffa plants are warm-season vegetables and need to be trellised.

**Winter melon (Benincasa hispida):** This vegetable is also known as ash gourd or wax gourd and is a native vegetable to Southeast Asia. It is grown like a watermelon and matures into a large green fruit with a waxy bloom and white flesh. When mature, it keeps for several months like a hard squash. The flavor is bland and it is used in soups and other dishes to absorb flavor of other ingredients, and candied for sweet chewy dried treats.

**Fruiting Vegetables**

**Asian Eggplants (Solanum melongena):** This crop is native to tropical Asia and very popular in Japan, China, India, Thailand, and the Philippines. Many varieties are available. They can be light or dark purple, brown, or green in skin color; and round and slender in shape. Culture is similar to standard eggplant.

**Legumes**

**Asparagus (Yardlong) Bean (Chinese Long Bean, Vigna sesquipedalis):** This long, trailing vine should be grown on trellises. This plant is more closely related to Southern peas (cowpeas, black-eyed peas) than to the common green snap bean, but it vines like a pole bean, and needs support to make long straight bean pods. Dark and light green varieties are available as well as a red type. The darker varieties are generally preferred. It is a warm-season vegetable. Yardlong beans are cut into 2-inch pieces and added to various stir fries. The paler green is sweeter and more tender than the dark green.

**Edamame (Glycine max):** This vegetable is the immature pod of a soybean plant. These can be grown like soybeans, but with a larger between-row spacing like a bush bean, for easier hand-harvesting. They are harvested 35 to 40 days after flowering when pods are plump, bright green, and succulent. Popular varieties include Envy, Butterbeans, Sayamusume, Shiromufi, Tohya, Midori Giant, and Chiba Green.

**Sugar Snap Pea and Snow Pea (Pisum sativum):** These cool-season vegetables should be sowed in April for a spring crop or sowed in July for a fall crop. Plants deteriorate quickly in the heat of summer. The plants of sugar snap pea and snow pea grow similarly to bush beans. It is often helpful to grow them on trellises to facilitate picking; however, if grown for the tender shoot tips, they are usually left untrellised.

**Root and Rhizome Vegetables**

Many root vegetables popular in Asia are long-lived perennial plants that are not suitable for our climate in the midwestern United States. However, a few can be grown in the field (sweet potato and daikon radish) and others can be grown in protected culture (ginger and turmeric).

**Daikon Radish (Raphanus sativus, var. longipinnatus) is also called Chinese radish and is closely related to the common radish crop. The main planting time for daikon is spring and fall, but some varieties can be planted almost year-round. April planting generates spring harvest, and July planting generates fall harvest. Spacing should be 4 to 6 inches within the rows and 3 feet between rows. To accommodate the large roots, it is recommended to plant in high raised beds that are amended with organic matter, such as compost. At each cultivation, move soil higher and higher around the roots, as they grow, to prevent greening of the root. Most daikon radishes reach their useable size in 60 to 70 days.

**Ginger (Zingiber officinale) and Turmeric (Curcuma longa):** These perennial crops are grown in tropical environments for their rhizomes, which creep laterally under the soil surface like irises. In the Midwest, they can be grown from 1-inch rhizome cuttings as a long-season annual planted in hoophouses that maintain minimum 50°F soil temps and 70°F air temps. Trench, hill, and irrigate like potatoes. Harvest and sell as “new” or “baby” ginger in mid-late fall. Our season is not long enough (5 to 7 months) to produce large mature and cured rhizomes, which require 8 to 10 months.

**Sweet potato (Ipomoea batatas):** Sweet potato varieties of Asian origin are starchier than more commonly grown varieties, and often are white or purple fleshed, instead of orange. Varieties include Murasaki, Okinawa Purple, Molokai Purple, Red Japanese, and Stokes Purple. Murasaki has been adopted in the Mid-Atlantic region of the United States and is easier to get than the others. However, most of these varieties take 120 to140 days.
Asparagus - Horticulture

Reviewed by Ben Phillips, Liz Maynard – Oct 2020

Crop Description

Hybrid varieties of asparagus (Asparagus officinalis) have improved vigor, disease tolerance, and higher yields, and are grown from seeds or crowns. All-male hybrids have higher yields and do not produce seed. Absence of seed production is desirable because seeds develop into volunteer asparagus seedlings that are a weed problem. Order hybrids well in advance.

All-male hybrids (listed in order of performance): Jersey General, Jersey Giant (56X22-8), Millennium, Jersey Knight, Jersey King, Jersey Supreme.

Other hybrids: Atlas, Purple Passion (specialty markets only).

Non-hybrids: Viking KB3, Mary Washington.

Planting and Spacing

Crowns: Use only 1-year old crowns. Transplant April 15 to May 15. Use 4- to 5-foot rows with crowns 12 to 16 inches apart. Set the crowns in 8-inch furrows in light soils and 5- to 6-inch furrows in heavy soils. Cover with 2 to 3 inches of soil. Select deep, well-drained sandy loam soils. Hybrids should be planted slightly deeper. Start cultivating when spears begin to emerge and continue periodically until furrows are level at end of first season.

Seedling transplant: 10- to 14-week old seedling transplants can be mechanically transplanted. Transplant in either the spring or fall.

Fertilizing

pH: Maintain a soil pH of 6.7 to 7.0. If possible, apply lime the year before planting.

New plantings: Before planting new crowns, apply 50 pounds N per acre, 0 to 160 pounds P₂O₅ per acre, and 0 to 150 pounds K₂O per acre based on soil test results and recommendations from your state. Broadcast the fertilizer and plow it under when preparing the land for the planting furrows. In addition, apply 30 pounds P₂O₅ per acre in the bottom of the trench and cover with 1 inch of soil before setting crowns. For transplanted seedlings, apply 4 ounces of transplant solution (e.g. 2-3 lbs. of 10-52-17 or 9-45-15 in 50 gallons of water) to each transplant.

Established plantings: Each year before emergence, apply 20 to 40 pounds N per acre by broadcasting and incorporate by lightly tilling. After harvests conclude, apply 40 to 60 pounds N per acre. The total amount of N from fertilizer should be 80 pounds N per acre. No P₂O₅ is necessary if adequate fertilization was achieved prior to planting. Every second year apply up to 60 pounds K₂O per acre if a soil test recommends it.
Harvesting

Harvest only 2 or 3 times in spring 1 year after transplanting. Thereafter, harvest for about 2 months in the spring. Harvest asparagus early in the morning for best quality. Allow the ferns to grow vigorously after this period to accumulate food reserves for the next season. As much care should be put into maintaining a healthy fern as into harvest.

Asparagus - Diseases

Reviewed by Dan Egel, Mary Hausbeck – Nov 2020

Recommended Controls

Crown and Root Rot of Asparagus - Fusarium Fungus

The Fusarium pathogen can be seed borne. Try to source material for new plantings from fields fumigated with chloropicrin.

Non-Pesticide

The disease is promoted by acidic (low pH) and poorly drained soil. Establish production fields with blemish-free crowns produced in virgin soil. Avoid fields with a history of crown and root rot. Use tolerant, vigorous varieties if available, and avoid long harvest periods to maintain vigor in the plant over years.

Pesticide

Cannonball (50WP) (fludioxonil) | 0.5 oz. per 100 gals. of water. Michigan only (MI 24c exp. 12/31/22). Submerge and soak crowns for 10 minutes and allow to drain before planting. REI: 12-hour. PHI: 365-day. FRAC 12.

Crown and Spear Rot of Asparagus - Phytophthora Oomycete

Non-Pesticide

Avoid excessive irrigation. Choose well-drained planting sites. Establish production fields from blemish-free crowns obtained from virgin soil. Avoid long harvest periods to maintain vigor in the plant over years.

Pesticide


Purple Spot of Asparagus - Stemphylium Fungus

Weather forecasting tools, such as TOM-CAST, can help asparagus farmers schedule their fungicide applications for control of purple spot. NOTE: Products labeled for rust may be helpful for purple spot control.

Non-Pesticide

Reduce crop residues by removing or mowing senescent and dried fern in the fall/winter.

Pesticide

azoxystrobin products (azoxystrobin) | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. REI: 4-hour. PHI: 100-day. FRAC 11.

chlorothalonil products (chlorothalonil) | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 190-day. FRAC M5.

Dexter Max (DG) (mancozeb, azoxystrobin) | 2-2.2 lbs. per acre. REI: 24-hour. PHI: 180-day. FRAC M3, FRAC 11.

Flint Extra (4.05) (trifloxystrobin) | 3-3.8 fl. oz. per acre. Apply on a 14-day interval as needed. Make applications to the fern stage only. Mow down the asparagus ferns (or allow the ferns to senesce) between the last fungicide application and harvest. REI: 12-hour. PHI: 180-day. FRAC 11.

Rust of Multiple Crops - Puccinia Fungus

Non-Pesticide

Reduce crop residues that may harbor the pathogen by removing or mowing senescent and dried ferns in the fall/winter. Scout for the early appearing bright orange aecial pustules in the spring, especially on new or young plantings that are not harvested the full season. Remove volunteer plants on field edges and ditchbanks. Plant crop rows with ample spacing and in the direction of the prevailing winds to increase air movement and minimize periods of prolonged leaf wetness. Reduce crop residues by removing or mowing senescent and dried fern in the fall/winter.

Pesticide

chlorothalonil products (chlorothalonil) | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 190-day. FRAC M5.

Dexter Max (DG) (mancozeb, azoxystrobin) | 2-2.2 lbs. per acre. REI: 24-hour. PHI: 180-day. FRAC M3, FRAC 11.

mancozeb products (mancozeb) | Several formulations of mancozeb products (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 180-day. FRAC M3.

Rally 40WSP (myclobutanil) | 5 oz. per acre. REI: 24-hour. PHI: 180-day. FRAC 3.

Sonoma 40WSP (myclobutanil) | 5 oz. per acre. REI: 24-hour. PHI: 180-day. FRAC 3.
tebuconazole products (tebuconazole) | 4-6 fl. oz. per acre.
There are many brand names (Monsoon, Onset, Vibe) with 3.6 lbs. a.i. per gallon that use the same rate. REI: 12-hour to 18-day. PHI: 180-day. FRAC 3.

Unicorn DF (WDG) (tebuconazole, sulfur) | 2-3.75 lbs. per acre. REI: 12 to 24-hour. PHI: 180-day. FRAC 3, FRAC M2, IRAC UN.

Asparagus - Insects
Reviewed by Laura Ingwell, Zsofia Szendrei – Nov 2020

Recommended Controls

Aphids
Treat when less than 5% of ferns have aphids present.

Pesticide
Assail 30SG (acetamiprid) | Use 30SG formulations at 2.5-5.3 oz. per acre and do not exceed 10.7 oz. per acre per season. Use 70WP formulations at 1.1-2.3 oz. per acre and do not exceed 4.6 oz. per acre per season. For control on spears during harvest, to prevent egg laying and feeding injury. Allow 10 days between applications. REI: 12-hour. PHI: 1-day. IRAC 4A.

Fulfill (50WDG) (pymetrozine) | 2.75 oz. per acre. Apply to fern only after harvest has been completed. Allow a minimum of 30 days between applications. Do not exceed 16.5 oz. per acre per season. REI: 12-hour. PHI: 170-day. IRAC 9B.

Lorsban 4E (chlorpyrifos) | Use 4E formulations at 2 pts. per acre. Use 75WG formulations at 1.33 lbs. per acre. Do not make more than one preharvest application. Do not make more than 2 postharvest applications during the fern stage. Broadcast with ground equipment. REI: 24-hour to 3-day. PHI: 1-day. IRAC 1B. RUP.

Asparagus Beetles
At Harvest: Treat when 5-10% of plants are infested, or 2% of spears have eggs.

At Fern: Treat when 10% of plants are defoliated, or 50% of plants have larvae.

Pesticide
Assail 30SG (acetamiprid) | Use 30SG formulations at 2.5-5.3 oz. per acre and do not exceed 10.7 oz. per acre per season. Use 70WP formulations at 1.1-2.3 oz. per acre and do not exceed 4.6 oz. per acre per season. For control on spears during harvest, to prevent egg laying and feeding injury. Allow 10 days between applications. REI: 12-hour. PHI: 1-day. IRAC 4A.

Dimethoate 4EC (dimethoate) | 1 pt. per acre. Use 4EC, LV-4 and 400 EC formulations at 1 pt. per acre and do not exceed 2 pts. per acre per season. REI: 48-hour. PHI: 180-day. IRAC 1B.

Entrust SC (2) (spinosad) | Use 2SC formulations at 4-6 fl. oz. per acre and do not exceed 18 fl. oz. per acre per season. Use 80WP formulations at 1.25-2.0 oz. per acre and do not exceed 5.6 oz. per acre per season. REI: 4-hour. PHI: 60-day. IRAC 5. OMRI-listed.

Lannate LV (2.4L) (methomyl) | 1.5 - 3.0 pts. per acre. Do not exceed 15 pts. per acre per season. REI: 48-hour. PHI: 1-day. IRAC 1A. RUP.

Lorsban 4E (chlorpyrifos) | Use 4E formulations at 2 pts. per acre. Use 75WG formulations at 1.33 lbs. per acre. Do not make more than one preharvest application. Do not make more than 2 postharvest applications during the fern stage. Broadcast with ground equipment. REI: 24-hour to 3-day. PHI: 1-day. IRAC 1B. RUP.

Perm-Up 25DF (permethrin) | Use 25W, 25WP or 25DF formulations at 3.2-6.4 oz. per acre and do not exceed 25.6 oz. per acre per season. Use 3.2EC formulations at 2-4 fl. oz. per acre and do not exceed 16 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Radiant 1SC (spinetoram) | 4-8 fl. oz. per acre. Postharvest protection of ferns only. Do not exceed 24 fl. oz. per acre per season. REI: 4-hour. PHI: 60-day. IRAC 5.

Sevin XLR Plus (4SC) (carbaryl) | 1-2 qts. per acre. Use low rate for control on seedlings and or spears during harvest, to prevent egg laying and feeding injury. Use high rate for control on fern growth after harvest is over. Do not exceed more than 5 applications to spears and ferns combined. Do not exceed 5 qts. per acre per year. Do not treat more than once every 3 days. REI: 12-hour. PHI: 1-day. IRAC 1A.

Caterpillars
For cutworm caterpillars: Treat when 5% of crowns are infested at harvest. Treat in the fall when there is 1 larva per 20 plants.

Pesticide
Coragen (1.67SC) (chlorantraniliprole) | 3.5-5.5 fl. oz. per acre. For armyworms. Do not exceed 4 applications per season. Do not exceed 15.4 fl. oz. per season. Minimum interval between treatments is 3 days. REI: 4-hour. PHI: 1-day. IRAC 28.

Lannate LV (2.4L) (methomyl) | 1.5 - 3.0 pts. per acre. For armyworms, and cutworms. Do not exceed 15 pts. per acre per season. REI: 48-hour. PHI: 1-day. IRAC 1A. RUP.

Lorsban 4E (chlorpyrifos) | For armyworms and cutworms to prevent egg laying and feeding injury during. Use 4E formulations at 2 pts. per acre. Use 75WG formulations at 1.33 lbs. per acre. Do not make more than one preharvest application. Do not make more than 2 postharvest applications during the fern stage. Broadcast with ground equipment. REI: 24-hour to 3-day. PHI: 1-day. IRAC 1B. RUP.
Asparagus - Weeds

Recommended Controls

All Weeds

Before establishing an asparagus planting, reduce perennial weeds in the area to be planted with systemic broad-spectrum herbicides. Herbicide options are limited in the planting year.

After the first year of establishment, a typical weed control program in asparagus includes a preemergence herbicide with a long residual applied before asparagus emerges. If needed, a preemergence herbicide may be applied again after harvest is finished and a clean harvesting. It is important to use herbicides with different modes of action from year to year with this perennial crop to avoid buildup of weed species not controlled by a particular mode of action.

Postemergence herbicides may be applied either before asparagus emerges, or during or after the harvest season. Some require directed or shielded spray applications to avoid spraying asparagus. It is important use herbicides with different modes of action from year to year with this perennial crop to avoid buildup of weed species not controlled by a particular mode of action.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

Non-Pesticide

Good weed control in the planting year is especially important. Multivators, tines, rolling cultivators, flame weeder work well before emergence of asparagus, but it is important to avoid damaging crowns when cultivating. Row-middle cultivate and hand hoe after emergence. Flame weeder can also be used after clean harvest or mowing. After established, straw mulch can be applied any time, but is easier for picking when applied after final harvest.

Broadleaf and Grass Weeds - Postemergence

Pesticide

Aim EC (2) (carfentrazone) | 0.5-1.92 gals. per acre. Include 0.5 pt. NIS or 0.25-0.5 gals. COC per 25 gals. of spray solution. Broadcast after spear harvest. Emerged asparagus will be injured. Do not exceed 3.8 fl. oz. per acre per season. Wait at least 20 days between applications. REI: 12-hour. PHI: 5-day. WSSA 14.

glyphosate products (glyphosate) | 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations containing 3 lbs. ae
Asparagus - Weeds

Pesticide

Chateau SW (51WDG) (flumioxazin) | 6 oz. per acre. Established plantings only. Apply to dormant asparagus at least 2 weeks before spears emerge. Crop injury may result if asparagus is not dormant. May be tank-mixed with paraquat to control emerged weeds. Or, apply after final harvest for the season before fern emerges. Do not exceed 6 oz. per acre per growing season. REI: 12-hour. PHI: 14-day. WSSA 15.

Command 3ME (clomazone) | 2.6 pts. per acre. Apply prior to spear emergence or apply after a clean harvest. Cover exposed plants with soil before applying. Do not exceed 2.6 pts. per acre per year. REI: 12-hour. PHI: 14-day. WSSA 13.

diuron products (diuron) | Established plantings only. Do not apply to young plants during the first year. Use 80DF formulations at 0.6-2.6 lbs. per acre. Use 4F formulations at 2-4 pts. per acre. See product label for split application rates. Use low rate if combined with diuron. 6-8 weeks residual activity. Two sprays necessary for seasonlong sandbur control. Do not exceed 2.6 lbs. or 4 pts. per acre per year. REI: 12-hour. PHI: 14-day. WSSA 5.

Dual Magnum (7.62EC) (s-metolachlor) | 1.33-2.0 pts. per acre. Illinois, Indiana, Michigan, and Minnesota only. IL 24c exp. 03/25/24. MI 24c exp. 12/31/21. MN 24c exp. 12/31/20. Apply before asparagus and weeds emerge in spring or after the harvest season. Needs moisture for activation. Do not exceed 1 application per crop. REI: 24-hour. PHI: 16-day. WSSA 15.

pendimethalin products (pendimethalin) | 2.4-8.2 pts. per acre. Use formulations with 3.8 lbs. active ingredient per gallon. Apply at least 14 days before first harvest and prior to spear emergence. If spears are present, remove before application. On sandy soil use no more than 2.4 pts. per acre. Do not apply to newly seeded asparagus during first year. REI: 24-hour. PHI: 14-day. WSSA 3.

Spartan 4F (sulfentrazone) | 4.5-12 fl. oz. per acre. Michigan only - applicators must have a supplemental label. Apply in spring before crop emerges. Use low rate on light soil. Do not use on soils with less than 1% organic matter. Do not exceed 1 application and 12 fl. oz. per acre per season. REI: 12-hour. PHI: 14-day. WSSA 14.

trifluralin products (trifluralin) | Established plantings only. Use 4EC formulations at 2-4 pts. per acre. Use 10G formulations at 0.62-1.5 lbs. per acre. Established crowns or direct-seeded crops only. Do not use on sandy soil or on soil with less than 1% organic matter. Established crowns: Apply in spring after cutting fern and prior to spear emergence. May also be applied after a clean cutting. Seeded crops: At planting spray activated charcoal at 300 lbs./per acre of actual area treated in a 1-inch band over the row (equivalent to 15 lbs. per acre of crop with 20-inch row spacing), then apply Sinbar. Do not plant other crops within 2 years of application. 8-12 weeks residual activity. REI: 12-hour. PHI: 5-day. WSSA 5.

Broadleaf and Grass Weeds - Preemergence

Chateau SW (51WDG) (flumioxazin) | 6 oz. per acre. Established plantings only. Apply to dormant asparagus at least 2 weeks before spears emerge. Crop injury may result if asparagus is not dormant. May be tank-mixed with paraquat to control emerged weeds. Or, apply after final harvest for the season before fern emerges. Do not exceed 6 oz. per acre per growing season. REI: 12-hour. PHI: 14-day. WSSA 14.

Command 3ME (clomazone) | 2.6 pts. per acre. Apply prior to spear emergence or apply after a clean harvest. Cover exposed plants with soil before applying. Do not exceed 2.6 pts. per acre per year. REI: 12-hour. PHI: 14-day. WSSA 13.
Broadleaf Weeds Only - Postemergence

**Pesticide**

**2,4-D amine products (2,4-D)** | Use 3-4 pts. per acre of liquid formulations with 3.8 lbs. per gal. acid equivalent, or 1.5-2.5 lbs. per acre of dry formulations with 78.9% acid equivalent. Apply before, during, or after the harvest season. During harvest season apply immediately after cutting. Discard deformed spears. Use drop nozzles or other equipment that will minimize contact with crop. Adding COC or NIS (alone or with UAN or AMS) will improve emerged weed control and increase crop injury risk in postharvest applications. Do not exceed 2 applications per year, or 7.7 fl. oz. per acre per year. REI: 12-hour. PHI: 3-day. WSSA 4.

**Callisto (40SC) (mesotrione)** | 3-7.7 fl. oz. per acre. Apply in spring before spears emerge after mowing, disking, or tilling; after final harvest; or both. For postharvest applications use drop nozzles or other equipment that will minimize contact with crop. Adding COC or NIS (alone or with UAN or AMS) will improve emerged weed control and increase crop injury risk in postharvest applications. Do not exceed 2 applications per year, or 7.7 fl. oz. per acre per year. REI: 12-hour. PHI: 1-day. WSSA 27.

**Clarity (4WS) (dicamba)** | 0.5-1.0 pt. per acre. Apply in 40-60 gals. of water per acre immediately after cutting. Discard crooked spears at harvest. Clarity can injure nearby broadleaf crops and garden plants. Maximum 1 pt. per acre per year. REI: 24-hour. PHI: 1-day. WSSA 4.

**Lorox DF (50) (linuron)** | 2-4 lbs. per acre. Established crowns: Apply before spears emerge, before cutting season or immediately after cutting, or as directed spray in ferns. New planted crowns: To control small emerged weeds apply 1-2 lbs. per acre, up to 2 applications when ferns are 6-18 inches tall. Newly seeded crops: Apply a 1-inch band of activated charcoal over the row at planting, then apply Lorox. Use charcoal at 300 lbs. per acre of actual area sprayed, which is equivalent to 15 lbs. per acre of crop with a 20-inch row-spacing. Or, use the low rate of Lorox when ferns are 6-18 inches tall and weeds are less than 4 inches tall. Do not use on sand, loamy sand, or soils with less than 1% organic matter. Maximum 4 lbs. or 3 applications per acre per year. REI: 24-hour to 8-day. PHI: 1-day. WSSA 7.

**Sandea (75) (halosulfuron)** | 0.5-1.5 oz. per acre. Apply before, during, or after harvest. Drop nozzles and using COC or NIS are recommended for applications after harvest. For first year transplants do not apply sooner than 6 weeks after fern emergence. Do not exceed 2 applications per crop cycle, or 2 oz. per acre per 12-month period. Has residual soil activity. Effective on nutsedge. REI: 12-hour. PHI: 1-day. WSSA 2.

Grass Weeds Only - Postemergence

**Pesticide**

**Fusilade DX (2EC) (fluazifop-P)** | 8-12 fl. oz. per acre. Include 1-2 pts. of COC or 0.5-1 pt. of NIS per 25 gals. of spray solution. Spray on actively growing grass. Wait at least 14 days between applications. Do not exceed 32 fl. oz. of 2EC formulations or 64 fl. oz. of Select Max per acre per season. REI: 24-hour. PHI: 1-day. WSSA 1.

**Post (1.5EC) (sethoxydim)** | 1-1.5 pts. per acre. Include 1 qt. COC per acre. Spray on actively growing grass. Use high rate on
Celery - Diseases

quackgrass. Do not exceed 5 pts. per acre per season. REI: 12-hour. PHI: 1-day. WSSA 1.

Celery - Horticulture

Reviewed by Ben Phillips, Liz Maynard, Ben Werling – Oct 2020

Crop Description

Commercial celery (Apium graveolens) production in the United States began in Michigan in the 1800s. Numbered commercial varieties are maintained by a small breeding effort supported directly by the largest growers of the commodity. Other seed sources are available for smaller-scale growers, and include bushier thin-stalked types, and taller thick-stalked types. The standard green varieties can be blanched to maintain a lighter white color of the inner stalks through soil-hilling or by dense plant spacing. There are also red varieties. Seeds are produced in the second year of production if plants are overwintered under mulch.

Planting and Spacing

Celery seed is small and difficult to germinate, thus all commercial celery is planted from greenhouse-grown transplants produced in plug trays using peat-based media. Allow 8 to 10 weeks for transplant production.

In early February, seeds are sown in greenhouses and are ready for transplanting to the field in about eight weeks. Transplanting begins 6 to 8 weeks before last frost, and ends 6 to 8 weeks after last frost. Schedule planting so that a uniform quantity of celery is ready to harvest every week. Using transplants as opposed to direct seeding ensures uniform stands and faster maturing crops. Often, succession plantings are started every three weeks.

Harden off transplants by reducing water, not temperatures. Celery is a cool-season crop that produces best at temperatures of 60° to 80° F. Plants can withstand light frosts, but prolonged frosts below 28° F will cause damage. Plants may form seed stalks (bolt) if exposed to temperatures below 55° F for 7 days or longer.

Traditionally, celery has been grown on muck soils, but it can be grown on coarse-textured mineral soils. Regardless of soil type, high fertility and moisture are necessary for tender succulent stalks.

Rotate celery with crops such as onions or corn whenever possible to avoid building up pests in the soil. At the end of the season, consider planting a winter cover crop of barley or rye to reduce erosion and add active organic matter to the soil.

Typical spacing for celery is rows 2 feet apart with plants 6 inches apart in row. One plant per square foot.

Fertilizing

pH: Maintain the soil pH above 5.5 in muck soils and 6.5 in mineral soils.

Before planting, apply 40 pounds N per acre, 0 to 230 pounds P₂O₅ per acre, and 0 to 500 pounds K₂O per acre based on soil test results and recommendations from your state. Celery is responsive to B. Apply 2 to 4 pounds of B per acre in banded or broadcast fertilizer to avoid stem cracking.

Banding fertilizer at transplanting can help when soil is less than 55° F. In these cases, band up to 40 pounds N per acre, up to 100 pounds P₂O₅ per acre, and up to 40 pounds K₂O per acre, and subtract those amounts from the preplant application.

Sidedress with 40 to 50 pounds N per acre two or three times, three or four weeks apart, starting six weeks after transplanting, or apply equivalent amount of N through fertigation. Reduce the amount of fertilizer N applied by the value of N credits from green manures, legume crops grown in the previous year, compost and animal manures, and soils with more than 3 percent organic matter. The total amount of N from fertilizer (including starter) and other credits should be 200 pounds per acre on mineral soils and 150 pounds per acre on muck soils.

Use overhead sprinkler or drip irrigation to apply water frequently to the shallow-rooted crop. If the soil gets too dry, physiological disorders such as blackheart (a calcium deficiency), will develop.

Harvesting

Once celery reaches marketable size, there is a narrow harvest window (about six to eight days) before quality significantly reduces. Fresh market and processing celery can be both handpicked or harvested mechanically. Time from transplanting to harvest ranges between 100 and 130 days.

Harvest celery by pulling the entire plant. Cut off the roots and trim the tops. Wash if necessary and cool quickly with water or forced air. Maintain a cold chain to market for best quality. Ideal storage conditions are near freezing and high humidity.

Celery - Diseases

Reviewed by Dan Egel – Nov 2020

Recommended Controls

Anthracnose of Celery - Colletotrichum Fungus

Disease and symptom development are favored by periods of warm temperatures (>68 F) combined with high humidity. Symptoms include curled/cupped leaves, sporadic leaf margin discoloration, twisted petioles and small, oval lesions on petioles.
Symptoms of anthracnose can be confused with those associated with aster yellows except that the affected foliage remains green.

**Pesticide**

Cabrio EG (20) (pyraclostrobin) | 12-16 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 11.

Merivon (fluxapyroxad, pyraclostrobin) | 4-11 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 7, FRAC 11.

Pristine 38WG (boscalid, pyraclostrobin) | 10-15 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

**Aster Yellows (Purple-Top Wilt) of Multiple Crops - Phytoplasma Mollicutes**

**Pesticide**

Insecticides | Use an insecticide to control leafhoppers that transmit the disease. Leafhoppers must be controlled before they feed. See Insect section.

**Bacterial Blight of Celery - Pseudomonas Bacteria**

Symptoms include leaf blight and extensive leaf death that requires additional trimming at harvest, resulting in yield loss. May be seedborne.

**Non-Pesticide**

Use disease-free seed. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 118 F for 30 minutes for celery. Rotate to non-host crops for 2 years. Varieties with partial resistance are available. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) | Several formulations of copper (Badge, Champ, Kocide) are labelled for use and may slow the spread of bacterial blight. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

**Crater Rot of Celery - Rhizoctonia Fungus**

**Non-Pesticide**

Clean and sanitize transplant trays, benches, and tools. Rogue infected transplants. Avoid working field under wet conditions. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

azoxystrobin products (azoxystrobin) | Use 2 lb. a.i. per gallon formulations (Quadris) at 0.4-0.8 fl. oz. per 1,000 row feet. Use 3.3 lb. per gallon formulations (Azteroid) at 0.24-0.48 fl. oz. per 1,000 row feet, REI: 4-hour. PHI: 0-day. FRAC 11.

Cataran (potassium phosphite, chlorothalonil) | 4-5 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC P7, FRAC M5.

chlorothalonil products (chlorothalonil) | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labelled at various rates. See label for directions. REI: 12-hour. PHI: 7-day. FRAC M5.

Quadris Opti (SC) (azoxystrobin, chlorothalonil) | 2.4-3.7 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC M5.

**Damping-Off Seed and Seedling Rots of Multiple Crops - Multiple Pathogens**

Michigan State University research has found *Pythium* spp. causing damping-off of celery in greenhouses can result in poor field establishment.

**Non-Pesticide**

Practice good greenhouse sanitation of equipment, tools propagation trays/pots, and surfaces. Avoid excess moisture to the transplants in the greenhouse by monitoring irrigation frequency. Plant in warm field soils. The fungi responsible for damping-off in field soils cause more loss when the seedling is slow to emerge.

**Pesticide**


Uniform (L) (mefenoxam, azoxystrobin) | 0.34 fl. oz. per 1,000 ft. of row. Make one application per crop per season. REI: 0-hour. PHI: 0-day. FRAC 4, FRAC 11.

**Early Blight of Celery - Cercospora Fungus**

Early blight (Cercospora leaf blight) symptoms include small, yellow spots that rapidly enlarge to tan or gray lesions. All above ground tissues of celery can become infected, resulting in losses of 50% or more when blighted stalks or leaves have to be removed at harvest. May be seedborne.

**Non-Pesticide**

Use disease-free seed. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 118 F for 30 minutes for celery. Rotate to non-host crops for 2 years. Varieties with partial resistance are available. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.
Celery - Diseases

**Pesticide**

*azoxyystrobin products (azoxyystrobin)* | Use 2 lb. a.i. per gallon formulations (Quadris) at 9.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 5.8-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.11-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

*Quadris Opti (SC) (azoxyystrobin, chlorothalonil)* | 2.4-3.7 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC M5.

*Quilt (SE) (azoxyystrobin, propiconazole)* | 14 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC 3.

**Late Blight of Celery - Septoria Fungus**

Late blight (Septoria leaf blight) include irregularly-shaped brown spots on leaves with pycnidia similar in appearance to grains of ground black pepper. Over time, these leaf spots expand and cause the entire leaf to die. May be seedborne.

*Non-Pesticide*

Use disease-free seed. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 118 F for 30 minutes for celery. Rotate to non-host crops for 2 years. Varieties with partial resistance are available. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

*azoxyystrobin products (azoxyystrobin)* | Use 2 lb. a.i. per gallon formulations (Quadris) at 9.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 5.8-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.11-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

*Cabrio EG (20) (pyraclostrobin)* | 12-16 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 11.

*Catamaran (potassium phosphite, chlorothalonil)* | 4-5 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC P7, FRAC M5.

*chlorothalonil products (chlorothalonil)* | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 7-day. FRAC M5.

*Flint Extra (4.05) (trifloxystrobin)* | 2.5-2.9 fl. oz. per acre. Maximum application volume: 30-gallons per acre. REI: 12-hour. PHI: 0-day. FRAC 11.

*Fontelis (1.67SC) (penthiopyrad)* | 14-24 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 7.

*Luna Sensation (fluopyram, trifloxystrobin)* | 4-5.8 fl. oz. per acre REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 11.

*Merivon (fluxapyroxad, pyraclostrobin)* | 4-11 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 7, FRAC 11.

*Pristine 38WG (boscalid, pyraclostrobin)* | 10-15 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

*propiconazole products (propiconazole)* | 4 fl. oz. per acre. PropiMax EC and Tilt are labeled. REI: 12-hour. PHI: 14-day. FRAC 3.

*Quadris Opti (SC) (azoxyystrobin, chlorothalonil)* | 2.4-3.7 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC M5.

*Quilt (SE) (azoxyystrobin, propiconazole)* | 14 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC 3.

**Nematodes**

*Pesticide*

*Nimitz (4EC) (fluensulfone)* | 3.5-7 pts. per acre. Do not use on direct-seeded plants. May be broadcast, banded, or drip-applied in the spring up to 7 days before planting at a depth of 8 inches.
Effectiveness is reduced on muck and clay soils. REI: 12-hour. IRAC UN.

Sectagon K42 (4.2L) (metam sodium) | 37.5-75 gals. per acre. Use high rates on muck, and lower rates on sands. In the fall, when soil at 6 inches is above 50 F and moist, place Sectagon K42 or VAPAM HL about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, it can be applied through drip irrigation under unperforated plastic beds. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC 8F, FRAC M3, WSSA 17. RUP.

Sectagon K54 (5.63L) (metam potassium) | 30-62 gals. per acre. Use high rates on muck, and lower rates on sands. In the fall, when soil at 6 inches is above 50 F and moist, place Sectagon K54 or K-PAM HL about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, it can be applied through drip irrigation under unperforated plastic beds. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC 8F, FRAC M3, WSSA 17. RUP.

Telone C-17 (L) (1,3-dichloropropene, chloropicrin) | Muck soils: Use C-17 formulation at 27.4-30 gals. per acre, and C-35 formulation at 33-36 gals. per acre. Mineral soils: Use C-17 formulation at 10.8-17.1 gals. per acre, and C-35 formulation at 13-20.5 gals per acre. In the fall, when soil at 6 inches is above 50 F and moist, place Telone C-17 or C-35 about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing, irrigation, or plastic. Or, in the spring, InLine may be applied through drip irrigation under unperforated plastic beds at 13-20.5 gals. per acre on mineral soils only. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 3-5-day. IRAC UN, FRAC NC, IRAC 8B. RUP.

Telone II (9.85L) (1,3-dichloropropene) | Muck soils: Use at 25 gals. per acre. Mineral soils: Use at 9-12 gals. per acre. In the spring or fall, when soil at 6 inches is above 50 F and moist, place Telone II about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, Telone EC may be applied through drip irrigation under unperforated plastic beds at 9-18 gals. per acre on mineral soils only. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC UN, FRAC NC. RUP.

Vydate L (2WSL) (oxamyl) | 0.5-2 pts. per acre. MI, and OH only. Apply as a banded or shank-injected pre-plant, at-plant infurrow or directed post-plant soil treatment with at least 20 gals. water per acre incorporated 2-4 inches deep by water or mechanical means. Start post-plant applications 3 weeks after transplanting. Allow 14 days between applications. Do not exceed 5 total applications, or 24 pts. per acre per season. REI: 48-hour. PHI: 21-day. IRAC 1A. RUP.

Rust of Multiple Crops - Puccinia Fungus

Pesticide

Flint Extra (4.05) (trifloxystrobin) | 2.5-2.9 fl. oz. per acre. Maximum application volume: 30-gallons per acre. REI: 12-hour. PHI: 0-day. FRAC 11.

Luna Sensation (fluopyram, trifloxystrobin) | 4-5.8 fl. oz. per acre REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 11.

Celery - Insects

Recommended Controls

Aphids

Over-treatment with pyrethroids (IRAC 3A) may cause increased aphid problems.

Treat when more than 3% of plants are infested or there are more than 6 aphids per 100 sweeps.

Pesticide

Actara (25WDG) (thiamethoxam) | 1.5-3.0 oz. per acre. Apply as a foliar treatment. Allow 7 days between applications. Do not exceed 11 oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 4A.

Admire Pro (4.6SC) (imidacloprid) | 4.4-10.5 fl. oz. per acre. Do not exceed 10.5 fl. oz. per acre per season. REI: 12-hour. PHI: 45-day. IRAC 4A.

Assail 30SG (acetamiprid) | Use 30SG formulations at 2-4 oz. per acre and do not exceed 20 oz. per acre per season. Use 70WP formulations at 0.8-1.7 oz. per acre and do not exceed 8.5 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

Belay (2.13SC) (clothianidin) | Soil applications: 9-12 fl. oz. per acre. Foliar applications: 3-4 fl. oz. per acre. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 4A.

Beleaf (50SG) (flonicamid) | 2-2.8 oz. per acre. Allow 7 days between applications. Do not exceed 8.4 oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 29.

Brigade 2EC (bifenthrin) | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Closer SC (2) (sulfoxaflor) | 1.5-2 fl. oz. per acre. Use high rate when pest pressure is heavy. Do not exceed 17 fl. oz. per acre per year. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 4C.
Celery - Insects

Durivo (SC) (thiamethoxam, chlorantraniliprole) | 10-13 fl. oz. per acre. Apply as a soil treatment. Do not exceed 13 fl. oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A, IRAC 28.

Exirel (0.83%SE) (cyrantraniliprole) | 13.5-20.5 fl. oz. per acre. Use an effective adjuvant. Allow 5 days between applications. Do not exceed 61.7 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 28.

Fulfill (50WDG) (pyrimezine) | 2.75 oz. per acre. May require 5-7 days for aphid mortality. Allow 7 days between applications. Do not exceed 5.5 oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 9B.

Malathion 5EC (malathion) | Use 5EC and 57EC formulations at 1.5-2.4 pts. per acre. Do not exceed 2 applications per season. Allow 7 days between applications. REI: 12 to 24-hour. PHI: 7-day. IRAC 1B.

Movento (2SC) (spirotetramat) | 4-5 fl. oz. per acre. Must be tank-mixed with an adjuvant with spreading and penetrating properties. Allow 7 days between applications. Do not exceed 10.0 fl. oz. per acre per season. REI: 24-hour. PHI: 3-day. IRAC 23.

Mustang Maxx (0.8) (zeta-cypermethrin) | 2.24-4.0 fl. oz. per acre. Allow 7 days between applications. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Nuprid 2SC (imidacloprid) | 10-24 fl. oz. per acre. Apply as a soil treatment. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 45-day. IRAC 4A.

Orthene 97 (S) (acephate) | 8-16 oz. per acre. Allow 3 days between applications of 8 oz. per acre, and 7 days between applications of over 16 oz per acre. Do not exceed 34 oz. per acre per season. REI: 24-hour. PHI: 21-day. IRAC 1B.

Perm-Up 25DF (permethrin) | Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 64 oz. per acre per season. Use 3.2EC formulations at 2.8 fl. oz. per acre and do not exceed 40 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Sivanto 200 (1.67SL) (flupyradifurone) | 10.5-12.0 fl. oz. per acre. Can be applied as a foliar spray or soil treatment. See label for application methods. REI: 4-hour. PHI: 1-day. IRAC 4D.

Torac (1.29SC) (tofenpyrad) | 17-21 fl. oz. per acre. Do not apply until 14 days after transplanting. Do not exceed 42 fl. oz. per crop cycle. REI: 12-hour. PHI: 1-day. IRAC 21A, FRAC 39.

Verimark (1.67%SC) (cyantraniliprole) | 6.75-13.5 fl. oz. per acre. Apply as a soil treatment. Do not exceed 30.6 fl. oz. per acre per season. REI: 4-hour. PHI: 0-day. IRAC 28.

Voliam Flexi (WDG) (thiamethoxam, chlorantraniliprole) | 4-7 oz. per acre. Do not exceed a total of 14 oz. per acre per growing season. Minimum interval between applications is 7 days. REI: 12-hour. PHI: 7-day. IRAC 4A, IRAC 28.

Carrot Weevil Beetle

Pesticide

Voliam Flexi (WDG) (thiamethoxam, chlorantraniliprole) | 4-7 oz. per acre. Do not exceed a total of 14 oz. per acre per growing season. Minimum interval between applications is 7 days. REI: 12-hour. PHI: 7-day. IRAC 4A, IRAC 28.

Vydate L (2WSL) (oxamyl) | 4 pts. per acre. Michigan and Ohio only. Apply as a soil-directed spray with at least 20 gals. water per acre, incorporated 2-4 inches deep by water or mechanical means. Start when eggs or larvae are first seen and repeat in 2 to 3 weeks. Allow 14 days between applications. Do not exceed 5 total applications, or 24 pts. per acre per season. REI: 48-hour. PHI: 21-day. IRAC 1A. RUP.

Caterpillars

There are many caterpillar pests of celery, including cabbageworms, diamond back moth caterpillars, earworms, corn borers, cutworms, loopers, and armyworms. Always check the label for the specific list of caterpillars that the product can be used on.

Apply preventative treatments within 4 weeks of harvest. Treat as needed before that.

Pesticide

Avaunt (30WDG) (indoxacarb) | 3.5 oz. per acre. For armyworms, and loopers. Allow 3 days between applications. Do not exceed 56 oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 22.

Bacillus thuringiensis products for caterpillars (Bacillus thuringiensis aizawai strain ABTS-1857, Bacillus thuringiensis aizawai strain GC-91, Bacillus thuringiensis kurstaki strain ABTS-351, Bacillus thuringiensis kurstaki strain EVB-113-19, Bacillus thuringiensis kurstaki strain SA-11) | For armyworms, cutworms, and loopers. Various Bt products are available for control of young caterpillars (Agree, Biobit, Dipel, Javelin, etc.) Different Bt subspecies have different control properties. Check labels for rates, timing of application and required safety equipment. REI: 4-hour. PHI: 0-day. IRAC 11A.

Baythroid XL (1EC) (beta-cyfluthrin) | 0.8-3.2 fl. oz. per acre. For armyworms, cutworms, and loopers. Use high rate for armyworms and target 1st and 2nd instar caterpillars. Allow 7 days between applications. Do not exceed 12.8 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

Brigade 2EC (bifenthrin) | For armyworms, cutworms, and loopers. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre and do not exceed 80
oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Confirm 2F (tebufenozide) | 6-8 fl. oz. per acre. For armyworms, and loopers. Do not exceed 40 fl. oz. per acre per crop. REI: 4-hour. PHI: 7-day. IRAC 18.

Coragen (1.67SC) (chlorantraniliprole) | 3.5-7.5 fl. oz. per acre. For armyworms, and loopers. Can be applied as a foliar spray or soil treatment. Allow 3 days between foliar applications and 10 days between soil applications. Do not exceed 15.4 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 18.

Durivo (SC) (thiamethoxam, chlorantraniliprole) | 10-13 fl. oz. per acre. For armyworms, and loopers. Apply as a soil treatment. Do not exceed 13 fl. oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A, IRAC 28.

Entrust SC (2) (spinosad) | For armyworms, and loopers. Use 2SC formulations at 1.5-8.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 0.5-2.5 oz. per acre and do not exceed 9 oz. per acre per season. Allow 4 days between applications. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

Exirel (0.83SE) (cyantraniliprole) | 7.0-17.0 oz. per acre. For armyworms, and loopers. Allow 5 days between applications. Do not exceed 61.7 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 28.

Intrepid 2F (methoxyfenozide) | 4-10 oz. per acre. For armyworms, and loopers. Use 4-8 fl. oz. per acre in early season, and 8-10 fl. oz. per acre on mid and late season. Do not exceed 64 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 18.

Lannate LV (2.4L) (methomyl) | 1.5 - 3.0 pts. per acre. For armyworms, cutworms, and loopers. Do not exceed 21 pts. per acre per season. REI: 48-hour. PHI: 7-day. IRAC 1A. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) | 2.24-4.0 fl. oz. per acre. For armyworms, cutworms, and loopers. Allow 7 days between applications. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Perm-Up 25DF (permethrin) | For armyworms, and loopers. Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 64 oz. per acre per season. Use 3.2EC formulations at 2-8 fl. oz. per acre and do not exceed 40 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Proclaim (5SG) (emamectin benzoate) | 2.4-4.8 oz. per acre. For armyworms, and loopers. Allow 7 days between applications. Do not exceed 28.8 oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 6. RUP.

Radiant 1SC (spinetoram) | 5-10 fl. oz. per acre. For armyworms, and loopers. Allow 4 days between applications. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 5.

Sevin XLR Plus (4SC) (carbaryl) | 1-2 qts. per acre. For armyworms. Do not exceed 6 qts. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 1A.

Verimark (1.67SC) (cyantraniliprole) | 5.0-13.5 fl. oz. per acre. For armyworms, and loopers. Apply as a soil treatment at-plant. Do not exceed 30.6 fl. oz. per acre per season. REI: 4-hour. PHI: 0-day. IRAC 28.

Leafhoppers

Treat when there are more than 14 leafhoppers per 100 sweeps. Repeat as needed, depending on number of leafhoppers.

Pesticide

Actara (25WDG) (thiamethoxam) | 1.5-3.0 oz. per acre. Apply as a foliar treatment. Allow 7 days between applications. Do not exceed 11 oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 4A.

Admire Pro (4.6SC) (imidacloprid) | 4.4-10.5 fl. oz. per acre. Do not exceed 10.5 fl. oz. per acre per season. REI: 12-hour. PHI: 45-day. IRAC 4A.

Belay (2.13SC) (clothianidin) | Soil applications: 9-12 fl. oz. per acre. Foliar applications: 3-4 fl. oz. per acre. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 4A.

Brigade 2EC (bifenthrin) | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Durivo (SC) (thiamethoxam, chlorantraniliprole) | 10-13 fl. oz. per acre. Apply as a soil treatment. Do not exceed 13 fl. oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A, IRAC 28.

Lannate LV (2.4L) (methomyl) | 1.5 - 3.0 pts. per acre. Do not exceed 21 pts. per acre per season. Allow 7 days between applications. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Nuprid 2SC (imidacloprid) | 10-24 fl. oz. per acre. For armyworms. Do not exceed 6 qts. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 1A.

Perm-Up 25DF (permethrin) | Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 64 oz. per acre per season. Use 3.2EC formulations at 2-8 fl. oz. per acre and do not exceed 40 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Platinum 2SC (thiamethoxam) | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 1A.
Celery - Insects

acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

**Scorpion 35SL (3.24) (dinetofuran)** | **Soil treatment:** Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-5.5 oz. per acre. **Foliar treatment:** Use Scorpion 25SL at 2.0-2.5 oz. per acre, or Venom 70SG at 1-3 oz. per acre. Allow 7 days between applications. REI: 12-hour. PHI: 21-day as soil application, 7-day as foliar application IRAC 4A.

Sevin XLR Plus (4SC) (carbaryl) | 1-2 qts. per acre. Do not exceed 6 qts. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 1A.

Sivanto 200 (1.67SL) (flupyradifurone) | 7.0-10.5 fl. oz. per acre. Can be applied as a foliar spray or soil treatment. See label for application methods. REI: 4-hour. PHI: 1-day. IRAC 4D.

**Torac (1.29SC) (tolfenpyrad)** | 14-21 fl. oz. per acre. Do not apply until 14 days after transplanting. Do not exceed 42 fl. oz. per crop cycle. REI: 12-hour. PHI: 1-day. IRAC 21A, FRAC 39.

**Voliam Flexi (WDG) (thiamethoxam, chlorantraniliprole)** | 4-7 oz. per acre. Do not exceed a total of 14 oz. per acre per growing season. Minimum interval between applications is 7 days. REI: 12-hour. PHI: 7-day. IRAC 4A, IRAC 28.

**Leafminers**

Treat as soon as visible mines appear and repeat every 7 days as needed.

**Pesticide**

**Actara (25WDG) (thiamethoxam)** | 1.5-3.0 oz. per acre. Apply as a foliar treatment. Allow 7 days between applications. Do not exceed 11 oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Admire Pro (4.6SC) (imidacloprid)** | 4.4-10.5 fl. oz. per acre. Do not exceed 10.5 fl. oz. per acre per season. REI: 45-day. PHI: 1-day. IRAC 4A.

**Agri-Mek SC (0.7) (abamectin)** | 1.75-3.5 fl. oz. per acre. Use with a nonionic surfactant. Allow 7 days between applications. Do not exceed 10.5 fl. oz. per acre. REI: 12-hour. PHI: 7-day. IRAC 6. RUP.

**Baythroid XL (1EC) (beta-cyfluthrin)** | 0.8-3.2 fl. oz. per acre. Allow 7 days between applications. Do not exceed 12.8 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Coragen (1.67SC) (chlorantraniliprole)** | 5.0-7.5 fl. oz. per acre. Can be applied as a foliar spray or soil treatment. See label for application methods. Allow 3 days between foliar applications. Do not exceed 15.4 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

**Dimethoate 4EC (dimethoate)** | Use 4EC, LV-4, and 400 EC formulations at 1 pt. per acre and do not exceed 3 pts. per acre per season. REI: 48-hour. PHI: 7-day. IRAC 1B.

**Durivo (SC) (thiamethoxam, chlorantraniliprole)** | 10-13 fl. oz. per acre. Apply as a soil treatment. Do not exceed 13 fl. oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A, IRAC 28.

**Entrust SC (2) (spinosad)** | Use 2SC formulations at 6-10 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 2-3 oz. per acre and do not exceed 9 oz. per acre per season. Allow 4 days between applications. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

**Exirel (0.83SE) (cyrantraniliprole)** | 13.5-20.5 fl. oz. per acre. Use an effective adjuvant. Allow 5 days between applications. Do not exceed 61.7 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 28.

**Platinum 2SC (thiamethoxam)** | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

**Radiant 1SC (spinetoram)** | 6-10 fl. oz. per acre. Allow 4 days between applications. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 5.

**Scorpion 35SL (3.24) (dinetofuran)** | **Soil treatment:** Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-5.5 oz. per acre. **Foliar treatment:** Use Scorpion 25SL at 2.0-2.5 oz. per acre, or Venom 70SG at 1-3 oz. per acre. Allow 7 days between applications. REI: 12-hour. PHI: 21-day as soil application, 7-day as foliar application IRAC 4A.

**Trigard (75WP) (cyromazine)** | 2.66 oz. per acre. Allow 7 days between applications. Do not exceed 6 applications per crop. REI: 12-hour. PHI: 7-day. IRAC 17.

**Verimark (1.67SC) (cyantraniliprole)** | 6.75-13.5 fl. oz. per acre. Apply as a soil treatment. Do not exceed 30.6 fl. oz. per acre per season. REI: 4-hour. PHI: 0-day. IRAC 28.

**Mites**

**Pesticide**

**Admire Pro (4.6SC) (imidacloprid)** | 4.4-10.5 fl. oz. per acre. Do not exceed 10.5 fl. oz. per acre per season. REI: 12-hour. PHI: 45-day. IRAC 4A.

**Agri-Mek SC (0.7) (abamectin)** | 1.75-3.5 fl. oz. per acre. Use with a nonionic surfactant. Allow 7 days between applications. Do not exceed 10.5 fl. oz. per acre. REI: 12-hour. PHI: 7-day. IRAC 6. RUP.

**Baythroid XL (1EC) (beta-cyfluthrin)** | 0.8-3.2 fl. oz. per acre. Allow 7 days between applications. Do not exceed 12.8 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Coragen (1.67SC) (chlorantraniliprole)** | 5.0-7.5 fl. oz. per acre. Can be applied as a foliar spray or soil treatment. See label for application methods. Allow 3 days between foliar applications. Do not exceed 15.4 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

Dimethoate 4EC (dimethoate) | Use 4EC, LV-4, and 400 EC formulations at 1 pt. per acre and do not exceed 3 pts. per acre per season. REI: 48-hour. PHI: 7-day. IRAC 1B.
**Celery - Insects**

**Dimethoate 4EC (dimethoate)** | Use 4EC, LV-4, and 400 EC formulations at 1 pt. per acre and do not exceed 3 pts. per acre per season. REI: 48-hour. PHI: 7-day. IRAC 1B.

**Malathion 5EC (malathion)** | Use 5EC and 57EC formulations at 1.5-2.4 pts. per acre. Do not exceed 2 applications per season. Allow 7 days between applications. REI: 12 to 24-hour. PHI: 7-day. IRAC 1B.

**Oberon 2SC (spiromesifen)** | 7.0-8.5 fl. oz. per acre. *For the treatment of Two-Spotted Spider Mites in Michigan only. MI 24c exp. 08/23/22.* Allow 7 days between applications. Do not exceed 25.5 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 23.

**Verimark (1.67SC) (cyantraniliprole)** | 6.75-13.5 fl. oz. per acre. Apply as a soil treatment. Do not exceed 30.6 fl. oz. per acre per season. REI: 4-hour. PHI: 0-day. IRAC 28.

**Slugs**

**Pesticide**

**Deadline M-Ps (4P) (metaldehyde)** | 25 lbs. per acre. Apply between rows. Avoid contact with edible product. Allow 21 days between applications. Do not exceed 100 lbs. per acre per season. REI: 12-hour. PHI: 1-day. IRAC UN.

**Tarnished Plant Bug**

Treat if there are 2-4 tarnished plant bugs per 20 plants.

**Pesticide**

**Baythroid XL (1EC) (beta-cyfluthrin)** | 0.8-3.2 fl. oz. per acre. Allow 7 days between applications. Do not exceed 12.8 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Beleaf (50SG) (flonicamid)** | 2-2.8 oz. per acre. Allow 7 days between applications. Do not exceed 8.4 oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 29.

**Mustang Maxx (0.8) (zeta-cypermethrin)** | 2.24-4.0 fl. oz. per acre. Allow 7 days between applications. Do not exceed 4 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Sevin XLR Plus (4SC) (carbaryl)** | 1-2 qts. per acre. Do not exceed 6 qts. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 1A.

**Torac (1.29SC) (tolifenpyrad)** | 17-21 fl. oz. per acre. Do not apply until 14 days after transplanting. Do not exceed 42 fl. oz. per crop cycle. REI: 12-hour. PHI: 1-day. IRAC 21A, FRAC 39.

**Thrips**

**Pesticide**

**Closer SC (2) (sulfoxaflor)** | 4.25-5.75 fl. oz. per acre. *Suppression only.* Use high rate when pest pressure is heavy. Do not exceed 17 fl. oz. per acre per year. Allow 7 days between applications. Do not apply within 3 days of harvest. REI: 12-hour. PHI: 3-day. IRAC 4C.

**Exirel (0.83SE) (cyantraniliprole)** | 13.5-20.5 fl. oz. per acre. Use an effective adjuvant. Allow 5 days between applications. Do not exceed 61.7 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 28.

**Radiant 1SC (spinetoram)** | 6-10 fl. oz. per acre. Allow 4 days between applications. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 5.

**Torac (1.29SC) (tolifenpyrad)** | 21 fl. oz. per acre. Do not apply until 14 days after transplanting. Do not exceed 42 fl. oz. per crop cycle. REI: 12-hour. PHI: 1-day. IRAC 21A, FRAC 39.

**Whiteflies**

**Pesticide**

**Assail 30SG (acetamiprid)** | Use 30SG formulations at 2-4 oz. per acre and do not exceed 20 oz. per acre per season. Use 70WP formulations at 0.8-1.7 oz. per acre and do not exceed 8.5 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Closer SC (2) (sulfoxaflor)** | 5.75 fl. oz. per acre. *Suppression only.* Do not exceed 17 fl. oz. per acre per year. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 4C.

**Exirel (0.83SE) (cyantraniliprole)** | 13.5-20.5 fl. oz. per acre. Use an effective adjuvant. Allow 5 days between applications. Do not exceed 61.7 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 28.

**Movento (2SC) (spirotetramat)** | 4-5 fl. oz. per acre. Must be tank-mixed with an adjuvant with spreading and penetrating properties. Allow 7 days between applications. Do not exceed 10.0 fl. oz. per acre per season. REI: 24-hour. PHI: 3-day. IRAC 23.

**Sivanto 200 (1.67SL) (flupyradifurone)** | 10.5-14.0 fl. oz. per acre. Can be applied as a foliar spray or soil treatment. See label for application methods. REI: 4-hour. PHI: 1-day. IRAC 4D.

**Voliam Flexi (WDG) (thiamethoxam, chlorantraniliprole)** | 4-7 oz. per acre. Do not exceed a total of 14 oz. per acre per growing season. Minimum interval between applications is 7 days. REI: 12-hour. PHI: 7-day. IRAC 4A, IRAC 28.
Celery are nearly always started as transplants. Early season plantings are more at risk of herbicide stunting in cool soils. There are several herbicides labeled for the control of weeds preemergence, applied before celery is transplanted, or directed between the rows only after transplanting.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

### Non-Pesticide

Weed control in celery often relies heavily on cultivation and hand weeding for full season weed control. These operations are most efficient when planting arrangement is designed with weed control in mind and is designed to work with available weed control equipment. Specialized weeding equipment for leafy vegetables includes basket weeder, narrow-bladed hoes, finger weeders, and others. Prepare a stale seedbed prior to transplanting with flaming or very shallow cultivation, instead of herbicides.

### Broadleaf and Grass Weeds - Preemergence

#### Pesticide

**Caparol 4L (prometryn)** | 1-2 qts. per acre. Make 1 or 2 applications 2-6 weeks after transplanting but before weeds are 2 inches tall. Do not exceed 2 qts. per acre per year. REI: 12-hour. WSSA 5.

**Chateau SW (51WDG) (flumioxazin)** | 3 oz. per acre. Apply before transplanting or 3-7 days after transplanting for control of many annual broadleaf weeds and grasses. Do not tank mix with other pesticides. REI: 12-hour. WSSA 14.

**Dual Magnum (7.62EC) (s-metolachlor)** | 1-2 pts. per acre. Indiana, Michigan, and Minnesota only (MI 24c exp. 12/31/21. MN 24c exp. 12/31/20): apply before or immediately after transplanting. Will control annual grass and small-seeded broadleaf weeds and nutsedge. Use high rate on muck soils. Follow with 0.25-inch water within 7 days. REI: 24-hour. PHI: 62-day. WSSA 15.

**Lorox DF (50) (linuron)** | 1.5-2 lbs. per acre. Apply after transplants are established but before celery is 8 inches tall. Do not exceed 40 PSI pressure. Do not apply when temperatures exceed 85 F, and do not mix with wetting agents or other pesticides. REI: 24-hour to 8-day. PHI: 45-day. WSSA 7.

**trifluralin products (trifluralin)** | 0.5-1 lb. a.i. per acre. Use 4EC formulations at 1-2 pts. per acre. Use 10G formulations at 5-10 lbs. per acre. Apply and incorporate 1-2 inches before, during, or immediately after planting. Use low rate on coarse soils with less than 2% organic matter. Not effective on muck or high organic matter soils. REI: 12-hour. WSSA 3.

**Zidua (85WDG) (pyroxasulfone)** | 3.25 fl. oz. per acre of SC formulation. 2.0 oz. per acre of WG formulation. Use only on muck soil with greater than 20% organic matter. Apply to transplanted celery 1-6 days after transplanting. REI: 12-hour. WSSA 15.

### Grass Weeds Only - Postemergence

#### Pesticide

**clethodim products (clethodim)** | Use 2EC formulations at 6-8 fl. oz. per acre with 1 qt. of COC per 25 gals. of spray solution (1% v/v). Use Select Max at 9-16 fl. oz. per acre with 8 fl. oz. of NIS per 25 gals. of spray solution (0.25% v/v). Spray on actively growing grass. Wait at least 14 days between applications. Do not exceed 32 fl. oz. of 2EC formulations or 64 fl. oz. of Select Max per acre per season. REI: 24-hour. PHI: 30-day. WSSA 1.

**Poast (1.5EC) (sethoxydim)** | 1-1.5 pts. per acre. Apply to actively growing grasses. Include 1 qt. COC per acre. Do not exceed 3 pts. per acre per season. REI: 12-hour. PHI: 30-day. WSSA 1.
Cole Crops and Brassica Leafy Greens - Horticulture

Reviewed by Ben Phillips, Liz Maynard – Oct 2020

Crop Description

The term “cole crops” refers to leafy brassicas, with waxy leaves, of the species *Brassica oleracea*. Cabbage, cauliflower, broccoli, Brussels sprouts, kale, collards, and kohlrabi are hardy crops and well adapted to cool weather. Mustard and turnip greens, although not cole crops, are also frost-hardy and adapted to cool weather. Careful selection of the planting date and cultivars is crucial to a good harvest in the Midwest. Many cole crop varieties need 80 days or fewer to mature and can be sequentially planted in the spring through mid-summer for sequential harvests starting in the summer through late fall. Some Brussels sprouts, cabbage, and cauliflower varieties need over 100 days mature, and require a full season. Plants maturing under cool weather conditions are the highest in quality.

**Broccoli:** There are heading-types of broccoli that form a distinct domed head, and sprouting “broccolini” types that produce smaller sprigs of flower buds for multiple harvests. There are purple varieties as well. Broccoli is relatively fast-maturing, and varieties can be planted in spring for summer harvest and summer for fall harvest.

**Brussels sprouts:** Brussels sprouts require the entire season from spring to fall to produce small cabbage-like buds in a spiral around the stalk of the plant at the base of each leaf.

**Cabbage:** Among the brassica crops, cabbage is the most widely grown. Small-headed varieties of cabbage (3 to 4 lbs.) are the most desired varieties for fresh market sales. Some varieties can be planted in spring for summer harvest, and in summer for fall harvest. Others require the entire season from spring to fall to mature.

**Cauliflower:** Cauliflower is relatively more difficult to grow. The most common problems associated with cauliflower production are failure to head properly and poor curd quality. Cauliflower buttoning is the premature formation of curd. When the curd is formed very early in the plant’s life, the leaves of the plant are not large enough to sustain its development to a marketable size. Cold temperatures during seedling production or at transplanting encourage buttoning. In order to produce a white curd, leaves are tied over the developing head when it is about the size of a baseball to block out sunlight and blanch it. Self-blanching varieties produce leaves that naturally shade the curd, but they need to be planted closer together to effectively self-blanche, resulting in smaller head sizes. Orange, green, and purple colored varieties, and greenish Romanesco-types do not require blanching. Some varieties can be planted in spring for summer harvest, and in summer for fall harvest. Others require the entire season from spring to fall to mature.

**Kale:** Types and varieties differ in leaf color, texture, and shape. Scotch or Curly kale varieties have frilly leaf margins; cultivar examples include Winterbor, Darkibor, and Redbor (purple-red leaves). Lacinato, also called Tuscan or dinosaur kale, has long narrow leaves with smooth leaf margins and a puckered leaf surface; examples include Black Magic and Toscano. Siberian kale is a different species: *Brassica napus* var. *pabularia*. Siberian kale has wavy lobed leaf margins and is somewhat more tender in terms of eating quality than the curly kales; young leaves do well in salad mixes. Varieties White Russian and Dwarf Siberian are examples. The variety Red Russian has sharply lobed leaves with purple veins; leaves are commonly harvested at a small size for salad mixes. Kale flavor is best when grown in cool weather and harvested after a light frost.

**Mustard:** Mustards come in a wide variety of leaf shapes, colors, and textures. Leaves may be harvested for salad or braising mixes when young, or allowed to grow to full size and sold in bunches.

**Kohlrabi:** The edible stem of kohlrabi looks like a turnip growing on top of the ground with sprouting leaves over the surface. Green and purple varieties are available. It can be ready to harvest sooner than most cole crops and therefore can fit well as a crop for farmers markets early in the season.

Planting and Spacing

Brassicas can be planted from seed, but, aside from baby greens, are more commonly established as transplants. Raised beds (6 inches high, 40 inches wide, with 2 rows 11 inches apart on beds) may be desirable under certain conditions.

**Broccoli:** Rows 3 feet apart. Plants 12 to 18 inches apart in row.

**Brussels sprouts:** Rows 3 feet apart. Plants 18 to 24 inches apart in row. Removing the growing point at the top of the plant when the oldest sprouts are about half their full size can speed development of the remaining buds.

**Cabbage for Market:** Rows 2 to 3 feet apart. Plants 12 to 15 inches apart in row.

**Cabbage for Kraut:** Rows 3 feet apart. Plants 18 inches apart in row.

**Cauliflower:** Rows 3 feet apart. Plants 15 to 18 inches apart in row, or 12 to 15 inches apart in row for self-blanching types.

**Collards:** Rows 3 to 3.5 feet apart. Plants 18 to 24 inches apart in row. Seed 1 to 2 pounds per acre.

**Kale:** Rows 2 to 3 feet apart. Plants 8 to 16 inches apart in row. Seed 2 to 4 pounds per acre. Use denser plantings if harvesting small leaves for salad or braising mixes.
Before planting, apply 50 to 60 pounds N per acre, 25 to 200 pounds P2O5 per acre, and 0 to 200 pounds K2O per acre based on soil test results and recommendations from your state. Cole crops, particularly cauliflower, are responsive to B on low organic matter soils, sandy soils, or where the pH is greater than 7.0. If B is needed, apply 1 to 2 pounds B per acre broadcast. Soil test and/or perform plant analysis on the previous crop to be sure B is needed. High soil B can be detrimental to rotational crops as they reach marketable size, or during one single harvest at the end of the season. In a once-over harvest sprouts can be harvested individually, or entire stalks can be cut. Harvesting the entire stalk saves on labor in the field and extends the shelf life of the buds. The flavor is best after the first frosts of the season. Brussels sprouts are generally long season crops ranging from 80 to 110 days to maturity and harvested in the fall.

Cabbage for fresh market and processing: Cut cabbage when the head has reached a marketable size of 6 to 12 inches in diameter. Peel off the first few wrapper leaves for fresh market sale. Cabbages for processing into kraut are harvested similarly. Cabbage for the bagged salad market are sometimes field-cored. Sometimes a second harvest of side shoots can be obtained. Cabbage varieties range in maturity from 60 to 120 days.

Cauliflower: When ready to harvest, the heads should be compact and clean white. Typical harvest size for wholesale markets is a diameter of approximately 6 inches, but heads can reach 12 inches in diameter and sell well. Delaying harvest usually will not result in obtaining larger heads. If larger heads are desired consider cultivar selection and wider plant spacing. Cauliflower should be hand-harvested and cut with 1 to 2 whorls of leaves to protect the head. Cauliflower varieties range in maturity from 55 to 100 days.

Greens (collards, kale, mustards): Greens are ready to harvest when the leaves reach the size that your markets desire. Leaves are grabbed by the handful and cut with knives or plucked by hand by snapping handfuls of leaf stalks downwards, and then quickly bunching them with rubber bands that are preloaded on to the picker’s wrists. Specialized greens harvesters can be used for baby-leaf greens. From seed to harvest ranges from 30 to 75 days.

Kohlrabi: Harvest when its diameter reaches 1-1/2 to 2 inches for best quality. Larger sizes may be tough and stringy. Kohlrabi varieties range in maturity between 45 to 60 days.
Cole Crops and Brassica Leafy Greens - Diseases

Reviewed by Dan Egel – Nov 2020

Recommended Controls

Black Leg of Brassicas - Phoma Fungus
Black leg is an important disease of broccoli, Brussel sprouts, cauliflower and turnip. May be seedborne.

Non-Pesticide
Broccoli, Brussel sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use disease-free seed and transplants. Hot water treatment may help to reduce this seedborne pathogen. Use temperatures and times of 122 for 25 minutes for Brussels sprouts and cabbage, 122 for 15 minutes for mustard greens, and 122 for 20 minutes for other Brassicas. Since oilseed rape is particularly susceptible to black leg, avoid planting crucifer crops close to oilseed rape. Leave 1/4-mile buffer from previously infected fields, delay plant until conditions are dry. Rotate to a non-Brassica crop for 3-5 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

iprodione products (iprodione) Broccoli | 2 pts. per acre. Formulations of iprodione include Nevada and Rovral. REI: 24-hour. PHI: 0-day. FRAC 2.

Priaxor (fluxapyroxad, pyraclostrobin) Broccoli, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 7, FRAC 11.

Black Rot of Brassicas - Xanthomonas Bacteria
Black rot is an important bacterial disease of cole crops. May be seedborne.

Non-Pesticide
Broccoli, Brussel sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use disease-free seed and transplants. Hot water treatment may help to reduce this seedborne pathogen. Use temperatures and times of 122 for 25 minutes for Brussels sprouts and cabbage, 122 for 15 minutes for mustard greens, and 122 for 20 minutes for other Brassicas. Rotate to a non-Brassica crop for 2-3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Actigard (0.5WDG) (acibenzolar-s-methyl) Broccoli, Brussel sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 0.5-1.0 oz. per acre. Suppression only. Do not apply to stressed plants. REI: 12-hour. PHI: 7-day. FRAC P1.

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) Broccoli, Brussel sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Several formulations of copper (Badge, Champ, Kocide) are labelled for use and may slow the spread of black rot. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

Bottom Rot of Cabbage - Rhizoctonia Fungus
This soil disease can form a complex with Black Leg stem canker pathogen.

Non-Pesticide
Broccoli, Brussel sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Clean and sanitize transplant trays, benches, and tools. Rogue infected transplants. Avoid working field under wet conditions. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Blocker 4F (PCNB) Broccoli, Brussel sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | 2.8-3.75 gals. per acre of 4F formulation or 3.4 lbs. per 1,000 feet of linear row of 10G formulation. See label for other application methods and rates. The 10G formulation is labeled for wirestem and bottom rot on cauliflower only. REI: 12-hour. FRAC 14.

Endura (WG) (boscalid) Broccoli, Brussel sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | 6-9 oz. per acre. Suppression only for bottom rot and powdery mildew. REI: 12-hour. PHI: 14-day for collard, kale and mustard; 0-day for broccoli, Brussel sprouts, cabbage and cauliflower. FRAC 7.

Club Root of Brassicas - Plasmodiophora Fungus
Club root is a long-surviving pathogen that can live on some grasses, clovers, weeds, and other plants, which makes crop rotation difficult. The disease tends to be more prevalent in soils with acidic pH.

Non-Pesticide
Broccoli, Brussel sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use disease-free transplants. Choose resistant varieties. Rotate to a non-
Pesticide

**Blocker 4F (PCNB)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | 3 pts. per acre of 4F formulation or 5.15 lb. per 1,000 feet of linear row of 10G formulation. See label for other application methods and rates. REI: 12-hour. FRAC 14.

**Omega 500F (4.17) (fluazinam)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | 6.45 fl. oz. per 100 gals. of water. Apply 3.4 fl. oz. of solution to each plant applied as a transplant soil drench. REI: 12-hour. PHI: 50-day for heading vegetables. FRAC 29.

Damping-Off Seed and Seedling Rots of Multiple Crops - Multiple Pathogens

Non-Pesticide

Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | Practice good greenhouse sanitation of equipment, tools propagation trays/pots, and surfaces. Avoid excess moisture to the transplants in the greenhouse by monitoring irrigation frequency. Plant in warm field soils. The fungi responsible for damping-off in field soils cause more loss when the seedling is slow to emerge.

Pesticide

**phosphite and phosphorous acid products (phosphorous acid, potassium phosphite, mono-dipotassium salts of phosphorous acid, mono- and dibasic sodium, potassium, and ammonium phosphites, fosetyl-aluminum)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | Several phosphate or phosphorus acid products (Aliette, Phostrol, ProPhyt, Rampart) are labeled at various rates. Label includes different crops, PHIs, resistance instructions, and other important information. Some manufacturers recommend tank-mixing. These products may be used in a preventative program until the disease is observed. REI: 4 to 12-hour. PHI: 0-day. FRAC P7.

Downy Mildew of Brassicas - Hyaloperonospora Oomycete

May be seedborne.

Non-Pesticide

Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | Use disease-free seeds and transplants. Hot water treatment may help to reduce this seedborne pathogen. Use temperatures and times of 122 for 25 minutes for Brussels sprouts and cabbage, 122 for 15 minutes for mustard greens, and 122 for 20 minutes for other Brassicas. Resistant broccoli varieties are available. Rotate to a non-Brassica crop for 2-3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

**Actigard (0.5WDG) (acibenzolar-s-methyl)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 0.5-1.0 oz. per acre. Suppression only. Do not apply to stressed plants. REI: 12-hour. PHI: 7-day. FRAC P1.

**azoxystrobin products (azoxystrobin)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 7-day. FRAC M5.

**Forum (4.17SC) (dimethomorph)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 6 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 40.

**Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 7-day. FRAC M5.

**Orondis Ultra Premix (SC) (oxathiapiprolin, manadipropamid)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi | 5.5-8.0 fl. oz. per acre. REI: 1-day. PHI: 1-day. FRAC 49, FRAC M5.

**phosphite and phosphorous acid products (phosphorous acid, potassium phosphite, mono-dipotassium salts of phosphorous acid, mono- and dibasic sodium, potassium, and ammonium phosphites, fosetyl-aluminum)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Several phosphate or phosphorus acid products (Aliette, Phostrol, ProPhyt, Rampart) are labeled at various rates. Label includes different crops, PHIs, resistance instructions, and other important information. Some manufacturers recommend tank-mixing. These products may be used in a preventative program until the disease is observed. REI: 4 to 12-hour. PHI: 0-day. FRAC P7.
Ranman 400SC (34.5) (cyazofamid)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 2.75 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 21.

Reason 500SC (4.13) (fenamidone)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 5.5-8.2 fl. oz. per acre. REI: 12-hour. PHI: 2-day. FRAC 11.

Revis (2.08SC) (manipropamid)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | 8 fl. oz. per acre. REI: 4-hour. PHI: 1-day. FRAC 40.

Ridomil Gold Bravo SC (mefenoxam, chlorothalonil)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | 1.5 lbs. per acre. REI: 48-hour. PHI: 7-day FRAC 4, FRAC M5.

Zampro (SC) (ametocdradin, dimethomorph)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | 14 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 45, FRAC 40.

Leaf Spot of Brassicas - Alternaria Fungus

Non-Pesticide

Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use disease-free seed and transplants. Hot water treatment may help to reduce this seedborne pathogen. Use temperatures and times of 122 for 25 minutes for Brussels sprouts and cabbage, 122 for 15 minutes for mustard greens, and 122 for 20 minutes for other Brassicas. Rotate to a non-Brassica crop for 3-4 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease buildup.

Pesticide

azoxyprodin products (azoxyprodin)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

Cabrio EG (20) (pyraclostrobin)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 8-16 oz. per acre. Use only up to 12 oz. per acre for turnip greens. REI: 12-hour. PHI: 3-day for collard, kale, and mustard; 0-day for all other cole crops. FRAC 11.

chlorothalonil products (chlorothalonil)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 7-day. FRAC M5.

Endura (WG) (boscalid)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | 6-9 oz. per acre. Suppression only for bottom rot and powdery mildew. REI: 12-hour. PHI: 14-day for collard, kale and mustard; 0-day for broccoli, Brussels sprouts, cabbage and cauliflower. FRAC 7.

Fontelis (1.67%SC) (penthiopyrad)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 14-30 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7.

Inspire Super (EW) (difenoconazole, cyprodinil)  

Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi | 1.75-2.5 pts. per acre. REI: 12-hour. PHI: 12-hour. FRAC 49, FRAC M5.

Priaxor (fluxapyroxad, pyraclostrobin)  
Broccoli, Cabbage, Cauliflower, Collards, Kale, Mustard Greens | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 7, FRAC 11.

Quadrus Top (SC) (azoxyprodin, difenoconazole)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 12-14 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC 3.

Reason 500SC (4.13) (fenamidone)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 8.2 fl. oz. per acre. REI: 12-hour. PHI: 12-hour. FRAC 7, FRAC 11.

Ridomil Gold Bravo SC (mefenoxam, chlorothalonil)  
Broccoli, Brussels sprouts, Cabbage, Gauliflower, Kohlrabi | 1.5 lbs. per acre. REI: 48-hour. PHI: 7-day FRAC 4, FRAC M5.

Switch 62.5WG (cyprodinil, fludioxonil)  
Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 11-14 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 9, FRAC 12.

Powdery Mildew of Multiple Crops - Erysiphe Fungus

Non-Pesticide

Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Resistant Brussels sprouts and cabbage varieties are available. Rotate to a non-Brassica crop for 3 years. Avoid over-applying nitrogen and drought stress. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.
Pesticide

**Azoxyostrobin products (azoxyostrobin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

**Endura (WG) (boscalid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 6-9 oz. per acre. Suppression only for bottom rot and powdery mildew. REI: 12-hour. PHI: 14-day for collard, kale and mustard; 0-day for broccoli, Brussels sprouts, cabbage and cauliflower. FRAC 7.

**Fontelis (1.67SC) (penthiopyrad)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 14-30 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7.

**Inspire Super (EW) (difenconazole, cyprodinil)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 16-20 fl. oz. per acre. REI: 7-day. FRAC 3, FRAC 9.

**Microthiol Disperss (80W) (sulfur)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3-10 lbs. per acre. REI: 24-hour. PHI: 0-day. FRAC M2, IRAC UN. OMRI-listed.

**Procure 480SC (4) (triflumizole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 3.

**White Mold (Timber Rot, Drop, Stem Rot) of Multiple Crops - Sclerotinia Fungus**

This soil pathogen is long-lived in the soil, and has a wide host range on broadleaved crops and weeds, including beans, vine crops, lettuce, tomatoes, peppers, and cole crops. It goes by other names in other crops, such as Drop, White Mold, Stem Rot, and Timber Rot.

It is more commonly found where humidity and temperatures are high. The fungus often infects flowers, which then drop off and infect the stems that they land on. The stems take on a woody appearance and can split open. On cole crops, the pathogen infects the root crown and stem of the plant, which makes the leaves drop and rot. Inspection of the stems will reveal small black pellets that are the overwintering body of the pathogen.

**Non-Pesticide**

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Rotate to a non-broadleaf crop, such as grass grains or sweet corn for >3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

**Cabrio EG (20) (pyraclostrobin)** *Collards, Kale, Mustard Greens* | 12-16 oz. per acre. Suppression only. REI: 12-hour. PHI: 0-day. FRAC 11.

**Endura (WG) (boscalid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 6-9 oz. per acre. Suppression only for bottom rot and powdery mildew. REI: 12-hour. PHI: 14-day for collard, kale and mustard; 0-day for broccoli, Brussels sprouts, cabbage and cauliflower. FRAC 7.

**Fontelis (1.67SC) (penthiopyrad)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards* | 16 to 30 fl. oz. REI: 12-hour. PHI: 0-day. FRAC 7.

**White Rust of Multiple Crops - Albugo Oomycete**

**Non-Pesticide**

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use disease-free seeds and transplants. Hot water treatment may help to reduce this seedborne pathogen. Use temperatures and times of 122 for 25 minutes for Brussels sprouts and cabbage, 122 for 20 minutes for mustard greens, and 122 for 20 minutes for other Brassicas. Resistant varieties are available. Rotate to a non-Brassica crop for 3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

**Azoxyostrobin products (azoxyostrobin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

**Cabrio EG (20) (pyraclostrobin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 8-16 oz. per acre. REI: 12-hour. PHI: 3-day for collard, kale, and mustard; 0-day for all other brassicas. FRAC 11.

**Priaxor (fluxapyroxad, pyraclostrobin)** *Broccoli, Cabbage, Cauliflower, Collards, Kale, Mustard Greens* | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7.

**Reason 500SC (4.13) (fenamidone)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 8.2 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 11.
Wirestem of Brassicas - Rhizoctonia Fungus

This soil disease can form a complex with Black Leg stem canker pathogen.

Non-Pesticide

Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Clean and sanitize transplant trays, benches, and tools. Rogue infected transplants. Avoid working field under wet conditions. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

**Blocker 4F (PCNB)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | 2.8-3.75 gals. per acre of 4F formulation or 3.4 lbs. per 1,000 feet of linear row of 10G formulation. See label for other application methods and rates. The 10G formulation is labeled for wirestem and bottom rot on cauliflower only. REI: 12-hour. FRAC 14.

**Cabrio EG (20) (pyraclostrobin)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | 12-16 oz. per acre. REI: 12-hour. PHI: 3-day for collard, kale and mustard; 0-day for all other brassicas. FRAC 11.

**Priaxor (fluxapyroxad, pyraclostrobin)** Broccoli, Cabbage, Cauliflower, Collards, Kale, Mustard Greens | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 7, FRAC 11.

Yellows of Multiple Crops - Fusarium Fungus

Non-Pesticide

Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use disease-free seed and transplants. Hot water treatment may help to reduce this seedborne pathogen. Use temperatures and times of 122 for 25 minutes for Brussels sprouts and cabbage, 122 for 15 minutes for mustard greens, and 122 for 20 minutes for other Brassicas. Resistant varieties are available. Rotate to a non-Brassica crop for >6 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Cole Crops and Brassica Leafy Greens - Insects

Reviewed by Laura Ingwell, Anthony Hanson – Nov 2020

**Recommended Controls**

**Aphids**

**Pesticide**

**Actara (25WDG) (thiamethoxam)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 1.5-3.0 oz. per acre. Do not exceed 11 oz. per acre per season. REI: 12-hour. PHI: 0-day PHI for broccoli, Brussels sprouts, cabbage, and cauliflower, 7-day PHI for leafy greens. IRAC 4A.

**Admire Pro (4.6SC) (imidacloprid)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Soil Application: 4.4-10.5 fl. oz. per acre. Do not exceed 10.5 fl. oz. per acre per crop. Foliar Application: 1.3 fl. oz. per acre. Do not exceed 6.5 fl. oz. per acre per crop. REI: 12-hour. PHI: 21-day for soil application, 7-day for foliar application. IRAC 4A.

**Assail 30SG (acetamiprid)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use 30SG formulations at 2.0-5.3 oz. per acre on leafy cole crops or 2.0-4.0 oz. per acre for heading cole crops and do not exceed 20 oz. per acre per season. Use 70WP formulations at 0.8-2.3 oz. per acre on leafy cole crops or 0.8-1.7 oz. per acre on heading cole crops and do not exceed 8.5 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day for leafy cole crops, 7-day for heading cole crops. IRAC 4A.

**Beleaf (50SG) (flonicamid)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 2.0-2.8 oz. per acre. Do not exceed 8.4 oz. per acre per season. REI: 12-hour. PHI: 0-day PHI. IRAC 29.

**Closer SC (2) (sulfoxaflor)** Broccoli, Brussels sprouts, Cabbage, Cauliflower | 1.5-2.0 fl. oz. per acre. No applications between 3 days prior to bloom and until petal fall. Do not make applications less than 7 days apart or consecutively on the same crop. No more than four applications per crop. Maximum of 17 fl. oz. per acre per year. REI: 12-hour. PHI: 3-day. IRAC 4C.

**Dimethoate 4EC (dimethoate)** Kale, Mustard Greens | Use 2.67EC formulations at 0.75 pt. per acre on kale and mustard greens or 0.75-1.0 pt. per acre on broccoli, Brussels sprouts, or cauliflower and do not exceed 1.5 pts. per acre per season on kale and mustard greens, or 4.5 pts. per acre for broccoli, Brussels sprouts, or cauliflower. Use 4EC, LV-4, and 400 EC formulations at 0.5 pt. per acre on kale and mustard greens or 0.5-1.0 pt. per acre on broccoli and cauliflower and do not exceed 1 pt. per acre per season on kale and mustard greens or 3
**Cole Crops and Brassica Leafy Greens - Insects**

**Fulfill (50WDG) (pymetrozine)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.75 oz. per acre. Do not exceed 5.5 oz. per acre per crop per season. REI: 12-hour. PHI: 7-day PHI. IRAC 1B.

**Harvanta (0.42SL) (cyclaniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 10.9-16.4 fl. oz. per acre. Use with adjuvant. Do not exceed 65.6 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

**Hero (bifenthrin, zeta-cypermethrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 4.0-10.3 fl. oz. per acre. Do not exceed 46.35 fl. oz. per acre per season. Application to *turnip greens only allowed in Ohio* (OH 24c exp. 12/31/20). REI: 12-hour. PHI: 7-day PHI. IRAC 3A.

**M-Pede (3.8) (potassium salts of fatty acids)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 0.5-1.0 lbs. per acre. Do not exceed 4.1 lbs. per acre per season. REI: 24-hour. PHI: 14-day. IRAC 23.

**Mustang Maxx (0.8) (zeta-cypermethrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3.2-4.0 fl. oz. per acre. Do not exceed 24 oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A.

**M-Pede (3.8) (potassium salts of fatty acids)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 4-5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 23.

**Sivanto 200 (1.67SL) (flupyradifurone)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 7-12 fl. oz. per acre. For foliar application. Do not exceed 28 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 4D.

**Caterpillars**

**From transplant to early head or first curd:**

Diamethane Moth Caterpillars: 40% infested
Cabbage worm and Loopers: 25% infested

**From early head or first curd to harvest:**

Diamethane Moth Caterpillars: 10% infested
Cabbage worm and Loopers: 10% infested

**Pesticide**

**Asana XL (0.66EC) (esfenvalerate)** *Broccoli, Cabbage, Cauliflower, Collards, Mustard Greens* | 2.9-9.6 fl. oz. per acre. For armyworms, cabbageworms, and loopers. Heading crops: Do not exceed 77.5 fl. oz. per acre per season. Collards and mustard greens: Do not exceed 38.7 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 3A.

**Avaunt (30WDG) (indoxacarb)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.5-3.5 fl. oz. per acre. For armyworms, cabbageworms, diamondback moth, and loopers. Do not exceed 14 oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 22.

**Bacillus thuringiensis products for caterpillars (Bacillus thuringiensis aizawai strain ABTS-1857, Bacillus thuringiensis aizawai strain GC-91, Bacillus thuringiensis kurstaki strain ABTS-351, Bacillus thuringiensis kurstaki strain EVB-113-19, Bacillus thuringiensis kurstaki strain SA-11)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | See labels. For cabbageworms, diamondback moths, and loopers. Various Bt products are available for control of young caterpillars (Agree, Biobit, Dipel, Javelin, etc.) Different Bt subspecies have different control properties. Check labels for rates, timing of application and required safety equipment. REI: 4-hour. PHI: 0-day. IRAC 11A.

**Baythroid XL (1EC) (beta-cyfluthrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 0.8-3.2 fl. oz. per acre. For armyworms, cabbageworms, cutworms, diamondback moths, and loopers. Do not exceed 12.8 fl. oz. per acre per crop. REI: 12-hour. PHI: 0-day. IRAC 3A.

**Brigade 2EC (bifenthrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.1-6.4 fl. oz. per acre. For armyworms, cabbageworms, cutworms, diamondback moths, and loopers. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on heading cole crops or 25.6 fl. oz. per acre per season for leafy cole crops. Use 10DF, 10WP, or 10WSP formulations at 5.3-16 oz. per acre on heading cole crops.
only and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Confirm 2F (tebufenozide) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 6.0-8.0 fl. oz. per acre. For armyworms, cabbageworms, and loopers. Do not exceed 40 fl. oz. per season. REI: 4-hour. PHI: 7-day. IRAC 18.

Coragen (1.67SC) (chlorantraniliprole) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 3.5-7.5 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Can be applied as a foliar spray or soil treatment. Allow 3 days between foliar applications and 10 days between soil applications. Do not apply more than twice within a generation or two successive generations. Do not exceed 15.4 fl. oz. per acre per season. REI: 4-hour. PHI: 3-day. IRAC 28.

Entrust SC (2) (spinosad) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 1.5-6.0 fl. oz. per acre. For cabbageworms, diamondback moths, and loopers. Use 2SC formulations at 1.5-6.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 0.5-2.0 oz. per acre and do not exceed 9 oz. per acre per season. Allow 4 days between applications. Do not apply more than twice within a generation or two successive generations. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

Exirel (0.83SC) (cyantraniliprole) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 1-7 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not apply more than twice within a generation or two successive generations. Do not exceed 61 fl. oz. per acre per crop. REI: 12-hour. PHI: 1-day. IRAC 28.

Harvanta (0.42SL) (cyclaniliprole) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 10.9-16.4 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not apply more than twice within a generation or two successive generations. Do not exceed 49.2 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

Hero (bifenthrin, zeta-cypermethrin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 4.0-10.3 fl. oz. per acre. For cabbageworms, diamondback moths, and loopers. Do not exceed 46.35 fl. oz. per acre per season. Application to turnip greens only allowed in Ohio (OH 24c exp. 12/31/20). REI: 7-day. PHI: 7-day. IRAC 3A. RUP.

Intrepid 2F (methoxyfenozide) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 4-10 fl. oz. per acre. For armyworms, cabbageworms, and loopers. Do not exceed 64 fl. oz. per acre per season REI: 4-hour. PHI: 1-day. IRAC 18.

Lorsban 4E (chlorpyrifos) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 1-2 pts. per acre. For armyworms, cabbageworms, cutworms, and diamondback moths. Use 4E formulations at 1-2 pts. per acre as a foliar spray. Use 75WG formulations at 0.67-1.33 lb. per acre as a foliar spray. Do not exceed three applications per season. Allow 10 days between applications. REI: 24-hour to 3-day. PHI: 21-day. IRAC 1B. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 2.24-4.0 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not apply more than twice within a generation or two successive generations. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 3A. RUP.

Orthene 97 (S) (acephate) Brussels sprouts, Cauliflower | 1 lb. per acre. For cabbageworms, diamondback moths, and loopers. Do not exceed 4 1/8 lbs. per acre per season. REI: 24-hour. PHI: 14-day. IRAC 1B.

Perm-Up 25DF (permethrin) Broccoli, Cauliflower, Collards, Mustard Greens | For armyworms, cabbageworms, diamondback moths, and loopers. Use 25W, 25WP, and 25DF formulations at 3.2-12.8 oz. per acre for cabbage, or 3.2-6.4 oz. per acre for broccoli, Brussels sprouts and cauliflower, and do not exceed 25.6 oz. per acre per season on broccoli or 12.8 oz. for Brussels sprouts, cabbage and cauliflower. For use on collards in Illinois only at 3.2-9.6 oz. per acre, not to exceed 28.8 oz. per acre per season. Use 3.2EC formulations at 2-8 fl. oz. per acre for cabbage, or 2-4 fl. oz. per acre for broccoli, Brussels sprouts and cauliflower, and do not exceed 32 fl. oz. per acre on broccoli or 16 fl. oz. per acre for Brussels sprouts, cabbage and cauliflower. For use on collards in Illinois only at 2-6 fl. oz. per acre, not to exceed 18 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Proclaim (SSG) (emamectin benzoate) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 2.4-4.8 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not exceed 28.8 oz. per acre per season. REI: 12-hour. PHI: 7-day for heading cole crops, 14-day for leafy cole crops. IRAC 6. RUP.

Radiant 1SC (spinetoram) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 5-10 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. An adjuvant can improve control. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 5.

Rimon 0.83EC (novaluron) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi | 6-12 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 15.
Cole Crops and Brassica Leafy Greens - Insects

Sevin XLR Plus (4SC) (carbaryl) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 1-2 qts. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not apply more than twice within a generation or two successive generations. Do not exceed 6 qt. per acre per crop. REI: 12-hour. PHI: 3-day for heading cole crops, 14-day for leafy cole crops. IRAC 3A.

Warrior II (2.08CS) (lambda-cyhalothrin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi | 0.96-1.92 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not apply more than twice within a generation or two successive generations. Do not exceed 15.36 fl. oz. per acre per season.

Flea Beetles

Pesticide

Actara (25WDG) (thiamethoxam) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 1.5-3.0 oz. per acre. Do not exceed 11 oz. per acre per season. REI: 12-hour. PHI: 0-day PHI for broccoli, Brussels sprouts, cabbage, and cauliflower, 7-day PHI for leafy greens. IRAC 4A.

Asana XL (0.66EC) (esfenvalerate) Broccoli, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 5.8-9.6 fl. oz. per acre. Heading crops: Do not exceed 77.5 fl. oz. per acre per season. Collards and mustard greens: Do not exceed 38.7 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day for heading crops, 7-day for collards and mustard greens. IRAC 4A.

Baythroid XL (1EC) (beta-cyfluthrin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 2.4-3.2 fl. oz. per acre. Do not exceed 12.8 fl. oz. per acre per crop. REI: 12-hour. PHI: 12-hour. IRAC 3A. RUP.

Belay (2.13SC) (clothianidin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Soil applications: 9-12 fl. oz. per acre. Foliar applications: 3-4 fl. oz. per acre. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day for soil application, 7-day for foliar application. IRAC 4A.

Brigade 2EC (bifenthrin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on heading cole crops or 25.6 fl. oz. per acre per season for leafy cole crops. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre on heading cole crops only and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Exirel (0.83SE) (cyantraniliprole) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 13.5-20 fl. oz. per acre. Do not exceed 61 fl. oz. per acre per crop. REI: 12-hour. PHI: 1-day. IRAC 28.

Harvanta (0.42SL) (cyclaniliprole) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 10.9-16.4 fl. oz. per acre. Do not exceed 65.6 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

Hero (bifenthrin, zeta-cypermethrin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 4.0-10.3 fl. oz. per acre. Do not exceed 46.3 fl. oz. per acre per season. Application to turnip greens only allowed in Ohio (OH 24c exp. 12/31/20). REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Lorsban 4E (chlorpyrifos) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use 4E formulations at 1-2 pts. per acre as a foliar spray. Use 75WG formulations at 0.67-1.33 lb. per acre as a foliar spray. Do not exceed three applications per season. Allow 10 days between applications. REI: 24-hour to 3-day. PHI: 21-day. IRAC 1B. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 2.24-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Perm-Up 25DF (permethrin) Cabbage | Use 25W, 25WP, and 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 25.6 fl. oz. per acre per season. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 16 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Platinum 2SC (thiamethoxam) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 1.66-3.67 oz. per acre. Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

Sevin XLR Plus (4SC) (carbaryl) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 0.5-1 qt. per acre. Do not exceed 6 qts. per acre per crop. REI: 12-hour. PHI: 3-day for heading cole crops, 14-day for leafy cole crops. IRAC 1A.

Warrior II (2.08CS) (lambda-cyhalothrin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi | 0.28-1.92 fl. oz. per acre. Do not exceed 15.36 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 3A. RUP.
Leafminers

Pesticide

Entrust SC (2) (spinosad) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard greens, Turnip greens* | Use 2C formulations at 4.0-10.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 1.25-3.0 oz. per acre and do not exceed 9 oz. per acre per season. Allow 4 days between applications. REI: 12-hour. PHI: 1-day. IRAC 5. OMRI-listed.

Exirel (0.83SE) (cyrantraniliprole) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard greens, Turnip greens* | 13.5-20 fl. oz. per acre. Do not exceed 61 fl. oz. per acre per crop. REI: 12-hour. PHI: 1-day. IRAC 28.

Harvanta (0.42SL) (cyclaniliprole) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard greens, Turnip greens* | 10.9-16.4 fl. oz. per acre. Do not exceed 65.6 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

M-Pede (3.8) (potassium salts of fatty acids) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard greens, Turnip greens* | 1-2% by volume. Works best in tank mix with other insecticide. REI: 12-hour. PHI: 0-day. IRAC UN, FRAC NC. OMRI-listed.

Mustang Maxx (0.8) (zeta-cypermethrin) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard greens, Turnip greens* | 3.2-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Radiant 1SC (spinetoram) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard greens* | 6-10 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 4-hour. PHI: 7-day. IRAC 5.

Rimon 0.83EC (novaluron) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 12 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 15.

Scorpion 35SL (3.24) (dinotefuran) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard greens, Turnip greens* | Soil treatment: Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venomi 70SG at 5.0-7.5 oz. per acre. Foliar treatment: Use Scorpion 35SL at 2.0-7.0 oz. per acre, or Venomi 70SG at 1-4 oz. per acre. Allow 7 days between applications. REI: 12-hour. PHI: 21-day for soil applications, 7-day for foliar applications. IRAC 4A.

Trigard (75WP) (cyromazine) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard greens, Turnip greens* | 2.66 oz. per acre. Do not exceed 6 applications per season. REI: 12-hour. PHI: 7-day. IRAC 17.

Seed and Root Maggots

Pesticide

Capture LFR (1.5) (bifenthrin) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard greens, Turnip greens* | Can be used banded at-plant, pre-plant, or incorporated shortly after planting. See label. REI: 12-hour. IRAC 3A. RUP.

Diazinon AG500 (4ES) (diazinon) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | Use 50W formulations at 4-6 lbs. per acre as a pre-plant broadcast or 0.5-1.0 lbs per 100 gallons of transplant water at planting, and do not exceed 8 lbs. per acre per season. Use AG500 formulations at 64-96 fl. oz. per acre as a pre-plant broadcast or 8-16 fl. oz. per acre in 100 gallons of transplant water at planting, and do not exceed 128 fl. oz. per acre per season. Use AG600 formulations at 51-76.5 fl. oz. per acre as a pre-plant broadcast or 6.5-12.0 fl. oz. per acre in 100 gallons of transplant water at planting, and do not exceed 102 fl. oz. per acre per season. Water treatments may reduce stands due to plants stress at time of transplanting. Cabbage maggot exhibit resistance to diazinon. REI: 2 to 4-day. IRAC 1B. RUP.

Lorsban 4E (chlorpyrifos) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Mustard greens* | Use 4E formulations at 4.0-4.5 pts. per acre as a pre-plant incorporation, or 1.6-2.75 fl. oz. per 1,000 foot of row (max rate 2.4 fl. oz. for Cauliflower) as an at-plant soil drench. Use 15G formulations at 4.6-9.2 oz. per 1,000 foot of row as an at-plant application. Use 75WG formulations at 2.6-3.0 lb. per acre as a pre-plant incorporation or 1.1-1.8 oz. per 1,000 linear ft. of row (max rate 1.6 fl. oz. for Cauliflower) as an at-plant soil drench. Apply at the base of plants immediately after setting in the field. Do not apply as foliage application. Do not exceed one application per acre per season. REI: 24-hour to 3-day. PHI: 30-day. IRAC 1B. RUP.

Slugs

Pesticide

Deadline M-Ps (4P) (metaldehyde) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard greens, Turnip greens* | 25 lbs. per acre. Apply between rows. Avoid contact with edible product. Allow 21 days between applications. Do not exceed 100 lbs. per acre per season. REI: 12-hour. PHI: 0-day. IRAC UN.

 Sluggo 1B (iron phosphate) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard greens, Turnip greens* | 20-44 lbs. per acre, or at 0.5-1 lb. per square ft. Prevent infestation by scattering bait products to the soil surface around the perimeter of the planting. Make a rescue treatment by scattering the bait products on the soil as a band between rows. REI: 0-hour. PHI: 0-day. IRAC UN. OMRI-listed.
Stink Bugs

Pesticide

Azerla (C) (azadirachtin, pyrethrins) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 16-56 fl. oz. per acre. Use lower rates for nymphs. Use 48 fl. oz. per acre for adults. Use higher rates (56 fl. oz. per acre) when pest pressure is extreme or plant canopy is dense. Do not exceed 10 applications per season. Do not reapply within 3 days except under extreme pest pressure. REI: 12-hour. PHI: 0-day. IRAC UN, IRAC 3A. OMRI-listed.

Baythroid XL (1EC) (beta-cyfluthrin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 2.4-3.2 fl. oz. per acre. Do not exceed 12.8 fl. oz. per acre per crop. REI: 12-hour. PHI: 0-day for soil applications, 7-day for foliar applications. IRAC 4A.

Belay (2.13SC) (clothianidin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Soil applications: 9-12 fl. oz. per acre. Foliar stink applications: 3-4 fl. oz. per acre. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day for soil applications, 7-day for foliar applications. IRAC 4A.

Brigade 2EC (bifenthrin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on heading cole crops or 25.6 fl. oz. per acre per season for leafy cole crops. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre on heading cole crops only and do not exceed 80 oz. per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Harvanta (0.42SL) (cyclaniliprole) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 10.9-16.4 fl. oz. per acre. For suppression of nymphs only. Do not exceed 65.6 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

Malathion 5EC (malathion) Collards | Harlequin Bugs only. Use 5EC and 57EC formulations at 1.0-1.5 pts. per acre. Do not exceed 3 applications per season. Allow 7 days between applications. REI: 12 to 24-hour. PHI: 7-day. IRAC 1B.

Mustang Maxx (0.8) (zeta-cypermethrin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 3.2-4 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Rimon 0.83EC (novaluron) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi | 12 fl. oz. per acre. Do not exceed 24 oz. or 2 applications per acre per season. REI: 12-hour. PHI: 7-day. IRAC 15.

Scorpion 35SL (3.24) (dinotefuran) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Soil treatment: Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-7.5 oz. per acre. Foliar treatment: Use Scorpion 35SL at 2.0-7.0 oz. per acre, or Venom 70SG at 1-4 oz. per acre. Allow 7 days between applications. REI: 12-hour. PHI: 21-day for soil applications, 7-day for foliar applications. IRAC 4A.

Sevin XLR Plus (4SC) (carbaryl) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 0.5-2 qts. per acre. Use low rates for Harlequin bugs. Use higher rates for other stink bugs. Do not exceed 6 qts. per acre per crop. REI: 12-hour. PHI: 3-day for heading cole crops, 14-day for leafy cole crops. IRAC 1A.

Warrior II (2.08CS) (lambda-cyhalothrin) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi | 1.28-1.92 fl. oz. per acre. Do not exceed 15.36 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 3A. RUP.

Swede Midge

Swede midge is most attracted to heading cole crops (broccoli, cauliflower, cabbage, and Brussels sprouts). Leafy crops can become twisted and yield can be reduced. Some products that control flea beetles and caterpillars in cole crop work well on Swede midge, but may not have Swede midge explicitly on their label. Take advantage of this implied rotation to prevent resistance if your state does not require 2(ee) labels for specific pests. Products include Admire Pro (IRAC 4A), Coragen (IRAC 28), Exirel (IRAC 28), Lorsban (IRAC 1B), Orthene (IRAC 1B), Verimark (IRAC 28), and Warrior II (IRAC 3A).

Non-Pesticide

Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Rotate away from cole crops for three years. Do not use brassica cover crops between cole crop plantings. Brassica weeds like shepherd's purse, yellow rocket, and wild mustard can host Swede midge and should be managed in rotation years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent population build-up.

Pesticide

Assail 30SG (acetamiprid) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use 30SG formulations at 4.0-5.3 oz. per acre on leafy cole crops or 4.0 oz. per acre for heading cole crops and do not exceed 20 oz. per acre per season. Use 70WP formulations at 1.7-2.3 oz. per acre on leafy cole crops or 1.7 oz. per acre on heading cole crops and do not exceed 8.5 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day for leafy cole crops, 7-day for heading cole crops. IRAC 4A.

Movento (2SC) (spirotetramat) Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | 4-5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 23.
**Thrips**

**Non-Pesticide**

Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Varieties tolerant of thrips include Bantly, Bravo, Brutus, King Cole, Little Rock, Manrico, Rio Granda, Rio Verde, Ruby Perfection, Starski, Stonar, SuperKraut, Titanic 90, Zerlina, and others.

**Pesticide**

**Actara (25WDG) (thiamethoxam)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 3.0-5.5 oz. per acre. Do not exceed 11 oz. per acre per season. REI: 12-hour. PHI: 0-day for broccoli, Brussels sprouts, cabbage, and cauliflower, 7-day for leafy greens. IRAC 4A.

**Admire Pro (4.6SC) (imidacloprid)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 4.4-10.5 fl. oz. per acre. Soil application. Do not exceed 10.5 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 4A.

**Assail 30SG (acetamiprid)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use 30SG formulations at 4.0-5.3 oz. per acre on leafy cole crops or 4.0 oz. per acre for heading cole crops and do not exceed 20 oz. per acre per season. Use 70WP formulations at 1.7-2.3 oz. per acre on leafy cole crops or 1.7 oz. per acre on heading cole crops and do not exceed 8.5 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day for leafy cole crops, 7-day for heading cole crops. IRAC 4A.

**Baythroid XL (1EC) (beta-cyfluthrin)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 0.8-1.6 fl. oz. per acre. Do not exceed 12.8 fl. oz. per acre per crop. REI: 12-hour. IRAC 3A. RUP.

**Brigade 2EC (bifenthrin)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on heading cole crops or 25.6 fl. oz. per acre per season for leafy cole crops. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre on heading cole crops only and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

**Closer SC (2) (sulfoxaflor)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 5.75 fl. oz. per acre. Suppression only. No applications between 3 days prior to bloom and until petal fall. Do not make applications less than 7 days apart or consecutively on the same crop. No more than four applications per crop. Maximum of 17 fl. oz. per acre per year. REI: 12-hour. PHI: 3-day. IRAC 4C.

**Entrust SC (2) (spinosad)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use 2SC formulations at 4.0-10.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 1.25-3.0 oz. per acre and do not exceed 9 oz. per acre per season. Allow 4 days between applications. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

**Exirel (0.83SE) (cyantraniliprole)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 13.5-20 fl. oz. per acre. Do not exceed 61 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 28.

**Mustang Maxx (0.8) (zeta-cypermethrin)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 3.2-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Perm-Up 25DF (permethrin)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Use 25W, 25WP, and 25DF formulations as a soil treatment at 3.2-4.0 fl. oz. per acre and do not exceed 25.6 oz. per acre per season on broccoli or 12.8 oz. per acre per season on Brussels sprouts or cauliflower. Use 3.2EC formulations at 2-4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on broccoli or 16 fl. oz. per acre per season on Brussels sprouts or cauliflower. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

**Platinum 2SC (thiamethoxam)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 1.66-3.67 oz. per acre. Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

**Radiant 1SC (spinetoram)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens | 6-10 fl. oz. per acre. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 5.

**Torac (1.29SC) (tolifenpyrad)** Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Mustard Greens, Turnip Greens | 21 fl. oz. per acre. Do not apply until 14 days after transplanting. Do not exceed 42 fl. oz. per crop per cycle. REI: 12-hour. PHI: 1-day. IRAC 21A, FRAC 39.
**Cole Crops and Brassica Leafy Greens - Weeds**

Recommended Controls

### All Weeds

Cole crops are cool-season plants, but are nearly always started as transplants. When growers transplant cole crops into plastic mulch, no herbicides are labeled for use under the plastic because of the risk of damaging the crop. Early season plantings are more at risk of herbicide stunting in cool soils. There are several herbicides labeled for the control of weeds preemergence, applied before cole crops are transplanted, or directed between the rows only after transplanting.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

### Non-Pesticide

**Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens**

- Design bed and row spacing to match equipment that will be used and other crops with similar space requirements. Use of a stale seedbed is helpful. Mulches provide good weed control when planted into, when used for between row spaces, or in combination in-row and between-row. Materials include landscape cloth, plastic, biodegradable plastic, or straw applied before weeds emerge. Weeds between beds and along the edges of beds can be controlled with a combination of cultivation, mowing, or hand hoeing/pulling. Weeds along the edge of the mulches can be a particular challenge to avoid ripping the mulch.

### Broadleaf and Grass Weeds - Postemergence

#### Pesticide

**Glyphosate products (glyphosate)**

- **Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards**

  - See product labels for rates, application volume, and adjuvants. Broadcast before seeding or transplanting, after seeding but before crop emergence, or apply between crop rows with hooded or shielded sprayers. Use low rate for annuals and higher rates for perennials. REI: 4 to 12-hour. PHI: 14-day. WSSA 9.

- **paraquat products (paraquat)**

  - **Broccoli, Cabbage, Cauliflower, Collards**

    - 2-4 pts. per acre. Include 1 qt. of COC or 4-8 fl. oz. of NIS per 25 gallons of spray solution. Apply before seeding or transplanting, or after seeding but before crop emergence. REI: 12 to 24-hour. WSSA 22. RUP.

**Broccoli and Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens**

- Preemergence - **Command 3ME (clomazone)**

  - **Broccoli, Cabbage**

    - 0.67-1.3 pts. per acre. For **cabbage**: apply before seeding or transplanting or after seeding before crop emerges. Use low rate for seeded cabbage. For **broccoli**: apply low rate within 48 hours of transplanting. May cause early stunting or discoloration. REI: 12-hour. PHI: 45-day for cabbage. WSSA 13.

- **Daetral W-75 (DCPA)**

  - **Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens**

    - 6-14 lbs. per acre. Apply at seeding or transplanting. May be incorporated. May be applied over top of transplants. REI: 12-hour. WSSA 3.

- **Devrinol DF-XT (50) (napropamide)**

  - **Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens**

    - 2 lbs. per acre. Apply and incorporate 1-2 inches before seeding or transplanting or apply after seeding and irrigate to wet soil 2-4 inches deep. After harvest or prior to planting succeeding crops, deep moldboard or disk plow. Do not seed alfalfa, small grains, sorghum, corn, or lettuce for 12 months after application. Most effective when combined with GoalTender. REI: 24-hour. WSSA 15.

- **Dual Magnum (7.62EC) (s-metolachlor)**

  - **Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens**

    - Implementing 0.67-1.3 pts. per acre to soil surface before transplanting or within 48 hours of transplanting. Reduce risk of crop injury by applying after transplanting and by using a directed spray rather than spraying over the top of plants. Do not tank-mix with pendimethalin for post-transplant application. For **leafy brassicas**: apply 0.67-1.3 pts. per acre after seeding before weeds or crop emerge or apply broadcast after crops have 1-2 true leaves. Do not exceed 1.3 pts. per acre or 1 application per crop per season. REI: 24-hour. PHI: 30-day for leafy brassicas, 60-day for heading cole crops. WSSA 15.

- **pendimethalin products (pendimethalin)**

  - **Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens**

    - Apply formulations with 3.8 lbs. active ingredient per gallon at 1.0-2.1 pts. per acre to soil as a broadcast before transplanting, or apply between the rows of established transplants and direct-seeded crops within 2-4 leaves for heading cole crops, or 4-5 leaves for leafy brassicas. Spray contact with plants may cause crop stunting. Do not use the roots from treated turnip greens for food. REI: 24-hour. PHI: 21-day for leafy brassicas; 60-day for broccoli; 70-day for Brussels sprouts, cabbage, cauliflower, and kohlrabi. WSSA 3.

- **Prefar 4E (bensulide)**

  - **Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens**

    - 0.5-1.3 pts. per acre. Use low rate for seeded crops. Use higher rates for perennials. REI: 4 to 12-hour. WSSA 22.
Broadleaf Weeds Only - Postemergence

Pesticide

**Aim EC (2) (carfentrazone)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Apply with hooded sprayers as a directed application between crop rows. Use COC or NIS. Weeds must be actively growing and less than 4 inches tall. Do not allow spray to contact crop. Do not exceed 6.1 fl. oz. per acre per season. REI: 12-hour. WSSA 14.

**Spartan Charge (SE) (carfentrazone, sulfentrazone)** *Cabbage* | 2.9-15.2 fl. oz. per acre. *Transplanted cabbage only.* Apply up to 60 days before transplanting as a broadcast on emerged weeds, or band between rows within 72 hours after transplanting. May also be incorporated no deeper than 2 inches before transplanting. Do not use on sandy soils with less than 1% organic matter. Has not been tested on all varieties. Refer to label for additional precautions. Maximum 15.2 fl. oz. per acre. REI: 12-hour. WSSA 14.

**Stinger (3) (clopyralid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 4-8 fl. oz. per acre. Apply at any crop stage. Kills composite weeds, legumes, and nightshades. Do not exceed 2 applications and 8 fl. oz. per acre per year. REI: 12-hour. PHI: 30-day. WSSA 4.

Broadleaf Weeds Only - Preemergence

Pesticide

**GoalTender (4) (oxyflurfen)** *Broccoli, Cabbage, Cauliflower* | Apply GoalTender at 0.5-1 pt. per acre after preparing soil but before transplanting, or Goal 2X at 1-2 pts. per acre. Transplant within 7 days of application. In Michigan only (MI 24c exp. 12/31/25) another application of GoalTender is allowed at 4-8 fl. oz. per acre to well-established transplants at least 2 weeks in the field, or to direct-seeded plants with at least 4 true leaves. Do not exceed 16 fl. oz. pre- and postemergence. Use lower rate on coarse-textured soils. Do not add adjuvant. REI: 24 to 48-hour.

**Spartan 4F (sulfentrazone)** *Cabbage* | 2.25-12 fl. oz. per acre. Transplanted cabbage for processing only. Do not use on cabbage for fresh market or on direct seeded cabbage. Apply preemergence before transplanting as a broadcast or banded spray or band to row middles within 72 hours after transplanting. May also be incorporated no deeper than 2 inches before transplanting. Do not use on soils classified as sand, with less than 1% organic matter. Controls pigweeds. REI: 12-hour. WSSA 14.

**Spartan Charge (SE) (carfentrazone, sulfentrazone)** *Cabbage* | 2.9-15.2 fl. oz. per acre. *Transplanted cabbage only.* Apply up to 60 days before transplanting as a broadcast on emerged weeds, or band between rows within 72 hours after transplanting. May also be incorporated no deeper than 2 inches before transplanting. Do not use on sandy soils with less than 1% organic matter. Has not been tested on all varieties. Refer to label for additional precautions. Maximum 15.2 fl. oz. per acre. REI: 12-hour. WSSA 14.

Grass Weeds Only - Postemergence

Pesticide

**clethodim products (clethodim)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | Use 2EC formulations at 6-8 fl. oz. per acre with 1 qt. of COC per 25 gals. of spray solution (1% v/v). Do not exceed 32 fl. oz. of 2EC formulations per acre per season. Use Select Max at 9-16 fl. oz. per acre with 8 fl. oz. of NIS per 25 gals. of spray solution (0.25% v/v). Do not exceed 64 fl. oz. of Select Max per acre per season. Use low rates for annual grasses, the high rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. REI: 24-hour. PHI: 14-day for leafy brassicas, 30-day for heading cole crops. WSSA 1.

**Poast (1.5EC) (sethoxydim)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 1-1.5 pts. per acre. Include 1 qt. COC per acre. Spray on actively growing grass. Use high rate on quackgrass. Do not exceed 2.5 pts. per acre per season for turnip greens, or 3 pts. per acre per season for other crops. REI: 12-hour. PHI: 14-day for turnip greens. 30-day for all others. WSSA 1.
Cucurbit Crops - Horticulture

Cucurbit Crops - Horticulture
Reviewed by Ben Phillips, Liz Maynard – Oct 2020

Crop Description

Cucumber
Several types of cucumbers are grown in the Midwest, all of which are the species Cucumis sativus. Fresh market slicing cucumbers have thick, dark skin and a few large spines. They are commonly grown in the field with no support. European greenhouse cucumbers are long with thin skin, no spines, no seeds, and are grown on trellises in greenhouses. Beit alpha cucumber types are shorter but also have thin skin with no spines and may be grown in the field or in protected structures. Pickling cucumbers are short with thin skins and large spines. They are adapted for field production. Pickling cucumbers can also be marketed for fresh use.

Gynoecious cucumber varieties produce mainly female flowers and, unless they are also parthenocarpic, require a pollenizer variety to supply pollen for good fruit set. Pollenizers are usually included when you buy gynoecious seed. Parthenocarpic varieties will set fruit without pollination and no seeds will develop. Parthenocarpic varieties produce seeds if they get pollinated.

Melon
The most commonly cultivated melon is the netted skin cantaloupe, also known as a muskmelon (Cucumis melo subsp. melo). Cantaloupes grown in the Midwest are primarily eastern types. Typical varieties include Athena and Aphrodite. Melons are warm-season crops that achieve prime quality when grown under warm, sunny conditions. Cool, cloudy weather results in melons with inferior quality. Melons prefer sandy and sandy loam soils. Production on plastic mulch and light soils produces an early crop that commands a premium price.

Melon types with distinctive fruit attributes are referred to as specialty melons. These melons with unique fruit characteristics attract consumers at local food markets. Common specialty melons fall into two major groups of Cucumis melo subsp. melo: the netted melons (Cantalupensis Group), including ananas, Charentais, galia, and Persian types; and the smooth-skinned melons (Inodorus Group), including canary, Crenshaw, and honeydew types. Asian melon types are in the Makua Group of Cucumis melo subsp. agrestis. Some specialty melon skins tend to crack with excessive water (such as ananas, Charentais, and galias). Greenhouse or high tunnel environments are more suitable for growing these melons in the Midwest. Note that there is disagreement among horticulturalists and scientists about the best way to categorize the many kinds of melons into groups, so other publications may use different group names.

Pumpkin and Winter Squash
Jack-o-lantern pumpkins grown for ornamental display and carving come from two species, Cucurbita pepo, and C. maxima. This market calls for a fruit up to 30 pounds. For giant pumpkins, the C. maxima varieties such as Atlantic Giant or Prize Winner are used. Varieties with hull-less or “naked” seed are favored as a source of seeds for eating. Many specialty pumpkins are also edible winter squash, such as fairytale and Cinderella pumpkins. Most of the “pie” pumpkins sold to consumers are used for decorating, but some varieties are still used for home baking. Pumpkins that are processed into pie filling and other products are normally grown under contract to processors, and the varieties are more like winter squash than jack-o-lantern pumpkins.

Common winter squash types include C. pepo types (acorn, delicata, and spaghetti), C. maxima types (buttercup, hubbard, kuri, and kabocha), and C. moschata types (butternut). Some varieties have a bush growth habit, instead of producing long vines.

Summer Squash
Common summer squash types are C. pepo fruit, including zucchini, yellow straightneck and yellow crookneck. Many specialty types also perform well, including golden zucchini, Middle-Eastern types, patty pan, and cocozelle. Most varieties have a bush growth habit.

Watermelon
Watermelons (Citrullus lanatus) are either seedless (triploid) or seeded (diploid). Seedless watermelons produce fruit that has few if any true seeds. For seedless watermelons to set fruit, growers must plant diploid watermelons (either non-edible pollenizer plants or seeded watermelons) near the triploid plants. Typically there is one pollenizer plant for every two to four seedless plants in the row, or one row of seeded watermelons for every two to four rows of seedless.

Watermelons produce a wide range of fruit sizes. Seeded watermelons generally have larger fruit (more than 20 pounds) than seedless types. Royal Sweet is a widely grown seeded watermelon variety that produces oblong melons that weigh 20 to 24 pounds.

Seedless watermelons typically are more than 12 pounds. They are sold in cardboard bins in quantities of 60, 45, 36 or 30. Excursion is a variety that produces relatively large fruit that are primarily 36-count. Wayfarer is a variety that produces relatively smaller fruit that are mainly 60-count. Mini or personal-size watermelons are less than 10 pounds and include varieties such as Extazy and Ocelott.

Watermelons differ in rind patterns and fruit shapes. Most watermelons have striped patterns on a dark or light green background. However, some varieties (Sweet Gem and Wayfarer) do not have stripes, but rather a pure dark green rind. A unique rind pattern called moon and star has golden-yellow spots on a deep green background. Seed companies have successfully bred both seedless and seeded watermelons with the moon and star patterns. The shapes of most large watermelons are blocky or oblong, while mini watermelons tend to be round.

Although watermelons with red flesh are most familiar, yellow, orange and white-fleshed varieties are available. Varieties include Orange Crisp (orange, seedless), Amarillo (yellow, seedless) and Cream of Saskatchewan (white, seeded).
Planting and Spacing

All cucurbits should be planted after the danger of frost is past, unless frost protection is used, because they are not frost-tolerant. Air temperatures below 50° F cause chilling injury and so it is best to wait until minimum temperatures are above that. For proper germination of direct-seeded crops, soil temperature must be above 60° F. Planting too early (when the soil is too cold and wet) results in poor seedling emergence.

Cucumbers for fresh market: Rows 4 to 6 feet apart. Plants 15 to 18 inches apart in row.

Cucumber pickles for machine harvest: Rows 18 to 20 inches apart. Plants 5 to 7 inches apart in row.

Maximum cucumber yields and fruit quality result only if plants receive adequate and timely moisture. Depending on your soil type, obtaining high-quality cucumbers requires approximately 1 to 2 inches of water per week. An irregular water supply, particularly during blossoming and fruit development, can negatively affect fruit quality and result in increased nubs or hooked fruit.

Melons: Rows 5 to 7 feet apart. Plants 3 to 5 feet apart in row. 1 to 2 plants per hill. Plastic mulch is recommended. Clear mulch is suggested only for earliest plantings in northern areas.

Melons are moderately deep rooted and require adequate soil moisture with good drainage. Natural rainfall may not be adequate, so supplemental irrigation may be required, particularly in the early stages of growth. When irrigating, irrigate the soil in the effective root zone to field capacity. A good, steady moisture supply is critical for good melon production. After melons have attained a good size, it is best to reduce irrigation. Reduced irrigation at this time can, in some cases, increase the mature fruit’s sugar content. Excessive moisture during fruit ripening can result in soft and split fruit.

Pumpkins and Squash – bush types: Rows 4-6 feet apart. Plant 18-24 inches apart in row. Seed: 4-6 pounds per acre.

Pumpkins and Squash – vining types: Rows 6-8 feet apart. Plant 2-5 feet apart in row. Seed: 2-3 pounds per acre.

Watermelons: Rows 6 to 12 feet apart. Plants 3 to 6 feet apart in row. One plant per hill. Plastic mulch is recommended for all transplanted watermelons.

Watermelons – mini or “personal-sized”: Rows 6 to 10 feet apart. Plants 1.5 to 2 feet apart in row to allow 12 to 15 square feet per plant.

Pumpkins, winter squash, and watermelons are deep-rooted plants, so natural rainfall is often adequate, and irrigation may not be cost effective on heavier soils. Adequate soil moisture in the early growth stages will help ensure vigorous growth. Soil moisture also is critical during blossoming and fruit development.

Fertilizing

pH: Maintain a soil pH of 6.0 to 6.8, or 6.3 to 6.8 for melons. If your soil test indicates less than 70 ppm magnesium, use dolomitic limestone, or apply 50 pounds per acre Mg broadcast preplant incorporated.

Cucumbers, Melons, Pumpkins, Squash, and Watermelon for Fresh Market: Before planting, apply 40 to 60 pounds N per acre, 0 to 150 pounds P₂O₅ per acre, and 0 to 200 pounds K₂O per acre based on soil test results and recommendations from your state. In plasticulture systems, preplant fertilizer may be applied just over the row prior to bedding and/or laying plastic. For transplants, a starter solution at a rate of 1 cup (8 ounces) per plant is recommended. If the transplant flat receives a heavy fertilizer feeding just prior to setting, the starter solution can be eliminated.

Watermelon Resistance to Fusarium Wilt

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<th>Variety</th>
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<tr>
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¹Inclusion of these varieties does not imply endorsement of criticism of any variety or company. Refer to company literature for information on host resistance claims.

²The resistance ratings provided here are averages based on several years of greenhouse research. In that research, each watermelon variety was observed after receiving an artificial inoculation with a race 1 strain of the disease. +++ = good resistance; ++++ = moderate resistance; ++ = some resistance; + = little or no resistance.
Sidedress with 30-45 pounds N per acre when the vines begin to run. If heavy rains occur in June, apply an additional 30 pounds N per acre at fruit set. Sidedressing may be replaced by supplying N through a drip irrigation system at 1/2 to 1 pound N per acre daily, or 3 to 6 pounds N weekly through the trickle system if additional N is needed until fruit are about 2 inches in diameter.

For direct seeded crops on sandy soils, the preplant N application can be replaced by an early sidedressing of 40 pounds N per acre when the plants show the first true leaves. Apply the second sidedressing of 45 pounds N per acre at onset of rapid vining.

Reduce the total amount of fertilizer N applied by the value of N credits from green manures, legume crops grown in the previous year, compost and animal manures, and soils with more than 3 percent organic matter. The total amount of N from fertilizer (including starter) and other credits should be 80 to 100 pounds per acre.

**Cucumbers for processing:** Before planting, apply 40 pounds N per acre, 0 to 150 pounds P<sub>2</sub>O<sub>5</sub> per acre, and 0 to 200 pounds K<sub>2</sub>O per acre based on soil test results and recommendations from your state. Sidedress with another 40 pounds N per acre.

### Harvesting

**Cucumbers:** Unless a once-over mechanical harvester is used, cucumbers should be harvested at two- to four-day intervals to prevent losses from oversized and over-mature fruit. Desired harvest sizes range from 5 to 8 inches long and 1.5 to 2 inches in diameter for fresh market slicing types. If growing for processors, be sure to understand the specific terms of their contracts at the beginning of the growing season. Prices received are related to the quantity of fruit within specific size ranges as established by either USDA guidelines or by the processor.

**Melons:** During ripening, eastern type cantaloupes develop an identifiable abscission zone and form tan-colored netting. Harvest index is at three-quarter or full-slip stage. The fruit do not keep well in the field when ripe. Harvest every one to three days.

Cantaloupe varieties with long shelf life (such as Infinite Gold and Durawest) were tested in the Midwest. Long shelf life varieties have delayed abscission compared to normal eastern type cantaloupes. They either stay in green or have a continuous color change. Color and abscission are not used as harvest indices for long shelf life varieties. Indicators of the optimal ripeness are when there are a few vertical cracks on the peduncle but the fruit has not slipped yet. Long shelf life varieties can hold longer in the field, allowing growers to harvest two or three times.

Honeydew, crenshaw and canary melons do not develop netting on the skin and do not form abscission zones during ripening. Color is the primary harvest index, and they must be cut from the vine.

**Pumpkins and Winter Squash:** For pumpkins and most winter squash it is desirable to maintain green plants as long as possible, to allow fruit to mature on the vine. Full fruit maturity typically occurs about 55 days after fruit set; this may be two or more weeks after the rind has turned to its mature color and hardened. Pumpkins and winter squash harvested before full maturity will not keep as long and have lower eating quality. Mature fruits can be windrowed in full sun without worrying about sunburn and collected over a week or more. Acorn squash should be picked and packed close to sale. Though they are considered a winter squash, they are an immature fruit, and do not respond well to field curing. They lose moisture in storage and become more susceptible to post-harvest rots.

For ornamental pumpkins, if the leaves are dying and the fruit is over 50% colored, it may be best to harvest. Fruit harvested earlier than 50% color eventually turn, but they do not become hard, mature fruit and they rot more easily. Getting immature fruit out of the field and into a dry, somewhat shady area will allow for curing without as much risk for sunburn, insect infestation and possibly some fruit rots. Cut them from the vines and clean off as much soil as you can. If you suspect fruit rots may become an issue it would be best to place them in a sanitizing dip if you can. This will not guarantee the fruit will not rot since some fruit rots can be systemic.

Avoiding harvesting in wet areas likely to be infested with phytophthora, or keep that fruit separate from fruit harvested from other areas of the field. This will minimize fruit to fruit contamination. Stack and package carefully to avoid stem breakage, and to prevent stems from puncturing other fruit.

**Summer Squash:** Harvesting and packing summer squash is a delicate process to avoid scratching the soft, immature fruit. Pick off and discard large or damaged fruit to keep the plant producing new flowers and fruit.

**Watermelons:** Harvesting watermelons at the correct stage of maturity is critical and difficult. While each cultivar is different, maturity can be determined in several ways, including ground spots changing from white to yellow, browning of tendrils nearest the fruit, and a hollow or dull sound when “thumped.” Watermelons should be cut from the plant to avoid vine damage and prevent stem-end rot. Leave 1 to 2 inches of stem attached.
Cucurbit Crops - Diseases

Reviewed by Dan Egel, Mohammad Babadoost – Nov 2020

Recommended Controls

Angular Leaf Spot of Cucurbits - Pseudomonas Bacteria

Angular leaf spot may be seedborne. Lesions on leaves and fruit of pumpkin and squash are similar in appearance to those of Xanthomonas bacterial leaf and fruit spot.

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Use disease-free seed and transplants. Resistant cucumber varieties are available. Rotate to non-cucurbit crops at least 2 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammomium diacetate complex, cuprous oxide) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Several formulations of copper (Badge, Champ, Kocide) are labelled for use. See label for directions. Apply fixed copper 2 weeks prior to the opening of the first female bloom, at first female bloom, and 2 weeks after the first female bloom. Later in the season, fixed copper products may be applied to help reduce disease spread. No more than 6 applications per season. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

Anthracnose of Cucurbits - Colletotrichum Fungus

Race 1 of the fungal pathogen that causes anthracnose affects mainly cucumber and melon; many watermelon varieties are resistant to Race 1. Race 2 affects mainly watermelon. Lesions of this disease may be observed from transplant stage through harvest on leaves, stems, and fruit. May be seedborne. At vine touch, at 7-14 day intervals or according to MELCAST - see Purdue Extension publication BP-67-W, Foliar Disease Fungicide Control Using MELCAST, available from the Purdue Extension Education Store, www.edustore.purdue.edu.

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Watermelon | Use disease free seed and transplants. Rotate to a non-Cucurbit crop for 2 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Aprovia Top (difenoconazole, benzovindiflupyr)
Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 10.5-15.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 7.

azoxystrobin products (azoxystrobin) Cantaloupe/Muskmelon, Cucumber, Watermelon | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 1-day. FRAC 11.

Cabrio EG (20) (pyraclostrobin) Cantaloupe/Muskmelon, Cucumber, Watermelon | 12-16 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 11.

chlorothalonil products (chlorothalonil) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC M5.


Luna Sensation (fluropyram, trifloxystrobin) Cantaloupe/Muskmelon, Cucumber, Watermelon | 7.6 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

mancozeb products (mancozeb) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Several formulations of mancozeb products (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M3.

Merivon (fluxapyroxad, pyraclostrobin) Cantaloupe/Muskmelon, Cucumber, Watermelon | 5.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 1.75-2.5 pts. per acre. Make no more than 2 sequential applications before rotating to a different mode of action. When 3 fungicide applications are used, Orondis can be in no more than 33% of the applications. Do not follow soil applications of Orondis Gold. REI: 12-hour. PHI: 0-day. FRAC 49, FRAC M5.

Pristine 38WG (boscalid, pyraclostrobin) Cantaloupe/Muskmelon, Cucumber, Watermelon | 18.5 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

Quadris Opti (SC) (azoxystrobin, chlorothalonil) Cantaloupe/Muskmelon, Cucumber, Watermelon | 3.2 pts. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC M5.
Cucurbit Crops - Diseases

**Quadris Top (SC) (azoxystrobin, difenoconazole)**
*Cantaloupe/Muskmelon, Cucumber, Watermelon* | 12-14 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC 3.

**Tanos (DF) (famoxadone, cymoxanil)**
*Cantaloupe/Muskmelon, Cucumber, Watermelon* | 8 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 11, FRAC 27.

**Topsin 4.5FL (thiophanate-methyl)**
*Cantaloupe/Muskmelon, Cucumber, Watermelon* | Use 4FL formulation or Cercobin at 10 fl. oz. per acre, or 70WSB formulation at 0.5 lb. per acre. REI: 24-hour to 3-day. PHI: 1-day. FRAC 1.

**Zing! (zoxamide, chlorothalonil)**
*Cantaloupe/Muskmelon, Cucumber, Watermelon* | 36 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 22, FRAC M5.

**Bacterial Fruit Blotch of Cucurbits - Acidovorax Bacteria**

**Pesticide**

**Actigard (0.5WDG) (acibenzolar-s-methyl)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 0.5-1 oz. per acre. Apply with two of the fixed copper products described for bacterial fruit blotch. REI: 12-hour. PHI: 0-day. FRAC P1.

**copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of copper (Badge, Champ, Kocide) are labelled for use. See label for directions. Apply fixed copper 2 weeks prior to the opening of the first female bloom, at first female bloom, and 2 weeks after the first female bloom. Later in the season, fixed copper products may be applied to help reduce disease spread. No more than 6 applications per season. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

**Bacterial Wilt of Cucurbits - Erwinia Bacteria**

Primarily a disease of cucumber and melon. Pumpkins and squash are only affected when striped and spotted beetles feed on the plants at or before the 5 true leaf stage. Disease control depends on control of striped and spotted cucumber beetles. See insect section.

**Pesticide**

**Insecticides**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash* | Apply systemic insecticides such as Admire or Platinum (see insect section) at transplant. Apply contact insecticides after systemic insecticides after systemic insecticides lose effectiveness (2-3 weeks). Apply foliar insecticides only when cucumber beetles are present. When large numbers are present, treatments may be required twice weekly. Scout fields regularly for cucumber beetles.

**Damping-Off Seed and Seedling Rots of Multiple Crops - Multiple Pathogens**

Using treated seed may help reduce the severity of damping-off if used with the cultural methods discussed above. Seed treated with contact fungicides with the active ingredients thiram or captan may help reduce the decay of the seed prior to emergence. Systemic products are designed to move into the seedling and help manage damping-off in the first two to three weeks. Examples of systemic products include Apron XL, Dynasty, and Maxim 4FS. Seed that is treated with all three of these systemic products is available with the trade name Farmore 300. Vegetable seed that is usually transplanted (such as muskmelon and watermelon) are less likely to benefit from fungicide seed treatments than crops that are direct seeded (such as pumpkin).

**Non-Pesticide**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Practice good greenhouse sanitation of equipment, tools propagation trays/pots, and surfaces. Avoid excess moisture to the transplants in the greenhouse by monitoring irrigation frequency. Plant in warm field soils. The fungi responsible for damping-off in field soils cause more loss when the seedling is slow to emerge.

**Pesticide**

**Apron XL (3) (mefenoxam)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 0.085-0.64 fl. oz. per 100 lb of seed. Seed treatment will help prevent damping-off caused by Phytophthora and Pythium. Ridomil products cannot be used until 6 weeks after transplant. REI: 48-hour. FRAC 4.

**azoxystrobin products (azoxystrobin)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 0.83 lb. per gallon formulations (Dynasty) for treating seed at 0.10-0.38 fl. oz. per 100 lbs. of seed. REI: 4-hour. PHI: 1-day. FRAC 11.

**Maxim 4FS (fludioxonil)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 0.08-0.16 fl. oz. per 100 lb. of seed. Seed treatment will help prevent damping-off caused by Rhizoctonia spp. REI: 12-hour. FRAC 12.

**Previcur Flex (6) (propamocarb)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | For Pythium in the field, apply 0.6-1.2 pts. per acre directed to base of plant and surrounding soil, or through drip irrigation or transplant water. In the greenhouse, maintain a 1:1000 stock solution of 12.8 fl. oz. per 100 gals. of water. Use that stock at 3.4-6.8 fl. oz per plant. REI: 12-hour. PHI: 2-day. FRAC 28.

**Ridomil Gold SL (4SC) (mefenoxam)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1-2 pts. per acre. For use on damping-off caused by Pythium species. REI: 48-hour. PHI: 5-day. FRAC 4.
Downy Mildew of Cucurbitis - Pseudoperonospora Oomycete

The fungus-like organism that causes downy mildew, *Pseudoperonospora cubensis*, has two clades. Clade 1 occurs more frequently on watermelon, pumpkin, and squash while clade 2 occurs more frequently on cucumber and cantaloupe.

The pathogen does not survive Midwest winters because it requires green, living plant tissues. That means the fungus-like organism only overwinters in south Florida or in greenhouses in northern U.S and Canada. The wind carries downy mildew spores to new, living hosts in the Midwest as early as July, and sometimes not at all. Since pumpkins are grown until relatively late in the growing season, this crop is often affected more than other cucurbits.

Clade 2 of the pathogen can quickly become resistant to fungicides, and some are no longer effective. Strobilurin fungicides (such as Cabrio, Flint, Merivon, Pristine, Quadris, Reason, Satori) and fungicides with the active ingredient mefenoxam (such as Ridomil) are particularly prone to resistance. In addition, Revus and Previcur Flex have occasionally been ineffective for management of downy mildew.

Non-Pesticide

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Partially-resistant varieties of cucumber and cantaloupe are available. If you market supports it, avoid late planted cucumbers that will yield after early July when disease pressure is strongest.

Pesticide

**Catamaran (potassium phosphate, chlorothalonil)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6 pts. per acre. REI: 12-hour. PHI: 1-day. FRAC P7, FRAC M5.

**chlorothalonil products (chlorothalonil)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC M5.

**Elumin (4SC) (ethaboxam)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 8 fl. oz. per acre. Tank-mixing this product with a contact fungicide such as chlorothalonil or mancozeb will help reduce resistance concerns. REI: 12-hour. PHI: 2-day. FRAC 22.

**Forum (4.17SC) (dimethomorph)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 40.

**Gavel 75DF (zoxamide, mancozeb)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.5-2.0 lbs. per acre. REI: 48-hour. PHI: 5-day. FRAC 22, FRAC M3.

**mancozeb products (mancozeb)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of mancozeb products (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M3.

**Omega 500F (4.17) (fluazinam)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of fluazinam products (Aliette, Phostrol, ProPhyt, Rampart) are labeled at various rates. Label includes different crops, PHIs, resistance instructions, and other important information. Some manufacturers recommend tank-mixing. These products may be used in a preventative program until the disease is observed. REI: 4 to 12-hour. FRAC P7.

**Presidio (4SC) (fluopicolide)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 4 fl. oz. per acre. REI: 12-hour. PHI: 2-day. FRAC 43.

**Ranman 400SC (34.5) (cyazofamid)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2.75 fl. oz. per acre. Mixing Ranman with a nonionic surfactant may increase efficacy. REI: 12-hour. PHI: 0-day. FRAC 21.

**Revus (2.08SC) (manipropamid)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 8 fl. oz. per acre. Suppression only. REI: 4-hour. PHI: 0-day. FRAC 40.

**Zampro (SC) (ametoctradin, dimethomorph)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 14 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 45, FRAC 40.
Cucurbit Crops - Diseases

Zing! (zoxamide, chlorothalonil) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 36 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 22, FRAC M5.

Fruit Rot of Cucurbits - Fusarium Fungus

Fruit with Fusarium fruit rot are often observed from fields where other disease or cultural problems are present. May be seedborne.

Non-Pesticide

Cantaloupe/Muskmelon, Pumpkin | Avoid fields with a history of the disease and excess water. Improve drainage with raised beds. Rotate to non-Cucurbit crops for >4 years. Manage foliar diseases for better fruit health.

Fusarium Wilt of Vine Crops - Fusarium Fungus

Non-Pesticide

Cantaloupe/Muskmelon, Watermelon | Avoid fields with a history of the disease and excess water. Improve drainage with raised beds. Rotate to non-Cucurbit crops for 5-7 years. Resistant varieties are available.

Pesticide

Proline 480SC (4) (prothioconazole) Watermelon | 5.7 fl. oz. per acre. May be applied by ground or chemigation application equipment. Do not use in water used for hand transplanting REI: 12-hour. PHI: 7-day. FRAC 3.

Gummy Stem Blight/Black Rot of Cucurbits - Didymella Fungus

Gummy stem blight may occur on cucurbits from transplant through harvest. The leaves and stems may be affected. Occasionally, fruit are affected, which is known as black rot. The black rot phase of the disease is more common in pumpkins than the gummy stem blight phase. May be seedborne.

Strains of the gummy stem blight fungus are known to exist in the Midwest that are resistant to some fungicides. Strobilurin fungicides in Group 11 (such as Cabrio, Flint, Merivon, Pristine, Quadris, Satori) and fungicides with the active ingredient boscalid Group 7 (such as Fontelis and Pristine) are particularly susceptible to resistance. Tank-mix these products with products that have a different mode of action in situations where resistance may be a factor.

At vine touch, apply contact or systemic fungicides at 7-14 day intervals or according to MELCAST - see Purdue Extension publication BP-67-W, Foliar Disease Fungicide Control Using MELCAST, available from the Purdue Extension Education Store, www.edustore.purdue.edu.

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Use disease-free seed and transplants. Rotate to non-Cucurbit crops for 3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

chlorothalonil products (chlorothalonil) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC M5.


Luna Experience (fluopyram, tebuconazole) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 10-17 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 3.

mancozeb products (mancozeb) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Several formulations of mancozeb products (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M3.

Merivon (fluxapyroxad, pyraclostrobin) Cantaloupe/Muskmelon, Cucumber, Watermelon | 5.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

Miravis Prime (SC) (pydiflumetofen, fludioxonil) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 9.2-11.4 fl. oz. per acre. An adjuvant may be added at recommended rates. REI: 12-hour. PHI: 1-day. FRAC 7, FRAC 12.

Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 1.75-2.5 pts. per acre. Make no more than 2 sequential applications before rotating to a different mode of action. When 3 fungicide applications are used, Orondis can be in no more than 33% of the applications. Do not follow soil applications of Orondis Gold. REI: 12-hour. PHI: 0-day. FRAC 49, FRAC M5.

Switch 62.5WG (cyprodinil, fludioxonil) Cantaloupe/Muskmelon | 11-14 oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 9, FRAC 12.

tebuconazole products (tebuconazole) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 8 fl. oz. per acre. There are many brand names (Monsoon, Onset, Vibe) with 3.6 lbs. a.i. per gallon that use the same rate. REI: 12-hour to 18-day. PHI: 7-day. FRAC 3.
**Leaf Blight of Cucurbits - Alternaria Fungus**

Alternaria leaf blight (ALB) primarily affects cantaloupe. ALB symptoms may occur on leaves from May through harvest. *At vine touch*, apply contact or systemic fungicides at 7-14 day intervals or according to MELCAST - see Purdue Extension publication BP-67-W, *Foliar Disease Fungicide Control Using MELCAST*, available from the Purdue Extension Education Store, www.edustore.purdue.edu. Fungicide applications are unnecessary within 2-3 weeks of final harvest.

**Non-Pesticide**

*Cantaloupe/Muskmelon* | Rotate to non-Cucurbit crops for 2 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

**Aprovia Top** (difenconazole, benzovindiflupyr)  
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 10.5-13.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 7.

**azoxystrobin products** (azoxystrobin)  
*Cantaloupe/Muskmelon, Cucumber, Watermelon* | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 1-day. FRAC 11.

**Cabrio EG (20)** (pyraclostrobin)  
*Cantaloupe/Muskmelon, Cucumber, Watermelon* | 12-16 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 11.

**chlorothalonil products** (chlorothalonil)  
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC M5.

**Fontelis (1.67SC)** (penthiopyrad)  
*Cantaloupe/Muskmelon* | 12-16 fl. oz. per acre. In the greenhouse use a rate of 0.5 fl. oz. per gallon per 1,360 sq. ft. REI: 12-hour. PHI: 1-day. FRAC 7.

**Gavel 75DF** (zoxamide, mancozeb)  
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.5-2.0 lbs. per acre. REI: 48-hour. PHI: 5-day. FRAC 22, FRAC M3.

**Inspire Super (EW)** (difenconazole, cyprodinil)  
*Cantaloupe/Muskmelon, Cucumber, Watermelon* | 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 3, FRAC 9.

**Luna Experience** (fluopyram, tebuconazole)  
*Cantaloupe/Muskmelon* | 6-17 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 3.

**Luna Sensation** (fluopyram, trifloxystrobin)  
*Cantaloupe/Muskmelon* | 7.6 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

**mancozeb products** (mancozeb)  
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of mancozeb products (Dithane, Manzate, Pencozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M3.

**Merivon** (fluxapyroxad, pyraclostrobin)  
*Cantaloupe/Muskmelon* | 4-5.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

**Miravis Prime (SC)** (pydiflumetofen, fludioxonil)  
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 9.2-11.4 fl. oz. per acre. An adjuvant may be added at recommended rates. REI: 12-hour. PHI: 1-day. FRAC 7, FRAC 12.

**Orondis Opti Premix** (SC) (oxathiapiprin, chlorothalonil)  
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.75-2.5 pts. per acre. Make no more than 2 sequential applications before rotating to a different mode of action. When 3 fungicide applications are used, Orondis can be in no more than 33% of the applications. Do not follow soil applications of Orondis Gold. REI: 12-hour. PHI: 0-day. FRAC 49, FRAC M5.

**Pristine 38WG** (boscalid, pyraclostrobin)  
*Cantaloupe/Muskmelon* | 12.5-18.5 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

**Quadris Opti (SC)** (azoxystrobin, chlorothalonil)  
*Cantaloupe/Muskmelon, Cucumber, Watermelon* | 3.2 pts. per acre. REI: 12-hour. PHI: 1-day. FRAC 7, FRAC M5.

**Quadris Top (SC)** (azoxystrobin, difenoconazole)  
*Cantaloupe/Muskmelon, Cucumber, Watermelon* | 12-14 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC 3.

**Switch 62.5WG** (cyprodinil, fludioxonil)  
*Cantaloupe/Muskmelon* | 11-14 oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 9, FRAC 12.

**Tanors (DF)** (famoxadone, cymoxanil)  
*Cantaloupe/Muskmelon* | 8 oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 11, FRAC 27.

**Zing!** (zoxamide, chlorothalonil)  
*Cantaloupe/Muskmelon* | 36 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 22, FRAC M5.

**Leaf Blight of Cucurbits - Plectosporium Fungus**

Plectosporium blight primarily affects pumpkin. Leaves, stems, and occasionally fruit can be affected. *At vine touch*, start applying contact/systemic fungicide applications and continue at 7-14 day intervals.
Cucurbit Crops - Diseases

Non-Pesticide

Pumpkin, Squash | Avoid fields with a history of the disease and excess water. Rotate to non-Cucurbit crops for 3-4 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Aprovia Top (difenoconazole, benzovindiflupyr)  
Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 1-day. FRAC 9.

Cabrio EG (20) (pyraclostrobin)  
Cantaloupe/Muskmelon, Cucumber, Watermelon | 2.0-3.8 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11.

chlorothalonil products (chlorothalonil)  
Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC M5.

Flint Extra (4.05) (trifloxystrobin)  
Pumpkin, Squash | 2.0-3.8 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11.

Inspire Super (EW) (difenoconazole, cyprodinil)  
Cantaloupe/Muskmelon, Cucumber, Watermelon | 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 3, FRAC 9.

mancozeb products (mancozeb)  
Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Several formulations of mancozeb products (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 0-day. FRAC M3.

Merivon (fluxapyroxad, pyraclostrobin)  
Cantaloupe/Muskmelon, Cucumber, Watermelon | 5.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7. FRAC 11.

Quadris Top (SC) (azoxystrobin, difenoconazole)  
Cantaloupe/Muskmelon, Cucumber, Watermelon | 12-14 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC 3.

Leaf Spot and Fruit Spot of Cucurbits - Xanthomonas Bacteria

Bacterial leaf and fruit spot occurs primarily on pumpkin and winter squash. Symptoms on leaves may occur from the 4-leaf stage through the remainder of the season. Fruits can be infected from time of set until harvest. Only fruit symptoms are of economic importance. Bacterial leaf and fruit spot lesions may be colonized by other organisms (such as Fusarium and soft-rot bacteria), which results in fruit rot.

The bacterial leaf and fruit spot pathogen can survive on infected leaf and fruit residues for more than 24 months. Also, the pathogen can be transmitted in and on seed for longer than 20 months. Leaf symptoms of this disease may be similar to angular leaf spot caused by Pseudomonas bacterium. The only known hosts of the leaf spot pathogen (Xanthomonas) are plants in the Cucurbitaceae family.

At planting, treat with fixed copper compounds mixed with mancozeb products if symptoms are present. At vine touch, apply fixed copper mixed with mancozeb when fruit is softball-sized. Continue applications until fruit set is complete.

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Several formulations of copper (Badge, Champ, Kocide) are labelled for use. See label for directions. Apply fixed copper 2 weeks prior to the opening of the first female bloom, at first female bloom, and 2 weeks after the first female bloom. Later in the season, fixed copper products may be applied to help reduce disease spread. No more than 6 applications per season. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

Nematodes

Winter/off-season: Root-knot nematodes have a host range of more than 2,000 plants, so crop rotation is often ineffective unless a grain crop is used. Certain cover crops may lessen symptom severity.

Planting: Vydate at planting may manage moderate nematode populations. Fumigants may be used for higher nematode populations.

Harvest: Examine stunted and wilting plants for the presence of root-knot nematodes.

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Collect soil samples for nematodes in the fall and avoid fields with high numbers. Rotate to a non-broadleaf crop, such as grass grains or sweet corn for >3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.
destruction of the finished crop with tillage to rapidly breakdown tissue and displace nematodes is an important method to prevent nematode build-up. Anaerobic soil disinfestation (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain nematodes.

Pesticide

Nimitz (4EC) (fluensulfone) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 3.5-7 pts. per acre. Do not use on direct-seeded plants. May be broadcast, banded, or drip-applied in the spring up to 7 days before planting at a depth of 8 inches. Effectiveness is reduced on muck and clay soils. REI: 12-hour. IRAC UN.

Sectagon K42 (4.2L) (metam sodium) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 37.5-75 gals. per acre. Use high rates on muck, and lower rates on sands. In the fall, when soil at 6 inches is above 50 F and moist, place Sectagon K42 or VAPAM HL about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, it can be applied through drip irrigation under unperforated plastic beds. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC 8F, FRAC M3, WSSA 17. RUP.

Sectagon K54 (5.63L) (metam potassium) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 30-62 gals. per acre. Use high rates on muck, and lower rates on sands. In the fall, when soil at 6 inches is above 50 F and moist, place Sectagon K54 or K-PAM HL about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, it can be applied through drip irrigation under unperforated plastic beds. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC 8F, FRAC M3, WSSA 17. RUP.

Telone C-17 (L) (1,3-dichloropropene, chloropicrin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Muck soils: Use C-17 formulation at 27.4-30 gals. per acre, and C-35 formulation at 33-36 gals. per acre. Mineral soils: Use C-17 formulation at 10.8-17.1 gals. per acre, and C-35 formulation at 13-20.5 gals. per acre. In the fall, when soil at 6 inches is above 50 F and moist, place Telone C-17 or C-35 about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing, irrigation, or plastic. Or, in the spring, InLine means, or drip chemigate 2-4 pts. per acre after transplanting. Allow 14 days between applications. Do not exceed 8 total applications, or 3 gals. per acre per season. REI: 5-day. IRAC 8F, FRAC M3, WSSA 17. RUP.

Telone II (9.85L) (1,3-dichloropropene) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Muck soils: Use at 25 gals. per acre. Mineral soils: Use at 9-12 gals. per acre. In the spring or fall, when soil at 6 inches is above 50 F and moist, place Telone II about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, Telone EC may be applied through drip irrigation under unperforated plastic beds at 9-18 gals. per acre on mineral soils only. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC UN, FRAC NC. RUP.

Velum Prime (4.16SC) (fluopyram) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 6.5-6.84 fl. oz. per acre. Apply through drip irrigation. Do not exceed 13.7 fl. oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. FRAC 7.

Vydate L (2WSL) (oxamyl) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Apply 1-2 gals. per acre as a banded or shank-injected pre-plant, at-plant in-furrow or directed post-plant soil treatment with at least 20 gals. water per acre incorporated 2-4 inches deep by water or mechanical means, or drip chemigate 2-4 pts. per acre after transplanting. Allow 14 days between applications. Do not exceed 8 total applications, or 3 gals. per acre per season. REI: 48-hour. PHI: 1-day. IRAC 1A. RUP.

Phytophthora Blight of Multiple Crops - Phytophthora Oomycete

Phytophthora may cause damping-off, vine infection, and fruit rot in cucurbits. It is often associated with heavy rains and fields with poor drainage. The first symptoms are usually observed in low areas. It has a wide host range of crops and weeds, including peppers, tomatoes, beans, nightshades and velvetleaf. Ponds and streams with run-off water from infested soil may be contaminated with Phytophthora.

At planting, direct-seeded crops benefit from fungicide-treated seed (see discussion of fungicide seed treatment under Damping-off). Treat seed with Apron XL LS to help prevent Phytophthora infection for 5 weeks from time of seeding. Ponds with run-off water from infested soil may be contaminated with Phytophthora. At vine touch, apply contact or systemic fungicides at first sign of the disease. Systemic fungicides are available.

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Avoid fields with a history of the disease and excess water. Improve drainage with raised beds. Reduce inoculum with weed control and rotate to non-Cucurbit and non-Solanaceous crops for >4 years. Do not irrigate with surface water. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Apron XL (3) (mefenoxam) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 0.085-0.64 fl. oz. per 100 lb of seed. Seed treatment will help prevent damping-off.
Cucurbit Crops - Diseases

caused by Phytophthora and Pythium. Ridomil products cannot be used until 6 weeks after transplant. REI: 48-hour. FRAC 4.

**Forum (4.17SC) (dimethomorph)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6 fl. oz. per acre.  
REI: 12-hour. PHI: 0-day. FRAC 40.

**Gavel 75DF (zoxamide, mancozeb)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.5-2.0 lbs. per acre.  
REI: 48-hour. PHI: 5-day. FRAC 22, FRAC M3.

**Orondis Gold (DC) (oxathiapiprolin, mfenoxam)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 28-55 fl. oz. per acre. Use as an at-plant soil drench, banded spray in furrow, or through drip irrigation. Do not follow soil applications of Orondis Gold with foliar applications of Orondis Opti, or Orondis Ultra. REI: 4-hour. PHI: 0-day. FRAC 49, FRAC 4.

**Orondis Ultra Premix (SC) (oxathiapiprolin, mandipropamid)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 28-55 fl. oz. per acre. Use as an at-plant soil drench, banded spray in furrow, or through drip irrigation. Do not follow soil applications of Orondis Gold with foliar applications of Orondis Opti, or Orondis Ultra. REI: 4-hour. PHI: 0-day. FRAC 49, FRAC 4.

**phosphite and phosphorous acid products (phosphorous acid, potassium phosphite, mono-dipotassium salts of phosphorous acid, mono- and dibasic sodium, potassium, and ammonium phosphites, fosetyl-aluminum)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several phosphite or phosphorous acid products (Aliette, Phostrol, ProPhyt, Rampart) are labeled at various rates. Label includes different crops, PHIs, resistance instructions, and other important information. Some manufacturers recommend tank-mixing. These products may be used in a preventative program until the disease is observed. REI: 4 to 12-hour. FRAC P7.

**Presidio (4SC) (fluopicolide)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 4 fl. oz. per acre.  
REI: 12-hour. PHI: 2-day. FRAC 43.

**Aprovia Top (difenoconazole, benzovindiflupyr)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 10.5-13.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 7.

**Fontelis (1.67SC) (penthiopyrad)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 12-16 fl. oz. per acre. In the greenhouse use a rate of 0.5 fl. oz. per gallon per 1,360 sq. ft. REI: 12-hour. PHI: 1-day. FRAC 7.

**Gatten (0.423) (flutianil)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC U13.

**Inspire Super (EW) (difenoconazole, cyprodinil)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6-17 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 3, FRAC 9.

**Luna Experience (fluopyram, tebuconazole)**

*Cantaloupe/Muskmelon* | 6-17 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 3, FRAC 9.

**Luna Sensation (fluopyram, trifloxystrobin)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 4-7.6 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

**Zampro (SC) (ametoctradin, dimethomorph)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 14 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 45, FRAC 40.

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**Powdery Mildew of Cucurbits - Podosphaera Fungus**

Powdery mildew is primarily a disease of cantaloupe, cucumber, pumpkin, and squash. This disease does not require leaf wetness for disease initiation or spread.

*At vine touch*, begin systemic fungicide applications at bush stage of pumpkin growth. Protect pumpkin vines until approximately 21 days from last harvest. Some pumpkin varieties have partial resistance to powdery mildew.

Fungicide resistance has been detected in the Midwest. Fungicides in Groups 1 and 11 may not be effective. Fungicides that are affected include Cabrio, Flint, Quadris, Satori, Sovran, and Topsin. Alternate fungicides between MOA groups.

**Non-Pesticide**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Rotate to non-Cucurbit crops for 2 years. Resistant or partially resistant cantaloupe, cucumber and pumpkin cultivars are available. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

*Aprovia Top (difenoconazole, benzovindiflupyr)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 10.5-13.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 7.

**Fontelis (1.67SC) (penthiopyrad)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 12-16 fl. oz. per acre. In the greenhouse use a rate of 0.5 fl. oz. per gallon per 1,360 sq. ft. REI: 12-hour. PHI: 1-day. FRAC 7.

**Gatten (0.423) (flutianil)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC U13.

**Inspire Super (EW) (difenoconazole, cyprodinil)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6-17 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 3, FRAC 9.

**Luna Experience (fluopyram, tebuconazole)**

*Cantaloupe/Muskmelon* | 6-17 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 3, FRAC 9.

**Luna Sensation (fluopyram, trifloxystrobin)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 4-7.6 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.
**Merivon (fluxapyroxad, pyraclostrobin)**
*Cantaloupe/Muskmelon, Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 4-5.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

**Microthiol Disperss (80W) (sulfur)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5-10 lbs. per acre. REI: 24-hour. PHI: 0-day. FRAC M2, IRAC UN. OMRI-listed.

**Miravis Prime (SC) (pydiflumetofen, fludioxonil)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 9.2-11.4 fl. oz. per acre. An adjuvant may be added at recommended rates. REI: 12-hour. PHI: 1-day. FRAC 7, FRAC 12.

**Procure 480SC (4) (triflumizole)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 4-8 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 3.

**Prolivo 300SC (2.5) (pyriofenone)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 4-5 fl. oz. per acre. REI: 4-hour. PHI: 0-day. FRAC 50.

**Quintec (2.08) (quinoxyfen)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 4-6 fl. oz. per acre. May cause leaf yellowing. Product is a contact fungicide. Labeled for winter squash—not summer squash. REI: 12-hour. PHI: 3-day. FRAC 13.

**Rally 40WSP (metylbutanil)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2.5-3.0 oz. per acre. REI: 24-hour. PHI: 0-day. FRAC 3.

**tebuconazole products (tebuconazole)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 4-6 fl. oz. per acre. There are many brand names (Monsoon, Onset, Vibe) with 3.6 lbs. a.i. per gallon that use the same rate. REI: 12-hour to 18-day. PHI: 7-day. FRAC 3.

**Torino (10SC) (cyflufenamid)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 3.4 oz. per acre. REI: 4-hour. PHI: 0-day. FRAC U6.

**Velum Prime (4.16SC) (fluopyram)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6.5-6.84 fl. oz. per acre. May cause a mild yellowing of leaf margins. May be applied through drip. REI: 12-hour. PHI: 0-day. FRAC 7.

**Vivando (2.5) (metrafenone)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 15.4 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 50.

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### Scab of Cucurbits - Cladosporium Fungus

Scab lesions may be observed on the fruit of most cucurbit crops. Fungicides may help to reduce the severity of scab if applied before fruit development. Some fungicides used for gummy stem blight control may help. But, fungicides may be ineffective when temperatures of less than 57 degrees F persist for longer than 9 hours.

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### Viruses of Multiple Crops - Multiple Pathogens

Aphids transmit virus diseases, including cucumber mosaic virus, papaya ring spot virus, watermelon mosaic virus, and zucchini yellow mosaic virus. Since these diseases usually appear later in the season, they most often affect pumpkin and squash. All types of vine crops are susceptible to these viruses. Squash mosaic virus is seed-borne and can be transferred by cucumber beetles. See insect section.

### Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Use disease-free seed and transplants. Rotate to non-Cucurbit crops for 3-4 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

### Recommended Controls

#### Aphids

### Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | It may help to kill perennial weeds (virus source plants) within 150 feet of planting. Controlling aphids (virus carriers) by insecticides can reduce secondary spread of viruses but does not reduce initial infection and rarely results in any decrease in the incidence of virus symptomatic fruit. Early planting and development of pumpkins and squash fruit before virus diseases become prevalent may reduce symptoms on fruit. Earlier planted or earlier maturing cultivars will help to avoid severe disease problems. Varieties with host resistance include cucumbers (cucumber mosaic virus) and squash (watermelon mosaic virus; zucchini yellow mosaic virus; cucumber mosaic virus; papaya ringspot virus).

### Cucurbit Crops - Insects

Reviewed by Laura Ingwell, Raymond Cloyd – Nov 2020

#### Recommended Controls

##### Aphids

**Non-Pesticide**

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Limiting insecticide use will conserve predators and parasites that help control aphid populations. Monitor the presence of predators and parasitized aphids. Several predators per aphid colony will probably bring the aphid population under control without insecticide.

##### Pesticide

**Actara (25WDG) (thiamethoxam)**
*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.5-3.0 oz. per acre. Apply as a foliar spray. Do not exceed 11 oz. per acre per season. See pollinator precautions. REI: 12-hour. PHI: 0-day. IRAC 4A.
**Cucurbit Crops - Insects**

**Admire Pro (4.6SC) (imidacloprid)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 7.0-10.5 fl. oz. per acre. See label for various soil application methods. Do not exceed 10.5 fl. oz. per acre. Should never be used in combination with insecticide-treated seed. REI: 12-hour. PHI: 21-day. IRAC 4A.

**Assail 30SG (acetamiprid)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 30SG formulations at 2.5-4.0 oz. per acre and do not exceed 26.5 oz. per acre per season. Use 70WP formulations at 1.1-1.7 oz. per acre and do not exceed 11.5 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 4A.

**Belay (2.13SC) (clothianidin)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Soil applications: 9-12 fl. oz. per acre. Foliar applications: 3-4 fl. oz. per acre. Do not use as foliar after the 4th true leaf on main stem has unfolded. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 4A.

**Beleaf (50SG) (flonicamid)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2-2.8 oz. per acre. Do no exceed 3 applications per season. REI: 12-hour. PHI: 0-day. IRAC 29.

**Dimethoate 4EC (dimethoate)** *Cantaloupe/Muskmelon, Watermelon* | Use 2.67EC formulations at 0.75-1.5 pts. per acre and do not exceed 3 pts. per acre per season. Use 4EC, LV-4, and 400EC formulations at 0.5-1.0 pt. per acre and do not exceed 2 pts. per acre per season. REI: 48-hour. PHI: 3-day. IRAC 1B.

**Exirel (0.83SE) (cyantraniliprole)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 13.5-20.5 fl. oz. per acre. Do not exceed 61 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 28.

**Fulfill (50WDG) (pyremetrozine)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2.75 oz. per acre. Do not exceed 5.5 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 9B.

**Harvanta (0.42SL) (cyflaniliprole)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 10.9-16.4 fl. oz. per acre. Use with adjuvant. Do not exceed 65.6 fl. oz. per acre per year. REI: 4-hour. PHI: 1-day. IRAC 28.

**Lannate LV (2.4L) (methomyl)** *Cantaloupe/Muskmelon, Cucumber, Squash, Watermelon* | 1.5-3.0 pts. per acre. Not for pumpkins or winter squash. Do not exceed 18 pts. per acre per season. REI: 48-hour. PHI: 1-day for 1.5 pts. rate, 3-day for rates over 1.5 pts. IRAC 1A. **RUP**.

**M-Pede (3.8) (potassium salts of fatty acids)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1-2% by volume. Must contact insect to be effective. REI: 12-hour. PHI: 0-day. IRAC UN, FRAC NC. OMRI-listed.

**Malathion 5EC (malathion)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 5EC formulations at 1.5-2.8 pts. per acre for cucumber and squash, 1.6 pts. per acre for melon, 1.5 pts. per acre for pumpkin, 1.6-2.8 pts. per acre for squash, or 1.5-2.5 pts. per acre for watermelon. Use 57EC formulations at 1.5 pts. per acre on cucumber, melon, pumpkin, squash, and watermelon. Do not exceed 2 applications per season on cucumbers, pumpkins, melons, and watermelons, or 3 applications per season on squash. REI: 12 to 24-hour. PHI: 1-day. IRAC 1B.

**Perm-Up 25DF (permethrin)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6.4-12.8 oz. per acre. Use 25W, 25WP, and 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2 oz. per acre per season for cantaloupe and 76.8 oz. per acre per season for all other cucurbits. Use 12.8 oz. per acre for aphids. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on cantaloupe, or 48 fl. oz. per acre per season for all cucurbits. REI: 12-hour. PHI: 0-day. IRAC 3A. **RUP**.

**Platinum 2SC (thiamethoxam)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5-11 fl. oz. per acre. Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. Should never be used in combination with insecticide-treated seed. REI: 12-hour. PHI: 30-day. IRAC 4A.

**Scorpion 35SL (3.24) (dinofluburamine)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Soil application: Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-7.5 oz. per acre. Foliar application: Use Scorpion 35SL at 2.0-7.0 fl. oz. per acre, or Venom 70SG at 1-4 oz. per acre. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 4A.

**Sivanto 200 (1.67SL) (flupyradifurone)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 21-28 fl. oz. per acre soil application, or 7-12 fl. oz. per acre foliar application. Should never be used in combination with insecticide-treated seed. REI: 4-hour. PHI: 21-day for soil application, or 1-day for foliar application. IRAC 4D.

**Venom 70SG (dinofluburamine)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5-7.5 oz. per acre and do not exceed 12 oz. per acre per season. Foliar application: 1-4 oz. per acre and do not exceed 6 oz. per acre per season. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 4A.

**Verimark (1.67SC) (cyflaniliprole)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 10.0-13.5 fl. oz. per acre. Apply via drip irrigation or soil injection. Do not exceed 30.65 fl. oz. per acre per season, or 2 applications per season. REI: 4-hour. PHI: 1-day. IRAC 28.

**Warrior II (2.08CS) (lambda-cyhalothrin)** *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash,
Cucumber Beetles

Cucumber beetles transfer bacterial wilt to plants, which cannot be saved once infected. Seed treatments for direct-seeded crops are effective. At-plant soil drenches used alone at the lowest recommended rate, with non-treated seed, offer similar protection to treated seed for beetle control. Due to increased residues in nectar and pollen, in-furrow applications should be considered last. Non-systemic foliar insecticides can be used during bloom in the evening when flowers are closed and bees are not actively foraging, which minimizes the risk to pollinators.

Thresholds range from 0.5 to 1 beetle per seedling, and 1 to 5 beetles per plant for plants after 4 leaf stage. The threshold for cantaloupes/musk melons and cucumber is lower (0.5 per seedling and 1 per plant) because these crops are susceptible to bacterial wilt, which is vectored by striped cucumber beetles. Pumpkin, squash, and watermelon have higher thresholds (1 per seedling and 5 per plant) because they are not susceptible to the disease. To detect beetle populations at an average of 0.5 beetles per plant (lowest threshold) examine 48 plants throughout the field. If operating under the higher threshold of 5 beetles per plant, examine 8 plants throughout the field. Weekly scouting is sufficient to track beetle populations and inform spray decisions. Economic damage can occur on fruit from feeding by both adult beetles and larvae. Beetles found in flowers do not pose a risk to the plant but as flowering decreases, rind feeding may increase and thresholds may need to be lowered.

Non-Pesticide

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<td>Asana XL (0.66EC) (esfenvalerate)</td>
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<td>Mustard Maxx (0.8) (zeta-cypermethrin)</td>
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Harvanta (0.42SL) (cyclaniliprole) Cantaloupe/Musk melon, Cucumber, Pumpkin, Squash, Watermelon | Seed treatments containing thiamethoxam,emenoxam, fludioxonil, azoxystrobin, thiabendazole, spinosad, abamectin |

Crop rotation can help control cucumber beetle populations, but repeated applications may be necessary. For transplanted crops and direct-seeded plants over 3 weeks old, the concentration of insecticide from residues in nectar and pollen, in-furrow applications should be considered last. Non-systemic foliar insecticides can be used during bloom in the evening when flowers are closed and bees are not actively foraging, which minimizes the risk to pollinators.

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seed treatments is no longer strong enough to kill beetles, but can still harm bees due to sublethal doses in the pollen and nectar. Treated seed should never be used in combination with at-plant soil drenches with flupyradifurone (Sivanto), imidacloprid (Admire or generics), or thiamethoxam (Platinum). IRAC 4A, FRAC 4, FRAC 12, FRAC 11, FRAC 1, IRAC 5, IRAC 6.

Sevin XLR Plus (4SC) (carbaryl) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 1 qt. per acre. When applied during hot, humid conditions, carbaryl may cause some phytotoxicity, especially on seedlings and newly set plants. See pollinator precautions. Do not exceed 6 qts. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 1A.

Warrior II (2.08CS) (lambda-cyhalothrin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 1.28-1.92 fl. oz. per acre. Do not exceed 11.5 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 3A. RUP.

Leafhoppers

Pesticide

Admire Pro (4.6SC) (imidacloprid) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 7.0-10.5 fl. oz. per acre. See label for various soil application methods. Do not exceed 10.5 fl. oz. per acre per season. Should never be used in combination with insecticide-treated seed. REI: 21-day. PHI: 21-day. IRAC 4A.

Asana XL (0.66EC) (esfenvalerate) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 5.8-9.6 fl. oz. per acre. Do not exceed 48 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

Assail 30SG (acetamiprid) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Use 30SG formulations at 2.5-4.0 oz. per acre and do not exceed 26.5 oz. per acre per season. Use 70WP formulations at 1.1-1.7 oz. per acre and do not exceed 11.5 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 0-day. IRAC 4A.

Baythroid XL (1EC) (beta-cyfluthrin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 0.8-1.6 fl. oz. per acre. Do not exceed 11.2 fl. oz. per acre or 4 applications per season. Allow 7 days between applications. REI: 12-hour. PHI: 0-day. IRAC 4A. RUP.

Belay (2.13SC) (clothianidin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Soil applications: 9-12 fl. oz. per acre. Foliar applications: 3-4 fl. oz. per acre. Do not use as foliar after the 4th true leaf on main stem has unfolded. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 4A.

Brigade 2EC (bifenthrin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Use 2EC formulations at 2.6-6.4 fl. oz. per acre and do not exceed 19.22 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 8-16 oz. per acre and do not exceed 48 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

Dimethoate 4EC (dimethoate) Cantaloupe/Muskmelon, Watermelon | Use 2.67EC formulations at 0.75-1.5 pts. per acre and do not exceed 3 pts. per acre per season. Use 4EC, LV-4, and 400EC formulations at 0.5-1.0 pt. per acre and do not exceed 2 pts. per acre per season. REI: 48-hour. PHI: 3-day. IRAC 1B.

Perm-Up 25DF (permethrin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 6.4-12.8 oz. per acre. Use 25W, 25WP, and 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2 oz. per acre per season for cantaloupe and 76.8 oz. per acre per season for all other cucurbits. Use 12.8 oz. per acre for aphids. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on cantaloupe or 48 fl. oz. per acre per season for all cucurbits. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

Platinum 2SC (thiamethoxam) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 5-11 fl. oz. per acre. Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. Should never be used in combination with insecticide-treated seed. REI: 12-hour. PHI: 30-day. IRAC 4A.

Scorpion 35SL (3.24) (dinofuran) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Soil application: Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-7.5 oz. per acre. Foliar application: Use Scorpion 35SL at 2.0-7.0 fl. oz. per acre, or Venom 70SG at 1-4 oz. per acre. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 4A.

Sivanto 200 (1.67SL) (flupyradifurone) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 21-28 fl. oz. per acre soil application, or 7-12 fl. oz. per acre foliar application. Should never be used in combination with insecticide-treated seed. REI: 4-hour. PHI: 21-day for soil application, or 1-day for foliar application. IRAC 4D.

Venom 70SG (dinofuran) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Soil application: 5-7.5 oz. per acre and do not exceed 12 oz. per acre per season. Foliar application: 1-4 oz. per acre and do not exceed 6 oz. per acre per season. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 4A.

Warrior II (2.08CS) (lambda-cyhalothrin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 1.28-1.92 fl. oz. per acre. Do not exceed 11.5 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 3A. RUP.
Mites

Pesticide

Acramite 50WS (bifentrazate) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 0.75-1 lb. per acre.
One application per season. REI: 12-hour. PHI: 3-day. IRAC UN.

Agri-Mek SC (0.7) (abamectin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Use 0.7SC formulations at 1.75-3.5 fl. oz. per acre and do not exceed 10.25 fl. oz. per acre per season. Use 0.1SEC formulations at 8-16 fl. oz. per acre and do not exceed 48 fl. oz. per acre per season. Allow at least 7 days between applications. Do not make more than 2 sequential applications. REI: 12-hour. PHI: 7-day. IRAC 6. RUP.

Brigade 2EC (bifenthrin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 5.12-6.4 fl. oz. per acre. Use 2EC formulations at 5.12-6.4 fl. oz. per acre and do not exceed 19.22 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 12.8-16.0 oz. per acre and do not exceed 48 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

Danitol 2.4EC (30.9) (fenpropathrin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 10.67-16 fl. oz. per acre. Do not exceed 42.67 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 3A. RUP.

Kanemite 15SC (1.25) (acequinocyl) Cantaloupe/Muskmelon, Cucumber, Watermelon | 31 fl. oz. per acre. Do not exceed 2 applications per year. Allow 21 days between applications. REI: 12-hour. PHI: 1-day. IRAC 20B.

Oberon 2SC (spiromesifen) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 7.0-8.5 fl. oz. per acre. Do not exceed 3 applications per season. REI: 12-hour. PHI: 7-day. IRAC 23.

Portal (0.4EC) (fenpyroximate) Cantaloupe/Muskmelon, Cucumber | 2 pts. per acre. Do not exceed 2 applications per season. REI: 12-hour. PHI: 1-day for cucumber, 3-day for melon. IRAC 21A.

Zeal (72WP) (etoxazole) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 2-3 oz. per acre. Do not exceed 1 application per season. REI: 12-hour. PHI: 7-day. IRAC 10B.

Seed and Root Maggots

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Early plowing of cover crops and weeds will generally result in less damage to seedling plants in field.

Pesticide

Seed treatments (thiamethoxam, mefenoxam, fludioxonil, azoxystrobin, thiamendazole, spinosad, abamectin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Seed treatments containing thiamethoxam (FarMore FI400, Cruiser) offer maximum protection against cucumber beetles and root maggots for about 2 to 3 weeks after seedling emergence. For transplanted crops and direct-seeded plants over 3 weeks old, the concentration of insecticide from seed treatments is no longer strong enough to kill beetles, but can still harm bees due to sublethal doses in the pollen and nectar. Treated seed should never be used in combination with at-plant soil drenches with flupyradifurone (Sivanto), imidacloprid (Admire or generics), or thiamethoxam (Platinum). IRAC 4A, FRAC 4, FRAC 12, FRAC 11, FRAC 1, IRAC 5, IRAC 6.

Verimark (1.67SC) (cyantraniliprole) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 10.0-13.5 fl. oz. per acre. Apply via drip irrigation or soil injection. Do not exceed 30.65 fl. oz. per acre per season, or 2 applications per season. REI: 4-hour. PHI: 1-day. IRAC 28.

Squash Bug

Pesticide

Asana XL (0.66EC) (esfenvalerate) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 5.8-9.6 fl. oz. per acre. Do not exceed 48 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

Assail 30SG (acetamiprid) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 2.5-5.3 oz. per acre. Use 30SG formulations at 2.5-5.3 oz. per acre and do not exceed 26.5 oz. per acre per season. Use 70WP formulations at 1.1-2.3 oz. per acre and do not exceed 11.5 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 4A.

Azer (C) (azadirachtin, pyrethrins) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 32-48 fl. oz. per acre. Use higher rates for squash bug adults, or when pest pressure is extreme of plant canopy is dense. Do not exceed 10 applications per season. Do not reapply within 3 days except under extreme pest pressure. REI: 12-hour. PHI: 0-day. IRAC UN, IRAC 3A. OMRI-listed.

Belay (2.13SC) (clothianidin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Soil applications: 9-12 fl. oz. per acre. Foliar applications: 3-4 fl. oz. per acre. Do not use as foliar after the 4th true leaf on main stem has unfolded. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 4A.

Brigade 2EC (bifenthrin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Use 2EC formulations at 2.6-6.4 fl. oz. per acre and do not exceed 19.22 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 8-16 oz. per acre and do not exceed 48 oz. per acre per season. Allow 7
Cucurbit Crops - Insects

**Harvanta (0.42SL) (cyclaniliprole)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 10.9-16.4 fl. oz. per acre Effective on nympha only. Do not exceed 65.6 fl. oz. per acre per year. REI: 4-hour. PHI: 1-day. IRAC 28.

**Mustang Maxx (0.8) (zeta-cypermethrin)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2.8-4 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Perm-Up 25DF (permethrin)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6.4-12.8 oz. per acre. Use 25W, 25WP, and 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2 oz. per acre per season for cantaloupe and 76.8 oz. per acre per season for all other cucurbits. Use 12.8 oz. per acre for aphids. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on cantaloupe. or 48 fl. oz. per acre per season for all cucurbits. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Scorpion 35SL (3.24) (dinotefuran)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Soil application: Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-7.5 oz. per acre. *Foliar application*: Use Scorpion 35SL at 2.0-7.0 fl. oz. per acre, or Venom 70SG at 1-4 oz. per acre. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 4A.

**Sevin XLR Plus (4SC) (carbaryl)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1 qt. per acre. When applied during hot, humid conditions, carbaryl may cause some phytotoxicity, especially on seedlings and newly set plants. See pollinator precautions. Do not exceed 6 qts. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 1A.

**Venom 70SG (dinitofuran)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Soil application: 5-7.5 oz. per acre and do not exceed 12 oz. per acre per season. *Foliar application*: 1-4 oz. per acre and do not exceed 6 oz. per acre per season. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 4A.

**Warrior II (2.08CS) (lambda-cyhalothrin)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.28-1.92 fl. oz. per acre. Do not exceed 11.5 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 3A. RUP.

**Squash Vine Borer**

**Non-Pesticide**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Pheromone-baited traps are attractive to squash vine borers and can detect mass flights and heavy egg-laying activity. Fall tillage can disrupt overwintering success.

**Pesticide**

**Asana XL (0.66EC) (esfenvalerate)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5.8-9.6 fl. oz. per acre. Do not exceed 48 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

**Assail 30SG (acetamiprid)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 30SG formulations at 2.5-5.3 oz. per acre and do not exceed 26.5 oz. per acre per season. Use 70WP formulations at 1.1-2.3 oz. per acre and do not exceed 11.5 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 4A.

**Brigade 2EC (bifenthrin)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 2EC formulations at 2.6-6.4 fl. oz. per acre and do not exceed 19.22 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 8-16 oz. per acre and do not exceed 48 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

**Mustang Maxx (0.8) (zeta-cypermethrin)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2.8-4 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Perm-Up 25DF (permethrin)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6.4-12.8 oz. per acre. Use 25W, 25WP, and 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2 oz. per acre per season for cantaloupe and 76.8 oz. per acre per season for all other cucurbits. Use 12.8 oz. per acre for aphids. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on cantaloupe. or 48 fl. oz. per acre per season for all cucurbits. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Warrior II (2.08CS) (lambda-cyhalothrin)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.28-1.92 fl. oz. per acre. Do not exceed 11.5 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 3A. RUP.

**Thrips**

**Pesticide**

**Admire Pro (4.6SC) (imidacloprid)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 7.0-10.5 fl. oz. per acre. See label for various soil application methods. Do not exceed 10.5 fl. oz. per acre per season. Should never be used in combination with insecticide-treated seed. REI: 21-day. IRAC 4A.

**Entrust SC (2) (spinosad)**

*Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 2SC formulations at 6.0-8.0 fl. oz. per acre and do not exceed 29.0 fl. oz. per acre per season. Use 80WP formulations at 2.0-2.5 oz. per acre and do not exceed 9.0 oz. per acre per season. Allow 5 days between applications. REI: 4-hour. PHI: 1-day for cucumber, 3-day for all others. IRAC 5. OMRI-listed.
Harvanta (0.42SL) (cyfluthrin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 10.9-16.4 fl. oz. per acre. Do not exceed 65.6 fl. oz. per acre per year. REI: 4-hour. PHI: 1-day. IRAC 28.

Platinum 2SC (thiamethoxam) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 5-11 fl. oz. per acre. Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. Should never be used in combination with insecticide-treated seed. REI: 12-hour. PHI: 30-day. IRAC 4A.

Radiant 1SC (spinetoram) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 6-10 fl. oz. per acre. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day for cucumber; 3-day for cantaloupe/muskmelon, pumpkin, squash, and watermelon. IRAC 5.

Venom 70SG (dinotefuran) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Soil application: 5-7.5 oz. per acre and do not exceed 12 oz. per acre per season. Foliar application: 1-4 oz. per acre and do not exceed 6 oz. per acre per season. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 4A.

Whiteflies

Pesticide

Actara (25WDG) (thiamethoxam) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 3.0-5.5 oz. per acre. Apply as a foliar spray. Do not exceed 11 oz. per acre per season. See pollinator precautions. REI: 12-hour. PHI: 0-day. IRAC 4A.

Admire Pro (4.6SC) (imidacloprid) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 7.0-10.5 fl. oz. per acre. See label for various soil application methods. Do not exceed 10.5 fl. oz. per acre per season. Should never be used in combination with insecticide-treated seed. REI: 12-hour. PHI: 21-day. IRAC 4A.

Assail 30SG (acetamiprid) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 2.5-5.3 oz. per acre. Use 30SG formulations at 2.5-5.3 oz. per acre and do not exceed 26.5 oz. per acre per season. Use 70WP formulations at 1.1-2.3 oz. per acre and do not exceed 11.5 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 4A.

Beleaf (50SG) (flonicamid) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 2-8 oz. per acre. Do not exceed 3 applications per season. REI: 12-hour. PHI: 0-day. IRAC 29.

Brigade 2EC (bifenthrin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 5.12-6.4 fl. oz. per acre. Use 2EC formulations at 5.12-6.4 fl. oz. per acre and do not exceed 19.22 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 12.8-16.0 oz. per acre and do not exceed 48 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

Exirel (0.83SE) (cypermethrin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 13.5-20.5 fl. oz. per acre. Do not exceed 61 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 28.

Fulfill (50WDG) (pymethenine) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 2.75 oz. per acre. Do not exceed 5.5 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 9B.

Knack (0.86) (pyriproxyfen) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 8-10 fl. oz. per acre. Do not exceed 2 applications. REI: 12-hour. PHI: 7-day. IRAC 7C.

M-Pede (3.8) (potassium salts of fatty acids) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 1-2% by volume. Must contact insect to be effective. REI: 12-hour. PHI: 0-day. IRAC UN, FRAC NC. OMRI-listed.

Neemix (0.39) (azadirachtin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 6-16 fl. oz. per acre. Do not exceed 3 applications per season. REI: 12-hour. PHI: 0-day. IRAC UN. OMRI-listed.

Oberon 2SC (spiromesifen) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 7.0-8.5 fl. oz. per acre. Do not exceed 3 applications per season. REI: 12-hour. PHI: 7-day. IRAC 23.

Platinum 2SC (thiamethoxam) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 5-11 fl. oz. per acre. Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. Should never be used in combination with insecticide-treated seed. REI: 12-hour. PHI: 30-day. IRAC 4A.

Scorpion 35SL (3.24) (dinothefuran) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Soil application: Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-7.5 oz. per acre. Foliar application: Use Scorpion 35SL at 2.0-7.0 fl. oz. per acre, or Venom 70SG at 1-4 oz. per acre. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 4A.

Sivanto 200 (1.67SL) (flupyradifurone) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 21-28 fl. oz. per acre soil application, or 7-12 fl. oz. per acre foliar application. Should never be used in combination with insecticide-treated seed. REI: 4-hour. PHI: 21-day for soil application, or 1-day for foliar application. IRAC 4D.

Venom 70SG (dinotefuran) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Soil application: 5-7.5 oz. per acre and do not exceed 12 oz. per acre per season.
Cucurbit Crops - Weeds

Foliar application: 1-4 oz. per acre and do not exceed 6 oz. per acre per season. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 4A.

Verimark (1.67SC) (cyantraniliprole) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 10.0-13.5 fl. oz. per acre. Apply via drip irrigation or soil injection. Do not exceed 30.65 fl. oz. per acre per season, or 2 applications per season. REI: 4-hour. PHI: 1-day. IRAC 28.

Wireworms

Pesticide

Capture LFR (1.5) (bifenthrin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 0.2-0.39 fl. oz. per 1,000 linear ft. of row. Do not exceed 8.5 fl. oz. per acre per season. REI: 12-hour. IRAC 3A. RUP.

Cucurbit Crops - Weeds

Reviewed by Stephen Meyers, Ben Phillips – Nov 2020

Recommended Controls

All Weeds

Weed control methods in cucurbits vary by production system. The challenges for those who rely on herbicides include the chance of injuring crops under adverse weather, the relatively short residual of preemergence herbicides, and the lack of a broad-spectrum postemergence broadleaf herbicide that can be applied over the top of the crop.

For cucurbits that are no-till direct-seeded into a killed crop (such as pumpkins after soybeans, rye cover crop, or wheat) growers often use a burndown herbicide with a preemergence herbicide. If residue and cucurbit vines are not sufficient to suppress later-emerging weeds, growers may use postemergence herbicides, or shielded applications of nonselective herbicides.

For cucurbits direct-seeded into tilled soil, growers often combine one or more preemergence herbicides at planting with one or more cultivations. Sometimes, growers also apply a preemergence herbicide at the last cultivation to improve control of late-emerging weeds. If needed, growers may use postemergence herbicides or shielded applications of nonselective herbicides.

When cucurbits are transplanted into plastic mulch, some growers apply a preemergence herbicide under the mulch as well as between the rows. Other growers only apply between the rows. Growers may also use one or more cultivations, and if needed, postemergence herbicides or a shielded application of a nonselective herbicide.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Weed pressure may be substantially reduced when growers prepare seedbeds several weeks in advance of planting and kill the first one or two flushes of weeds before planting without stirring up new weed seeds. Cucurbits lend themselves to this stale seedbed practice because they are often planted after common weeds have emerged in tilled soil. The more quickly cucurbit vines cover the soil surface, the better they will suppress late-emerging weeds. Closer row spacing promotes rapid vine cover, and growers can increase in-row spacing to maintain a constant plant population. Uniform plant spacing in the row will also promote uniform vine cover. Seeding equipment that allows large gaps in direct-seeded crops usually leads to weed patches where the crop population is lower. Planting on the square will allow cultivation in two directions. These crops can also benefit from the soil warming properties of plastic mulch in addition to the in-row weed control. Mulches provide good weed control when planted into. Materials include landscape cloth, plastic, biodegradable plastic. Weeds between beds and along the edges of beds can be controlled with a combination of cultivation, mowing, or hand hoeing/pulling. Weeds along the edge of the mulches can be a particular challenge to avoid ripping the mulch. Some fresh market plantings are often small enough to accommodate some hand hoeing or pulling. For larger plantings it may make more sense to mechanically cultivate with tow-able tools between plastic rows or between bare-soil rows.

Broadleaf and Grass Weeds - Postemergence

Pesticide

glyphosate products (glyphosate) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations containing 3 lbs. ae per gal. (4 lbs. isopropylamine salt per gal.) at 1-5 qts. per acre, or formulations containing 4.5 lbs. ae per gal. (5 lbs. potassium salt per gal) at 0.66-3.3 qts. per acre. Broadcast 3 days before transplanting, or apply between crop rows with hooded or shielded sprayers. Use low rate for annuals and higher rates for perennials. See label for suggested application volume and adjuvants. Remove herbicide residue from plastic mulch prior to transplanting. REI: 4 to 12-hour. PHI: 14-day, WSSA 9.

paraquat products (paraquat) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 2-4 pts. per acre of 2 lb. per gal. formulation or 1.3-2.7 pt. per acre of 3 lb. per gal. formulation. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS (0.25% v/v) per 25 gal. of solution and apply to emerged weeds less than 6" tall prior to transplanting or after direct-seeding but before crop emergence. Certified applicators must successfully complete an EPA-approved training program before mixing, loading, and/or applying paraquat. REI: 12 to 24-hour. WSSA 22. RUP.
Broadleaf and Grass Weeds - Preemergence

Pesticide

Chateau SW (51WDG) (flumioxazin) Cantaloupe/Muskmelon, Watermelon | For cantaloupe, honeydew, and watermelon in Indiana only (IN 24c accessed through Indiana Vegetable Growers Association): use a shielded or hooded sprayer to apply before transplanting to row middles between plastic mulch-covered raised beds. Bed must be at least 4 inches higher than treated area and at least 24 inches wide. Spray must remain between raised beds and contact no more than the bottom 1 inch of plastic. Do not apply after crops are transplanted. Rainfall or irrigation over beds is required after application but before transplanting. REI: 12-hour. WSSA 14.

Command 3ME (clomazone) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | For cucumber: use 0.4-1.0 pt. per acre. For cantaloupe/muskmelon and watermelon: use 0.4-0.67 pt. per acre. For summer squash: use 0.67-1.33 pts. per acre. For winter squash and processing pumpkins: use 0.67-2.0 pts. per acre. Not for jack-o-lantern pumpkins. See label for sensitive varieties. Apply prior to seeding or transplanting, or after seeding before crop emergence. Does not control pigweed species. Rates below 1 pt. will only suppress weeds. May cause temporary bleaching of crop leaves. REI: 12-hour. PHI: 30-day for cucumber, 30-day for summer squash; 45-day for winter squash and processing pumpkins. WSSA 13.

Curbit EC (3) (ethalfluralin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 3-4 pts. per acre. Use lower rates on coarse soils. Direct-seeded crops: apply to soil surface within 2 days after seeding. Do not incorporate. Transplants: apply as a banded spray between rows. Does not control large-seeded broadleaves. Needs 0.5 inch of water within 5 days of application to be effective. If no rain occurs, cultivate shallowly. Do not apply over or under hot caps, row covers, or plastic mulch. Do not broadcast over top of plants. Under cool temperatures may cause crop injury or failure. REI: 24-hour. WSSA 3.

Daithal W-75 (DCPA) Cantaloupe/Muskmelon, Watermelon | Daithal W-75 at 6-14 lbs. per acre, or Daithal Flowable at 6-14 pts. per acre. Apply when plants have 4-5 true leaves and growing conditions favor good plant growth. Crop injury may occur if applied under unfavorable growing conditions or earlier than recommended. REI: 12-hour. WSSA 3.

Dual Magnum (7.62EC) (s-metolachlor) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Illinois, Indiana, Michigan, Minnesota, and Ohio only. IL 24c exp. 03/25/24. MI 24c exp. 12/31/21. MN 24c exp. 12/31/20. OH 24c exp. 12/31/22. For cantaloupes/muskmelon and watermelon: use 0.67-1.27 pts. per acre before transplanting or after seeding and before crop emergence. For cucumbers: use 0.67-1.0 pt. per acre after seeding before weeds or crop emerge, or broadcast after cucumbers have 1-2 true leaves. For pumpkins and winter squash: use 1.0-1.33 pts. per acre between rows after seeding and before emergence, or after emergence leaving an untreated area at least 6 inches from planted seed or pumpkin leaves. Broadcast application over top of pumpkin rows after seeding and before crop emergence permitted in all states listed above except Ohio. For summer squash in all states listed above except Ohio: use 0.67-1.33 pts. per acre as a broadcast application over top or between crop rows after seeding and before crop emergence. If growing on plastic mulch, broadcast before laying plastic. In all crops, there is less risk of crop injury if applied between rows and with transplants. Will not control emerged weeds. Do not exceed 1 application per crop per season. REI: 24-hour. PHI: 30-day for cucumbers, squash, and pumpkins; 60-day for cantaloupe/muskmelon, and watermelon. WSSA 15.

pendimethalin products (pendimethalin) Cantaloupe/Muskmelon, Watermelon | 2.1 pts. per acre. Apply 3.8 formulations to row middles using a shielded sprayer with 6 inches on either side of the row middles. Apply before transplanting or before emergence of direct-seeded crop. A second application may be made before vines run. Wait at least 21 days between applications. Do not exceed 2.1 pts. per acre application or 4.2 pts. per acre per season. REI: 24-hour. PHI: 35-day. WSSA 3.

Sinbar WDG (80) (terbacil) Watermelon | 2-4 oz. per acre. Apply pre-transplanting to bare ground or under plastic mulch, or to row middles. For direct-seeded crops on bare ground, apply after planting but before crop emergence. Do not allow spray to contact crop. Do not plant other crops within 2 years of application. Do not use on sand or gravel soils. Not recommended on soils with less than 1% organic matter due to crop injury potential. REI: 12-hour. PHI: 70-day. WSSA 5.

Strategy (ethylfluralin, clomazone) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 2-6 pts. per acre. Direct-seeded: apply to soil surface within 2 days after seeding. Do not incorporate. Transplanted: apply as a banded spray between rows. Does not control large-seeded broadleaves. Needs 0.5 inch of water within 5 days of application to be effective. If no rain occurs, cultivate shallowly. Do not apply over or under hot caps, row covers, or plastic mulch. Do not broadcast over top of plants. Under cool temperatures may cause crop injury or failure. REI: 24-hour. PHI: 45-day. WSSA 3, WSSA 5.

trifluralin products (trifluralin) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 0.5-1 lb. a.i. per acre. Use 10G formulations at 5-10 lbs. per acre and do not exceed 20 lbs. per acre per season on fine soils. Use 4EC formulations at 1-2 pts. per acre and do not exceed 4 pts. per acre per season on fine soils. Apply as a directed spray between rows after plants have 3-4 leaves and incorporate 1-2 inches. Use higher rates on heavier soils. 4-6 weeks of residual activity. Not effective on muck or high organic matter soils. REI: 12-hour. PHI: 30-day for cantaloupe, cucumber, pumpkin, and squash, 60-day for watermelon. WSSA 3.
Broadleaf Weeds Only - Postemergence

Pesticide

Aim EC (2) (carfentrazone) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 0.5-2 fl. oz. per acre. Apply a minimum of 1 day prior to transplanting or 7 days prior to direct-seeding, or apply between crop rows with hooded sprayer. Do not allow spray to contact crop. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gal. of spray solution (0.25% v/v). Weeds must be actively growing and less than 4 inches tall. Do not exceed 6.1 fl. oz. per acre per season. REI: 12-hour. PHI: 14-day. WSSA 2.

Sandea (75) (halosulfuron) Cantaloupe/Muskmelon, Watermelon | 4.0-6.4 oz. per acre. Use the higher rate in fields with a known history of yellow nutsedge. Apply between rows after plants are well-established and at least 5 inches wide. Avoid contact with crop and plastic mulch (if present). If emerged weeds are present include a manufacturer-recommended surfactant to control yellow nutsedge and labeled broadleaf weeds that are 1-3 inches tall. Do not exceed 1 application and 6.4 oz. per acre per year. REI: 12-hour. PHI: 48-day. WSSA 2.

Sandea (75) (halosulfuron) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | For cantaloupe/muskmelon, cucumber, pumpkin: apply 0.5-0.75 oz. per acre to the soil surface after direct-seeding but prior to cracking or apply at least 7 days before transplanting. Or apply 0.5-1.0 oz. per acre either over the top or a directed/hooded spray after the crop has been transplanted for a minimum of 14 days and reached the 2-5 true leaf stage, but before the first female flowers appear. Avoid contact with the top surface of plastic mulch if present. For watermelon in Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio: used as directed for cantaloupes/muskmelon but can also be applied under plastic mulch before laying. For processing summer squash in Missouri: used as directed for pumpkin, but up to 1 oz. per acre can be used after direct-seeding and before emergence. If weeds are present, add 0.5 pt. NIS per 25 gal. of solution (0.25% v/v). Not recommended for use under cool temperatures due to potential for crop injury. May delay crop maturity. Do not exceed 2 applications or 2 oz. per acre per 12-month period. REI: 12-hour. PHI: 30-day for cucumbers, pumpkins, and squash; 57-day for cantaloupes/muskmelons, and watermelons. WSSA 2.

Grass Weeds Only - Postemergence

Pesticide

clethodim products (clethodim) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Use 2EC formulations at 6-8 fl. oz. per acre with 1 qt. COC per 25 gals. of spray solution (1% v/v). Do not exceed 32 fl. oz. per acre per season. Use Select Max at 9-16 fl. oz. per acre with 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gals. of spray solution (0.25% v/v). Do not exceed 64 fl. oz. per acre per season. Use lower rates for annual grasses, the high rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. REI: 24-hour. PHI: 14-day. WSSA 1.

Poast (1.5EC) (sethoxydim) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 1-1.5 pts. per acre. Add 1 qt. COC per 25 gal. of spray solution (1% v/v). Spray on
actively growing grass. Do not exceed 3 pts. per acre per growing season. REI: 12-hour. PHI: 14-day for squash, pumpkin, and watermelon; 3-day for cantaloupe and cucumber. WSSA 1.

Prefar 4E (bensulide) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 5-6 qts. per acre. Use low rate on soils with less than 1% organic matter. Apply before planting and incorporate 1-2 in. or apply after seeding before crop emerges and irrigate within 24 hours. REI: 12-hour. WSSA 8.

Fruiting Vegetables - Horticulture

Reviewed by Ben Phillips, Liz Maynard – Oct 2020

Crop Description

Eggplants (Solanum melongena): In the midwest the primary eggplant varieties grown are tear-drop shaped and deep purple. There are many other types of eggplant and these should be considered when there is demand for them in your markets. Traditionally many types have been associated with specific cultures or cuisines. There are longer and thinner types that look more like summer squashes, and smaller and rounder types that are shaped more like beefsteak and cherry tomatoes. They come in a variety of colors from white, green, pink, purple, brown, and striped. There are also ornamental eggplants that make bright orange and red fruits shaped like miniature pumpkins, which can be dried.

Peppers (Capsicum annuum, C. chinense, C. baccatum, C. frutescens, and C. pubescens): Similar to eggplants, there are pepper types that are closely tied with specific cultures. The most common species grown for midwestern markets is C. annuum, which includes sweet green and colored bell peppers, as well as other sweet and hot peppers including banana, Hungarian wax, Italian, jalapeño, serrano, and poblano. These are grown for both fresh market and processing. The four other cultivated species include much hotter peppers that rate above 50,000 on the Scoville scale that is used to measure pepper pungency. These can be a strong niche market, but a little goes a long way, and these smaller-fruited types produce large numbers of fruit per plant. Clearly labeling varieties from seeding to sale is important to prevent look-alike sweet and hot peppers from being confused.

Tomatoes (Solanum lycopersicum): There are many types of tomatoes that differ in their fruit shape, size, color, and plant growth habits. Larger beefsteak tomatoes are juicy. Roma and plum types contain less juice and are better for canning and processing. Stuffing tomatoes are large like a beefsteak but without as much flesh or juice inside, leaving a hollow cavity like a pepper. Grape and cherry types tend to be sweeter. Determinate and semi-determinate plants grow 3 to 4 feet tall when trellised. Indeterminate plants continue to grow in height for the entire season and are almost always trellised or otherwise supported.

Planting and Spacing

Fresh market eggplant, peppers, and tomatoes are often grown on raised beds covered with plastic mulch to promote earliness. Drip irrigation beneath the mulch provides a uniform water supply and can deliver fertilizer during the growing season. Typical beds are 30 inches across, 4 to 6 inches high, and centered 5 to 6 feet apart. Bare ground production uses row spacings of 2-1/2 to 5 feet.

Eggplant for fresh market: Space plants 1-1/2 to 2-1/2 feet apart in the row on beds, or 1-1/2 to 3 feet apart in bare ground rows. Eggplant may benefit from staking and support from a trellis-weave system if plants tend to break, lean, or lodge. Eggplants require full sun and well-drained soil. Eggplants grow best with warm soil, and hot weather.

Peppers for fresh market: Space plants 1 to 1-1/2 feet apart in a single or double row on beds, or 1 to 1-1/2 feet apart in bare ground rows. Peppers may benefit from staking and support from a trellis-weave system if plants tend to break, lean, or lodge. If peppers are in a double row on a bed, a row of short stakes strung with twine along the outside of each row will support the plants.

Peppers for processing: Hand harvest is common for processing peppers, and similar spacings are used as for fresh market production. For machine harvested crops, select row spacing and bed formation that will work with available harvesting equipment.

Tomatoes for fresh market: Space plants 1-1/2 to 2-1/2 feet apart in the row on beds, or 1-1/2 to 3 feet apart in bare ground rows. Tomatoes may be left to grow over the ground or may be supported by cages, stakes, strings, or a trellis-weave system. Supported tomatoes produce higher quality fruit than unsupported plants and marketable yield is usually much greater. Tomatoes supported by stakes or trellises are sometimes pruned, which involves removing several or all of the branches up to the branch just below the first flower cluster when the branches are a few inches long. For tomatoes supported by a vertical string, only one or two stems are allowed to grow and so pruning continues throughout the season to remove branches that develop above the first flower cluster. Pruned plants produce larger fruit than unpruned plants, but the quantity of fruit is reduced.

Tomatoes for machine harvest and processing: Select row spacing and bed formation that will work with available harvesting equipment. Double rows 16 to 20 inches apart on 5 to 6 feet centers are common, with plants 1 to 2 feet apart in the row.

Fertilizing

pH: Maintain a soil pH of 6.0 to 6.8.

Eggplant, Peppers, and Tomatoes for Fresh Market: Before planting, apply 30 pounds N per acre, 0 to 240 pounds P2O5 per acre, and 0 to 300 pounds K2O per acre based on soil test results and recommendations from your state. At transplanting, a starter solution at a rate of 1 cup (8 ounces) per plant is recommended.
Fruiting Vegetables - Horticulture

If the transplant flat receives a heavy fertilizer feeding just prior to setting, the starter solution can be eliminated.

Sidedress with 30 to 40 pounds N per acre three to four weeks after transplanting, and then again six to eight weeks after transplanting. Sidedressing may be replaced by supplying N through a drip irrigation system at about 1 pound N per acre per day. Reduce the amount of fertilizer N applied by the value of N credits from green manures, legume crops grown in the previous year, compost and animal manures, and soils with more than 3 percent organic matter. The total amount of N from fertilizer (including starter) and other credits should be 100 to 120 pounds per acre.

K2O may also be supplied through drip irrigation at a rate of 1 to 1-1/2 pounds per acre per day for peppers and eggplant, and 1-1/2 to 2-1/2 pounds per acre per day for tomatoes. Reduce the amount of K2O applied before planting by the amount that will be supplied through drip irrigation.

Tomatoes for Processing: Before planting, apply 40 pounds N per acre, 0 to 240 pounds P2O5 per acre, and 0 to 300 pounds K2O per acre based on soil test results and recommendations from your state. At transplanting, apply a starter solution containing N and P.

Sidedress with 40 to 50 pounds N per acre four to five weeks after transplanting or after first fruit set. Reduce the amount of fertilizer N applied by the amount of N credits from green manures, legume crops grown in the previous year, compost and animal manures, and soils with more than 3 percent organic matter. The total amount of N from fertilizer (including starter) and other credits should be 80 to 100 pounds per acre.

Environmental Factors

There are several tomato problems related to environmental and nutrient factors that are not infectious diseases caused by pathogens.

Blossom End Rot: Tomatoes and peppers are susceptible to calcium deficiency even when adequate calcium levels are present in the soil. Deficiency results in a disorder called “blossom end rot.” It often occurs under conditions of inadequate or excessive watering and/or excessive N fertilization with an ammonium source. Where the soil pH has been adjusted to 6.0 or higher, additional soil-applied calcium does not correct the disorder. To limit this problem, choose less susceptible varieties, avoid drastic moisture fluctuations with irrigation monitoring and mulches, and Maintain soil pH and calcium levels in desired range.

Catfacing: Flower buds that have been exposed to cold temperatures very early in development have shown a higher proportion of catfaced fruit. Large-fruited varieties tend to be more susceptible to this disorder. In some heirloom varieties, nearly all fruit is catfaced so it does not detract from the fruit’s marketability. Variety selection is the most practical way to limit this problem. Exposure to some herbicides (2, 4-D or dicamba) can lead to similar fruit deformation.

Cracks, radial and concentric: Rapidly growing fruit and fruit exposed to the sun tend to crack more readily. Cracking is more severe under hot, dry conditions followed by rainfall. To defend against growth cracks, select crack-resistant cultivars, maintain healthy foliage, and carefully manage water availability through irrigation management and the use of plastic mulch.

Micro-cracks or rain checks: Very small cracks in the epidermis (called micro-cracks or rain checks) sometimes develop on fruit shoulders under highly humid conditions. Rain check is often more severe on fruit that has been exposed due to poor leaf cover. To minimize the problem, maintain healthy foliage and select varieties with good foliage cover.

Sunscaald: Fruit exposed to the sun may overheat and develop sunscald. The affected area turns white and does not ripen. The tissue may shrivel and sink in. It is most common when foliage does not shade fruit exposed to hot afternoon sun. Damage is usually confined to the area of the fruit with greatest exposure to the sun. Tomato variety, mineral nutrition, staking and pruning methods, and disease pressure can all influence the amount of foliage cover. This disorder also is observed on peppers and fruit of other vegetable crops.

Zipper scars: These may be caused when the blossom sticks to the developing fruit. Zipper scars are especially common during cool weather. To avoid this problem, select resistant varieties and maintain proper greenhouse temperatures.

Harvesting

Eggplant for fresh market: Harvests can take place every few days once fruits ripen to a glossy finish. Fruit sizes depend on variety. When the skin sheen gets dull and seeds turn brown, they are past their prime. Fruit quality diminishes late in the season. Fruit should be handled carefully to avoid bruising. Time from transplanting to harvest ranges from 80 to 100 days.

Peppers for fresh market and processing: Harvests can take place every few days once fruit reaches marketable size or color. Careful selection of early-ripening varieties and passing up green harvests will maximize the yield of colored fruits in our northern climate. Fruit quality diminishes late in the season. Time from transplanting to harvest ranges from 70 to 100 days.

Tomatoes for fresh market: Harvests can take place every few days once fruits start to ripen. Small-fruited varieties such as ‘cocktail’, grape, or cherry tomatoes can be harvested ‘on the vine’ by cutting clusters of fruit. To avoid unnecessary extra handling, place these clusters directly into sales containers. Time from transplanting to harvest ranges from 70 to 90 days.

Tomatoes for machine harvest and processing: Ethephon applications accelerate and concentrate fruit ripening, thus facilitating once-over machine harvesting of processing tomatoes. Apply 3.25 pts. Ethrel or Cepha in 5 to 70 gallons of water per acre as a spray over the entire plant when 10 to 30 percent of fruits are ripe. Harvest 15 to 21 days after treatment for optimum ripe fruit accumulation. Time from transplanting to harvest ranges from 90 to 110 days.
Fruiting Vegetables - Diseases

Reviewed by Dan Egel, Mohammad Babadoost – Nov 2020

Recommended Controls

**Anthracnose of Fruiting Vegetables - Colletotrichum Fungus**

Symptoms usually occur on ripe or over-ripe fruit. Begin fungicide applications at or shortly before fruit set.

**Non-Pesticide**

*Eggplant, Pepper, Tomato* | Use disease-free seed and transplants. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122 F for 25 minutes for eggplants and tomato, and 125 for 30 minutes for pepper. Rotate to non-Solanaceous crops for 3-4 years. Use raised beds, staking, and mulch to improve drainage, air flow, and reduce splashing. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up. Anaerobic soil disinfestation (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain this pathogen.

**Pesticide**

*Aprovia Top (difenoconazole, benzovindiflupyr)* *Eggplant, Pepper, Tomato* | 10.5-13.5 fl. oz. per acre. Use of a spreader sticker is recommended. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 7.

*azoxystrobin products (azoxystrobin)* *Eggplant, Pepper* | Use 2 lb. a.i. per gallon formulations (Quadris) at 5.0-6.2 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

*azoxystrobin products (azoxystrobin)* *Tomato* | Use 2 lb. a.i. per gallon formulations (Quadris) at 5.0-6.2 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.1-3.9 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

*Cabrio EG (20) (pyraclostrobin)* *Eggplant, Pepper, Tomato* | 8-12 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 11.

*chlorothalonil products (chlorothalonil)* *Eggplant, Pepper, Tomato* | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC M5.

*Fontelis (1.67SC) (penthiopyrad)* *Eggplant, Pepper, Tomato* | 24 fl. oz. per acre. Suppression only for anthracnose. In the greenhouse use a rate of 0.75 fl. oz. per gallon per 1,360 sq. ft. REI: 12-hour. PHI: 0-day. FRAC 7.

*Inspire Super (EW) (difenoconazole, cyprodinil)* *Eggplant, Pepper, Tomato* | 16-20 fl. oz. per acre. Do not apply to small fruited varieties such as cherry tomato. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 9.

*Luna Sensation (fluopyram, trifloxystrobin)* *Eggplant, Pepper, Tomato* | 7.6 fl. oz. per acre. Suppression only for anthracnose and white mold. REI: 12-hour. PHI: 3-day. FRAC 7, FRAC 11.

*mancozeb products (mancozeb)* *Pepper* | Several formulations of mancozeb (Dithane, Manzate, Pennczeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M3.

*mancozeb products (mancozeb)* *Tomato* | Several formulations of mancozeb (Dithane, Manzate, Pennczeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M3.

*Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil)* *Eggplant, Pepper, Tomato* | 1.75-2.5 pt. per acre. REI: 12-hour. PHI: 3-day. FRAC 49, FRAC M5.

*Priaxor (fluxapyroxad, pyraclostrobin)* *Eggplant, Pepper, Tomato* | 4-8 fl. oz. per acre. Suppression only for Botrytis gray mold and white mold. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

*Quadris Opti (SC) (azoxystrobin, chlorothalonil)* *Pepper, Tomato* | 1.6 pts. per acre. REI: 12-hour. PHI: 0-day. FRAC 11, FRAC M5.

*Quadris Top (SC) (azoxystrobin, difenoconazole)* *Eggplant, Pepper, Tomato* | 8 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 3.

*Quadris Top (SC) (azoxystrobin, difenoconazole)* *Tomato* | 8 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 3.

*Revus Top (SC) (mandipropamid, difenoconazole)* *Eggplant, Pepper, Tomato* | 5.5-7.0 fl. oz. per acre. Do not use on small-fruited varieties. REI: 12-hour. PHI: 1-day. FRAC 40, FRAC 3.

*Serenade Opti (26.2WP) (Bacillus subtilis strain QST-713)* *Eggplant, Pepper, Tomato* | Use Serenade Opti at 14-20 fl. oz. per plant or Serenade ASO at 2-4 qts. per acre. May help bacterial spot management when copper-resistant strains are present. REI: 4-hour. PHI: 0-day. FRAC 44. OMRI-listed.

*Tanos (DF) (famoxadone, cymoxanil)* *Eggplant, Pepper, Tomato* | 8 oz. per acre. Early blight rate 6-8 oz. per acre. Disease suppression for bacterial diseases. REI: 12-hour. PHI: 3-day. FRAC 11, FRAC 27.
Fruiting Vegetables - Diseases

**Bacterial Canker of Fruiting Vegetables - Clavibacter Bacteria**

The bacterium becomes systemic in the plant, causing wilt and leaf/fruit/stem lesions. It can occur on tomato and pepper, but is mainly a problem on tomato.

Sanitize machinery, seedlings, and plant production materials (transplant trays, greenhouse benches, and wooden stakes) with a disinfectant such as 10% chlorine bleach or a quaternary ammonium compound solution.

Inspect seedlings for disease and apply one or two fixed copper product applications before planting. Tank-mix copper products with mancozeb.

**Non-Pesticide**

**Pepper, Tomato** | Use disease-free seed and transplants. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122 F for 25 minutes for eggplants and tomato, and 125 for 30 minutes for pepper. Practice good greenhouse sanitation of equipment, tools propagation trays/pots, and surfaces. Avoid fields with a history of the disease and rotate to non-Solanaceous crops for 2-3 years. Stake and mulch the crops to improve air flow and reduce splashing. Avoid working in wet fields. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

**Tanos (DF) (famoxadone, cymoxanil)** Eggplant, Pepper, Tomato | 8 oz. per acre. Early blight rate 6-8 oz. per acre. Disease suppression for bacterial diseases. REI: 12-hour. PHI: 3-day. FRAC 11, FRAC 27.

**Bacterial Speck of Fruiting Vegetables - Pseudomonas Bacteria**

Lesions of this disease can be found on leaves, stems, and fruit of peppers and tomatoes. But, it is rarely a problem for eggplants.

Sanitize machinery, seedlings, and plant production materials (transplant trays, greenhouse benches, and wooden stakes) with a disinfectant such as 10% chlorine bleach or a quaternary ammonium compound solution.

While still in the greenhouse, scout and apply fixed copper alternated with streptomycin (Agri-mycin, Firewall, Streptrol). Once in the field, apply fixed copper product tank-mixed with mancozeb on 7-10 day schedule, depending on disease pressure, beginning within 1 week after transplanting. Airblast sprayers with high fan speed can make an outbreak worse by sandblasting plants with droplets and opening many small wounds that become infected.

**Copper Resistance**: Strains of the bacterium that cause bacterial spot on tomato that are resistant to copper products are common in the Midwest. Actigard, streptomycin products, mancozeb products, Tanos, and Serenade Max used as labeled may help manage copper-resistant strains.

**Non-Pesticide**

**Eggplant, Pepper, Tomato** | Use disease-free seed and transplants. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122 F for 25 minutes for eggplants and tomato, and 125 for 30 minutes for pepper. Practice good greenhouse sanitation of equipment, tools propagation trays/pots, and surfaces. Avoid fields with a history of the disease and rotate to non-Solanaceous crops for 2-3 years. Stake and mulch the crops to improve air flow and reduce splashing. Avoid working in wet fields. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

**copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide)** Eggplant, Pepper, Tomato | Several formulations of copper (Badge, Champ, Kocide) are labelled for use. See label for directions. Copper-resistant strains of the bacterial spot pathogen are common in the Midwest. Mancozeb products (e.g., Dithane, Manzate, Penncozeb) when tank-mixed with copper products, allow more copper to become available on the leaf surface and so may help manage copper-resistant bacterial strains. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

**Regalia (5) (Reynoutria sachalinensis)** Eggplant, Pepper, Tomato | 1-4 qts. per acre. Use in a program with copper products. REI: 4-hour. PHI: 0-day. FRAC P5. OMRI-listed.

**Serenade Opti (26.2WP) (Bacillus subtilis strain QST-713)** Eggplant, Pepper, Tomato | Use Serenade Opti at 14-20 fl. oz. per acre, or Serenade ASO at 2-4 qts. per acre. May help bacterial spot management when copper-resistant strains are present. REI: 4-hour. PHI: 0-day. FRAC 44. OMRI-listed.

**streptomycin products (Streptomycin sulfate)** Pepper, Tomato | Use 17% products at 16 oz. per 100 gals of water, or 50% products at 5.3 oz. per 100 gals of water to maintain a concentration of 200 ppm. Apply one or two times to seedlings, alternated with a fixed copper product compound beginning at the two-leaf stage. Not labeled for use after transplanting (greenhouse only). REI: 12-hour. FRAC 25.

**Tanos (DF) (famoxadone, cymoxanil)** Eggplant, Pepper, Tomato | 8 oz. per acre. Early blight rate 6-8 oz. per acre. Disease suppression for bacterial diseases. REI: 12-hour. PHI: 3-day. FRAC 11, FRAC 27.

**Bacterial Spot of Fruiting Vegetables - Xanthomonas Bacteria**

Lesions of this disease can be found on leaves, stems, and fruit of eggplants, peppers and tomatoes. But, it is rarely a problem for eggplants.
Sanitize machinery, seedlings, and plant production materials (transplant trays, greenhouse benches, and wooden stakes) with a disinfectant such as 10% chlorine bleach or a quaternary ammonium compound solution.

While still in the greenhouse, scout and apply fixed copper alternated with streptomycin (Agri-mycin, Firewall, Streptrol). Once in the field, apply fixed copper product tank-mixed with mancozeb on 7-10 day schedule, depending on disease pressure, beginning within 1 week after transplanting. Airblast sprayers with high fan speed can make an outbreak worse by sandblasting plants with droplets and opening many small wounds that become infected.

Copper Resistance: Strains of the bacterium that cause bacterial spot on tomato that are resistant to copper products are common in the Midwest. Actigard, streptomycin products, mancozeb products, Tanos, and Serenade Max used as labeled may help manage copper-resistant strains.

Non-Pesticide

Eggplant, Pepper, Tomato | Use disease-free seed and transplants. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122 F for 25 minutes for eggplants and tomato, and 125 for 30 minutes for pepper. Practice good greenhouse sanitation of equipment, tools propagation trays/pots, and surfaces. Avoid fields with a history of the disease and rotate to non-Solanaceous crops for 2-3 years. Stake and mulch the crops to improve air flow and reduce splashing. Avoid working in wet fields. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Actigard (0.5WDG) (acibenzolar-s-methyl) Pepper, Tomato | 0.3-0.75 oz. per acre. Begin season with lower rates and increase as plant canopy increases. Do not exceed 6 oz. per season. REI: 12-hour. PHI: 14-day. FRAC P1.

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diaminonium diacetate complex, cuprous oxide) Pepper, Tomato | Several formulations of copper (Badge, Champ, Kocide) are labelled for use. See label for directions. Copper-resistant strains of the bacterial spot pathogen are common in the Midwest. Mancozeb products (e.g., Dithane, Manzate, Pencozeb) when tank-mixed with copper products, allow more copper to become available on the leaf surface and so may help manage copper-resistant bacterial strains. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

Regalia (5) (Reynoutria sachalinensis) Eggplant, Pepper, Tomato | 1-4 qts. per acre. Use in a program with copper products. REI: 4-hour. PHI: 0-day. FRAC P5. OMRI-listed.

Serenade Opti (26.2WP) (Bacillus subtilis strain QST-713) Eggplant, Pepper, Tomato | Use Serenade Opti at 14-20 fl. oz. per acre, or Serenade ASO at 2-4 qts. per acre. May help bacterial spot management when copper-resistant strains are present. REI: 4-hour. PHI: 0-day. FRAC 44. OMRI-listed.

streptomycin products (Streptomycin sulfate) Pepper, Tomato | Use 17% products at 16 oz. per 100 gals of water, or 50% products at 5.3 oz. per 100 gals. of water to maintain a concentration of 200 ppm. Apply one or two times to seedlings, alternated with a fixed copper product compound beginning at the two-leaf stage. Not labeled for use after transplanting (greenhouse only). REI: 12-hour. FRAC 25.

Tanos (DF) (famoxadone, cymoxanil) Eggplant, Pepper, Tomato | 8 oz. per acre. Early blight rate 6-8 oz. per acre. Disease suppression for bacterial diseases. REI: 12-hour. PHI: 3-day. FRAC 11, FRAC 27.

Buckeye Rot of Tomatoes - Phytophthora Oomycete

These diseases are favored by heavy rains and waterlogged soils. Symptoms include discolored fruit and declining plants. Consider fungicide drench. Regular fungicide schedule may lessen impact of buckeye rot.

Non-Pesticide

Tomato | Rotate to non-Cucurbit, non-Legume, and non-Solanaceous crops for 3 years. Use raised beds, staking, and mulch to improve drainage, air flow, and reduce splashing. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up. Anaerobic soil disinfection (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain this pathogen.

Pesticide

azoxystrobin products (azoxystrobin) Tomato | Use 2 lb. a.i. per gallon formulations (Quadris) at 5.0-6.2 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.1-3.9 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diaminonium diacetate complex, cuprous oxide) Tomato | Several formulations of copper (Badge, Champ, Kocide) are labelled for use and may improve efficacy of fungicides against Phytophthora blight when tank mixed at labeled rates. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

Gavel 75DF (zoxamide, mancozeb) Tomato | 1.5-2 lbs. per acre. REI: 48-hour. PHI: 5-day. FRAC 22, FRAC M3.

Orondis Opti Premix (SC) (oxathiapiproplin, chlorothalonil) Tomato | 1.75-2.5 pt. per acre. REI: 12-hour. PHI: 3-day. FRAC 49, FRAC M5.

Orondis Ultra Premix (SC) (oxathiapiproplin, mandipropamid) Tomato | 5.5-8.0 fl. oz. per acre. Alternate with fungicides that have a different mode of action. Use either soil applications or foliar applications of oxathiapiproplin.
Fruiting Vegetables - Diseases

products, but not both. REI: 4-hour. PHI: 1-day. FRAC 49, FRAC 40.

Quadrис Opti (SC) (azoxystrobin, chlorothalonil) Tomato | 1.6 pts. per acre. REI: 12-hour. PHI: 0-day. FRAC 11, FRAC M5.

Ridomil Gold Copper (WSB) (mefenoxam, copper hydroxide) Tomato | For processing tomatoes: apply 1 pack per 3.7 acres plus 0.8 lb. a.i. per acre of mancozeb. For fresh market tomatoes: apply 1 pack per 2.5 acres plus 0.8 lb. a.i. per acre of mancozeb. REI: 48-hour. PHI: 14-day. FRAC 4, FRAC M1.

Tanозs (DF) (famoxadone, cymoxanil) Tomato | 8 oz. per acre. For late blight, tank-mix with a contact fungicide with a different mode of action. Disease suppression for Buckeye rot. REI: 12-hour. FRAC 11, FRAC 27.

Damping-Off Seed and Seeding Rots of Multiple Crops - Multiple Pathogens

Non-Pesticide

Eggplant, Pepper, Tomato | Practice good greenhouse sanitation of equipment, tools propagation trays/pots, and surfaces. Avoid excess moisture to the transplants in the greenhouse by monitoring irrigation frequency. Plant in warm field soils. The fungi responsible for damping-off in field soils cause more loss when the seeding is slow to emerge.

Early Blight of Fruiting Vegetables - Alternaria Fungus

This pathogen can infect peppers and tomatoes, but is mainly a problem in tomatoes. This disease initially causes lesions on lower leaves of the tomato plant. After field planting, begin protective fungicide applications on a 7-14 day schedule. May be seedborne.

Group 11 Resistance: Strains of the fungus that causes early blight that are resistant to group 11 fungicides have been observed in Indiana and Ohio. Group 11 products labeled for tomato and early blight include Cabrio and Quadris. Tank-mix group 11 fungicides with products that have a different mode of action, or alternate group 11 fungicides with fungicides that have a different group number.

Non-Pesticide

Eggplant, Pepper, Tomato | Use disease-free seed and transplants. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122 F for 25 minutes for tomato. Avoid fields with a history of Fusarium and Verticillium wilts. Rotate to non-Solanaceous crops for 3-4 years. Varieties with partial resistance are available, and varieties resistant to Fusarium and Verticillium wilt will hold up better against Alternaria. Use raised beds, staking, and mulch to improve drainage, air flow, and reduce splashing. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Aprovia Top (difenconazole, benzovindiflupyr) Eggplant, Pepper, Tomato | 10.5-13.5 fl. oz. per acre. Use of a spreader sticker is recommended. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 7.

azoxystrobin products (azoxystrobin) Eggplant, Pepper | Use 2 lb. a.i. per gallon formulations (Quadrис) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.1-3.9 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

chlorothalonil products (chlorothalonil) Eggplant, Pepper, Tomato | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC M5.

Endura (WG) (boscalid) Eggplant, Pepper, Tomato | 2.5-3.5 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7.

Fontelis (1.67SC) (penthiopyrad) Eggplant, Pepper, Tomato | 16-24 fl. oz. per acre. See label for greenhouse uses. REI: 12-hour. PHI: 0-day. FRAC 7.

Inspire Super (EW) (difenoconazole, cyprodinil) Eggplant, Pepper, Tomato | 16-20 fl. oz. per acre. Do not apply to small fruited varieties such as cherry tomato. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 9.

Luna Sensation (fluopyram, trifloxystrobin) Eggplant, Pepper, Tomato | 5-7.6 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 7, FRAC 11.


mancozeb products (mancozeb) Pepper | Several formulations of mancozeb (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M3.

mancozeb products (mancozeb) Tomato | Several formulations of mancozeb (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M3.
Fruiting Vegetables - Diseases

Miravis Prime (SC) (pydiflumetofen, fludioxonil) Pepper, Tomato | 9.2-11.4 fl. oz. per acre. Use high rate for gray mold, suppression only. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 12.

Prixor (fluxapyroxad, pyraclostrobin) Eggplant, Pepper, Tomato | 4-8 fl. oz. per acre. Suppression only for Botrytis gray mold and white mold. REI: 12-hour. PHI: 0-day. FRAC 7.

Quadris Opti (SC) (azoxystrobin, chlorothalonil) Pepper, Tomato | 1.3-1.6 pts. per acre. REI: 12-hour. PHI: 0-day. FRAC 11, FRAC M5.

Revs Top (SC) (mandipropamid, difenoconazole) Eggplant, Pepper, Tomato | 5.5-7.0 fl. oz. per acre. Do not use on small-fruited varieties. REI: 12-hour. PHI: 1-day. FRAC 40, FRAC 3.

Scala (SC) (pyrimethanil) Tomato | 7 fl. oz. per acre. Tank-mix with another fungicide. Allow greenhouse/hoophouse to ventilate for 2 hours. REI: 12-hour. PHI: 1-day. FRAC 9.

Switch 62.5WG (cyprodinil, fludioxonil) Eggplant, Pepper, Tomato | 11-14 oz. per acre. Do not apply to small fruited varieties in the greenhouse. REI: 12-hour. PHI: 0-day. FRAC 12.

Fusarium Wilt of Fruiting Vegetables - Fusarium Fungus

May be seedborne.

Non-Pesticide

Eggplant, Pepper, Tomato | Use disease-free seed and transplants. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122 F for 25 minutes for eggplants and tomato, and 125 for 30 minutes for pepper. Avoid fields with a history of the disease. Rotate to non-Solanaceous crops for >6 years. Varieties with resistance are available, and resistant rootstocks are available for grafting. Use raised beds, staking, and mulch to improve drainage, air flow, and reduce splashing. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up. Anaerobic soil disinfestation (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain this pathogen.

Gray Mold of Multiple Crops - Botrytis Fungus

This disease often occurs in greenhouse production with high humidity.

Non-Pesticide

Eggplant, Pepper, Tomato | Use raised beds and adequate plant spacing to improve drainage, air flow. Monitor humidity in the hoophouse and vent appropriately. Pruning the crop can help increase airflow as well. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Botran 75W (dichloro-nitroaniline) Pepper, Tomato | 1 lb. per 100 gals. of water. Labeled for stem phase of gray mold. Apply to stems up to a height of 24 inches. Young plants may be injured. REI: 12-hour. PHI: 0-day. FRAC 14.

Cabrio EG (20) (pyraclostrobin) Eggplant, Pepper, Tomato | 12-16 oz. per acre. Suppression only for Botrytis gray mold and white mold. REI: 12-hour. PHI: 0-day. FRAC 11.

chlorothalonil products (chlorothalonil) Eggplant, Pepper, Tomato | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC M5.

Endura (WG) (boscalid) Eggplant, Pepper, Tomato | 9-12.5 oz. per acre. Suppression only. REI: 12-hour. PHI: 0-day. FRAC 7.

Fontelis (1.67SC) (penthiopyrad) Eggplant, Pepper, Tomato | 16-24 fl. oz. per acre. See label for greenhouse uses. REI: 12-hour. PHI: 0-day. FRAC 7.

Inspire Super (EW) (difenzoconazole, cyprodinil) Eggplant, Pepper, Tomato | 16-20 fl. oz. per acre. Do not apply to small fruited varieties such as cherry tomato. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 9.

Luna Sensation (fluopyram, trifloxystrobin) Eggplant, Pepper, Tomato | 7.6 fl. oz. per acre. Suppression only for anthracnose and white mold. REI: 12-hour. PHI: 3-day. FRAC 7, FRAC 11.


Miravis Prime (SC) (pydiflumetofen, fludioxonil) Pepper, Tomato | 9.2-11.4 fl. oz. per acre. Use high rate for gray mold, suppression only. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 12.

Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil) Eggplant, Pepper, Tomato | 1.75-2.5 pt. per acre. REI: 12-hour. PHI: 3-day. FRAC 49, FRAC M5.

Pageant Intrinsic (boscalid, pyraclostrobin) Tomato | 23 oz. per acre. Labeled for greenhouse-/high tunnel-grown tomatoes. Do not apply on seedlings meant for transplanting in the field. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

Prixor (fluxapyroxad, pyraclostrobin) Eggplant, Pepper, Tomato | 4-8 fl. oz. per acre. Suppression only for Botrytis gray mold and white mold. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.
Late Blight of Potatoes/Tomatoes - Phytophthora Oomycete

This destructive pathogen causes quick plant death and can be identified by large spreading brown stem lesions, velvety white growth on plant surfaces, and large brown leathery spots on green fruits. It is favored by prolonged cold and damp conditions.

The pathogen overwinters on plant residue, including volunteer potatoes and potato cull piles. The first step to manage this disease is monitoring and destroying cull and volunteer potato emergence in the spring. When it is reported in your region, begin weekly preventive sprays with chlorothalonil and mancozeb for as long as favorable conditions persist. Pay attention to which pathogen strain is identified. If infections start in a field, the strain US-23 is sensitive to mefenoxam (Ridomil).

Non-Pesticide

*Tomato* | Avoid fields with a history the disease. Rotate to non-Solanaceous crops (including potatoes) for 3-4 years. Use raised beds, staking, and mulch to improve drainage, air flow, and reduce splashing. Prompt destruction of the infected crop or finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up. In small plantings, remove infected plants from the field and dispose in a sealed trash container, or burn. Anaerobic soil disinfection (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain this pathogen.

Pesticide

*chlorothalonil products (chlorothalonil)* *Tomato* | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC 5.

*Gavel 75DF (zoxamide, mancozeb)* *Tomato* | 1.5-2 lbs. per acre. REI: 48-hour. PHI: 5-day. FRAC 22, FRAC M3.

*Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil)* *Tomato* | 1.75-2.5 pt. per acre. REI: 12-hour. PHI: 3-day. FRAC 49, FRAC M5.

*Orondis Ultra Premix (SC) (oxathiapiprolin, mandipropamid)* *Tomato* | 5.5-8.0 fl. oz. per acre. Alternate with fungicides that have a different mode of action. Use either soil applications or foilar applications of oxathiapiprolin products, but not both. REI: 4-hour. PHI: 1-day. FRAC 49, FRAC 40.

*Presidio (4SC) (fluopicolide)* *Tomato* | 3-4 fl. oz. per acre. Must be tank-mixed with a product with a different mode of action. REI: 12-hour. PHI: 2-day. FRAC 43.

*Ranman 400SC (34.5) (cyazofamid)* *Tomato* | 2.1-2.75 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 21.

*Revus Top (SC) (mandipropamid, difenoconazole)* *Tomato* | 5.5-7.0 fl. oz. per acre. Do not use on small-fruited varieties. REI: 12-hour. PHI: 1-day. FRAC 40, FRAC 3.

*Tanos (DF) (famoxadone, cymoxanil)* *Tomato* | 8 oz. per acre. For late blight, tank-mix with a contact fungicide with a different mode of action. Disease suppression for Buckeye rot. REI: 12-hour. FRAC 11, FRAC 27.

*Zampro (SC) (ametoctradin, dimethomorph)* *Tomato* | 14 fl. oz. per acre. REI: 12-hour. PHI: 4-day. FRAC 45, FRAC 40.

Leaf Blight of Fruiting Vegetables - Septoria Fungus

This pathogen can infect eggplants, peppers, and tomatoes, but is mainly a problem in tomatoes. This disease initially causes lesions on lower leaves of the tomato plant. After field planting, begin protective fungicide applications on a 7-14 day schedule.

Non-Pesticide

*Eggplant, Pepper, Tomato* | Avoid fields with a history of Fusarium and Verticillium wilts. Rotate to non-Solanaceous crops for 2-3 years. Varieties resistant to Fusarium and Verticillium wilt will hold up better against Septoria. Use raised beds, staking, and mulch to improve drainage, air flow, and reduce splashing. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

*Aprovia Top (difenconazole, benzovindiflupyr)* *Eggplant, Pepper, Tomato* | 10.5-13.5 fl. oz. per acre. Use of a spreader sticker is recommended. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 7.

*azoxystrobin products (azoxystrobin)* *Eggplant, Pepper* | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

*azoxystrobin products (azoxystrobin)* *Tomato* | Use 2 lb. a.i. per gallon formulations (Quadris) at 5.0-6.2 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.1-3.9 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.
Cabrio EG (20) (pyraclostrobin) Eggplant, Pepper, Tomato | 8-12 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 11.

chlorothalonil products (chlorothalonil) Eggplant, Pepper, Tomato | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC M5.

Fontelis (1.67SC) (penthiopyrad) Eggplant, Pepper, Tomato | 16-24 fl. oz. per acre. See label for greenhouse uses. REI: 12-hour. PHI: 0-day. FRAC 7.

Inspire Super (EW) (difenoconazole, cyprodinil) Eggplant, Pepper, Tomato | 5.5-7.0 fl. oz. per acre. Do not use on small fruited varieties such as cherry tomato. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 9.

Luna Sensation (fluopyram, trifloxystrobin) Eggplant, Pepper, Tomato | 5.7-6.0 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 7, FRAC 11.


mancozeb products (mancozeb) Tomato | Several formulations of mancozeb (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M3.

Miravis Prime (SC) (pydiflumetofen, fludioxonil) Pepper, Tomato | 9.2-11.4 fl. oz. per acre. Use high rate for gray mold, suppression only. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 12.

Prixor (fluxapyroxad, pyraclostrobin) Eggplant, Pepper, Tomato | 4-8 fl. oz. per acre. Suppression only for Botrytis gray mold and white mold. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

Quadris Opti (SC) (azoxystrobin, chlorothalonil) Pepper, Tomato | 1.3-1.6 pts. per acre. REI: 12-hour. PHI: 0-day. FRAC 11, FRAC M5.

Quadris Top (SC) (azoxystrobin, difenoconazole) Tomato | 8 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 11, FRAC 3.

Revus Top (SC) (mandipropamid, difenoconazole) Eggplant, Pepper, Tomato | 5.5-7.0 fl. oz. per acre. Do not use on small-fruited varieties. REI: 12-hour. PHI: 1-day. FRAC 40, FRAC 3.

Tanos (DF) (famoxadone, cymoxanil) Eggplant, Pepper, Tomato | 8 oz. per acre. Early blight rate 6-8 oz. per acre. Disease suppression for bacterial diseases. REI: 12-hour. PHI: 3-day. FRAC 11, FRAC 27.

Leaf Mold of Fruiting Vegetables - Passalora Fungus

This pathogen can infect eggplants, peppers and tomatoes, but is mainly a problem in tomatoes. This disease causes yellow lesions on the upper side of the tomato leaf. It is common in greenhouse and high tunnel tomatoes but is less common in open field tomatoes.

Non-Pesticide

Eggplant, Pepper, Tomato | Use disease-free seed and transplants. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122 F for 25 minutes for tomato. Rotate to non-Solanaceous crops for 2 years. Resistant varieties are available. Use raised beds, staking, and mulch to improve drainage, air flow, and reduce splashing. Monitor humidity in the hoophouse and vent appropriately. Pruning the crop can help increase airflow as well. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Gavel 75DF (zoxamide, mancozeb) Tomato | 1.5-2 lbs. per acre. REI: 48-hour. PHI: 5-day. FRAC 22, FRAC M3.

Inspire Super (EW) (difenoconazole, cyprodinil) Eggplant, Pepper, Tomato | 4-8 fl. oz. per acre. Early blight rate 6-8 oz. per acre. Disease suppression only for Botrytis gray mold, suppression only. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 9.

mancozeb products (mancozeb) Tomato | Several formulations of mancozeb (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M3.

Miravis Prime (SC) (pydiflumetofen, fludioxonil) Pepper, Tomato | 9.2-11.4 fl. oz. per acre. Use high rate for gray mold, suppression only. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 12.

Quadris Top (SC) (azoxystrobin, difenoconazole) Tomato | 8 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 11, FRAC 3.

Revus Top (SC) (mandipropamid, difenoconazole) Eggplant, Pepper, Tomato | 5.5-7.0 fl. oz. per acre. Do not use on small-fruited varieties. REI: 12-hour. PHI: 3-day. FRAC 11, FRAC 27.

Nematodes

Non-Pesticide

Tomato | Collect soil samples for nematodes in the fall and avoid fields with high numbers. Rotate to a non-broadleaf crop, such as grass grains or sweet corn for >3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue and displace nematodes is an important method to prevent nematode build-up. Anaerobic soil disinfestation (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain nematodes.
Fruiting Vegetables - Diseases

Pesticide

Nimitz (4EC) (fluensulfone) Eggplant, Pepper, Tomato | 3.5-7 pts. per acre. Do not use on direct-seeded plants. May be broadcast, banded, or drip-applied in the spring up to 7 days before planting at a depth of 8 inches. Effectiveness is reduced on muck and clay soils. REI: 12-hour. IRAC UN.

Sectagon K42 (4.2L) (metam sodium) Eggplant, Pepper, Tomato | 37.5-75 gals. per acre. Use high rates on muck, and lower rates on sands. In the fall, when soil at 6 inches is above 50 F and moist, place Sectagon K42 or VAPAM HL about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, it can be applied through drip irrigation under unperforated plastic beds. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC 8F, FRAC M3, WSSA 17. RUP.

Sectagon K54 (5.63L) (metam potassium) Eggplant, Pepper, Tomato | 30-62 gals. per acre. Use high rates on muck, and lower rates on sands. In the fall, when soil at 6 inches is above 50 F and moist, place Sectagon K54 or K-PAM HL about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, it can be applied through drip irrigation under unperforated plastic beds. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC 8F, FRAC M3, WSSA 17. RUP.

Telone C-17 (L) (1,3-dichloropropene, chloropicrin) Eggplant, Pepper, Tomato | Muck soils: Use C-17 formulation at 27.4-30 gals. per acre, and C-35 formulation at 33-36 gals. per acre. Mineral soils: Use C-17 formulation at 10.8-17.1 gals. per acre, and C-35 formulation at 13-20.5 gals per acre. In the fall, when soil at 6 inches is above 50 F and moist, place Telone C-17 or C-35 about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing, irrigation, or plastic. Or, in the spring, InLine may be applied through drip irrigation under unperforated plastic beds at 13-20.5 gals. per acre, on mineral soils only. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 3-5-day. IRAC UN, FRAC NC, IRAC 8B. RUP.

Telone II (9.85L) (1,3-dichloropropene) Eggplant, Pepper, Tomato | Muck soils: Use at 25 gals. per acre. Mineral soils: Use at 9-12 gals. per acre. In the spring or fall, when soil at 6 inches is above 50 F and moist, place Telone II about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, Telone EC may be applied through drip irrigation under unperforated plastic beds at 9-18 gals. per acre on mineral soils only. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC UN, FRAC NC. RUP.

Velum Prime (4.16SC) (fluopyram) Eggplant, Pepper, Tomato | 6.5-6.84 fl. oz. per acre. Apply through drip irrigation. Do not exceed 13.7 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 0-day. FRAC 7.

Vydate L (2WSL) (oxamyl) Eggplant | 2-4 pts. per acre. Apply as a transplant water drench (peppers and tomatoes only), banded directly post-plant soil treatment at with at least 20 gals. water per acre incorporated 2-4 inches deep by water or mechanical means, or drip chemigate after transplanting with at least 40 gals. water per acre. Allow 14 days between applications. For eggplants, do not exceed 16 pts. per acre per season. For peppers, do not exceed 24 pts. per acre per season. For tomatoes, do not exceed 32 pts. per acre per season. In Kansas, only drip treatment allowed for eggplant, only low rate allowed for peppers, and up to 8 pts. allowed for tomato drip applications. In Missouri, up to 8 pts. per acre allowed for tomato drip applications. REI: 48-hour. PHI: 7-day for eggplants and peppers, 3-day for tomatoes. IRAC 1A. RUP.

Phytophthora Blight of Multiple Crops - Phytophthora Oomycete

Phytophthora may cause damping-off, stem infection, and fruit rot in tomatoes and peppers. It is often associated with heavy rains and fields with poor drainage. The first symptoms are usually observed in low areas. It has a wide host range of crops and weeds, including vine crops, beans, nightshades and velvetleaf. Ponds and streams with run-off water from infested soil may be contaminated with Phytophthora.

At planting, use a transplant drench to help prevent Phytophthora infection of young plants. At fruit set, apply contact or systemic fungicides at first sign of the disease to prevent fruit rots. Systemic fungicides are available.

Non-Pesticide

Eggplant, Pepper, Tomato | Rotate to non-Cucurbit, non-Legume, and non-Solanaceous crops for 3 years. Avoid fields with a history of the disease and poor drainage. Use raised beds, staking, and mulch to improve drainage, air flow, and reduce splashing. Do not irrigate with surface water. Pepper varieties with moderate to good resistance to the crown and root rot phase of Phytophthora blight include the Bell-types, Paladin, Aristotle, Archimedes, Revolution, Declaration, Intruder, and Vanguard; Jalapeno-types, Hechicero; and Ancho-type, Sequoia. These varieties are susceptible to the foliar and fruit rot phases of Phytophthora blight. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up. Anaerobic soil disinfestation (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain this pathogen.

Pesticide

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) Eggplant, Pepper, Tomato | Several formulations of copper (Badge, Champ, Kocide) are labelled for use and may improve efficacy of fungicides against
Phytophthora blight when tank mixed at labeled rates. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

Elumin (4SC) (ethaboxam) Eggplant, Pepper | 8 fl. oz. per acre. REI: 12-hour. PHI: 2-day. FRAC 22.

Omega 500F (4.17) (fluazinam) Eggplant, Pepper | 16-24 fl. oz. per acre. Apply 24 fl. oz. per acre as a soil drench at transplanting. Then, begin foliar applications using low rates under low disease pressure, and high rates under high disease pressure. REI: 12-hour. PHI: 30-day. FRAC 29.

Orondis Gold (DC) (oxathiapiprolin, mefenoxam) Eggplant, Pepper, Tomato | 28-55 fl. oz. per acre. Use as an at-plant soil drench, banded spray in furrow, or through drip irrigation. Do not follow soil applications of Orondis Gold with foliar applications of Orondis Opti, or Orondis Ultra. REI: 2-day. PHI: 3-day. FRAC 49, FRAC 4.

Orondis Gold SL (4SC) (mefenoxam) Tomato | Use less for band applications before transplanting. Subsequent applications may be needed. REI: 12-hour. PHI: 1-day. FRAC 27.

Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil) Eggplant, Pepper, Tomato | 1.75-2.5 pt. per acre. REI: 12-hour. PHI: 1-day. FRAC 49, FRAC M5.

Orondis Ultra Premix (SC) (oxathiapiprolin, mandipropamid) Eggplant, Pepper, Tomato | 5.5-8.0 fl. oz. per acre. Alternate with fungicides that have a different mode of action. Use either soil applications or foliar applications of oxathiapiprolin products, but not both. REI: 4-hour. PHI: 1-day. FRAC 49, FRAC 40.

pephosphate and phosphorous acid products (phosphorous acid, potassium phosphate, mono-dipotassium salts of phosphorous acid, mono- and dibasic sodium, potassium, and ammonium phosphites, fosetyl-aluminum) Pepper, Tomato | Several phosphate or phosphorous acid products (Aliette, Phostrol, ProPhyt, Rampart) are labeled at various rates. Label includes different crops, PHIs, resistance instructions, and other important information. Some manufacturers recommend tank-mixing. These products may be used in a preventative program until the disease is observed. REI: 4 to 12-hour. FRAC P7.

Presidio (4SC) (fluopicolide) Eggplant, Pepper, Tomato | 3-4 fl. oz. per acre. Must be tank-mixed with a product with a different mode of action. REI: 12-hour. PHI: 2-day. FRAC 43.

Ranman 400SC (34.5) (cyazofamid) Eggplant, Pepper, Tomato | 2.1-2.75 fl. oz. per acre. For Buckeye rot and Phytophthora blight, apply to base of plant or in transplant water. REI: 12-hour. PHI: 0-day. FRAC 21.

Revus (2.08SC) (mandipropamid) Eggplant, Pepper | 8 fl. oz. per acre. REI: 4-hour. PHI: 1-day. FRAC 40.

Ridomil Gold SL (4SC) (mefenoxam) Eggplant, Pepper, Tomato | 1 pt. per acre. Soil treatment at 1 pt. per acre broadcast (use less for band applications) before transplanting. Subsequent directed sprays may be needed. Phytophthora crown rot only. Fungicides will not be effective if plants are planted in poorly drained fields with a history of the disease. REI: 48-hour. PHI: 7-day. FRAC 4.

Tanors (DF) (famoxadone, cymoxanil) Eggplant, Pepper, Tomato | 8 oz. per acre. Early blight rate 6-8 oz. per acre. Disease suppression for bacterial diseases. REI: 12-hour. PHI: 3-day. FRAC 11, FRAC 27.

Zampro (SC) (ametocradin, dimethomorph) Eggplant, Pepper, Tomato | 14 fl. oz. per acre. REI: 12-hour. PHI: 4-day. FRAC 45, FRAC 40.

Powdery Mildew of Fruiting Vegetables - Leveillula Fungus

This pathogen can infect eggplants, peppers, and tomatoes, but is mainly a problem in tomatoes.

Non-Pesticide

Eggplant, Pepper, Tomato | Avoid fields with a history of the disease. Rotate to non-Solanaceous crops for 2 years. Use raised beds, staking, and mulch to improve drainage, air flow, and reduce splashing. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Aprovia Top (difenoconazole, benzovindiflupyr) Eggplant, Pepper, Tomato | 10.5-13.5 fl. oz. per acre. Use of a spreader sticker is recommended. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 7.

azoxyystrobin products (azoxyystrobin) Eggplant, Pepper | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

azoxyystrobin products (azoxyystrobin) Tomato | Use 2 lb. a.i. per gallon formulations (Quadris) at 5.0-6.2 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.1-3.9 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

Cabrio EG (20) (pyraclostrobin) Eggplant, Pepper, Tomato | 8-16 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 11.

Inspire Super (EW) (difenoconazole, cyprodinil) Eggplant, Pepper, Tomato | 16-20 fl. oz. per acre. Do not apply to small fruited varieties such as cherry tomato. REI: 12-hour. PHI: 0-day. FRAC 3, FRAC 9.

Luna Sensation (fluopyram, trifloxystrobin) Eggplant, Pepper, Tomato | 5-7.6 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 7, FRAC 11.

Fruiting Vegetables - Diseases

Miravis Prime (SC) (pydiflumetofen, fludioxonil) *Pepper, Tomato* | 9.2-11.4 fl. oz. per acre. Use high rate for gray mold, suppression only. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 12.

Priaxor (fluxapyroxad, pyraclostrobin) *Eggplant, Pepper, Tomato* | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

Quadris Opti (SC) (azoxystrobin, chlorothalonil) *Pepper, Tomato* | 1.6 pts. per acre. REI: 12-hour. PHI: 0-day. FRAC 11, FRAC M5.

Quadris Top (SC) (azoxystrobin, difenoconazole) *Tomato* | 8 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 11, FRAC 3.

Switch 62.5WG (cyprodinil, fludioxonil) *Eggplant, Pepper, Tomato* | 11-14 oz. per acre. Do not apply to small fruited varieties in the greenhouse. REI: 12-hour. PHI: 0-day. FRAC 9, FRAC 12.

Southern Blight of Fruiting Vegetables - Sclerotium Fungus

This disease is normally observed in southern climates or during seasons with above normal temperatures.

Non-Pesticide

*Eggplant, Pepper, Tomato* | Rotate to a non-broadleaf crop, such as grass grains, sweet corn, or onions for >6 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up. Anaerobic soil disinfestation (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain this pathogen.

Pesticide

Fontelis (1.67SC) (penthiopyrad) *Eggplant, Pepper, Tomato* | 1-1.6 fl. oz. per 1,000 row ft. Apply to base of plant as directed spray 5-10 days after transplanting and 14 days later. Follow up with effective fungicide as needed. REI: 12-hour. PHI: 0-day. FRAC 7.

Viruses of Multiple Crops - Multiple Pathogens

There are three main virus diseases in tomatoes: Impatiens Necrotic Spot Virus (INSV), Tomato Spotted Wilt Virus (TSWV), and Tobacco Mosaic Virus (TMV).

INSV and TSWV is carried by thrips and can cause major loss to tomatoes if they infect young plants. It is more common in greenhouse and high tunnel situations, especially where tomatoes and ornamental flowers share space.

TMV is more of a problem in fresh market tomatoes than processing tomatoes due to extensive handling. Disease can spread through smoking tobacco and tobacco residue.

Non-Pesticide

*Tomato* | For INSV and TSWV: maintain transplant greenhouse sanitation and good weed control is important. Avoid shared space with hanging basket flowers, and Solanaceous weeds like nightshades and horse nettle. Use a monitoring program to time the release of natural enemies of thrips (see insect section). Remove infected transplants and do not plant them out into fields. For TMV: establish and enforce break area and handwashing rules and procedures to avoid tobacco residue on tomato plants. Remove infected transplants and do not plant them out into fields.

White Mold (Timber Rot, Drop, Stem Rot) of Multiple Crops - Sclerotinia Fungus

This soil pathogen is long-lived in the soil, and has a wide host range on broadleaved crops and weeds, including beans, vine crops, lettuce, tomatoes, peppers, and cole crops. It goes by other names in other crops, such as Drop, White Mold, Stem Rot, and Timber Rot.

It is more commonly found in greenhouses and high tunnels where humidity and temperatures are high. The fungus often infects flowers, which then drop off and infect the stems that they land on. The stems take on a woody appearance and can split open, revealing small black pellets that are the overwintering body of the pathogen.

Non-Pesticide

*Eggplant, Pepper, Tomato* | Avoid fields with a history of the problem. Rotate to a non-broadleaf crop, such as grass grains or sweet corn for >6 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up. Anaerobic soil disinfestation (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain this pathogen.

Pesticide

Cabrio EG (20) (pyraclostrobin) *Eggplant, Pepper, Tomato* | 12-16 oz. per acre. Suppression only for Botrytis gray mold and white mold. REI: 12-hour. PHI: 0-day. FRAC 11.

Endura (WG) (boscalid) *Tomato* | 12.5 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7.

Luna Sensation (fluopyram, trifloxystrobin) *Eggplant, Pepper, Tomato* | 7.6 fl. oz. per acre. Suppression only for anthracnose and white mold. REI: 12-hour. PHI: 3-day. FRAC 7, FRAC 11.

Priaxor (fluxapyroxad, pyraclostrobin) *Eggplant, Pepper, Tomato* | 4.8 fl. oz. per acre. Suppression only for Botrytis gray mold and white mold. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.
Wilt of Multiple Crops - Verticillium Fungus
This is a soil pathogen. Eggplants are more sensitive to it than other Solanaceous crops.

Non-Pesticide
**Eggplant, Tomato** | Avoid fields with a history of the disease. Rotate to non-Cucurbit, non-Legume, and non-Solanaceous crops for >6 years. Many tomato varieties with resistance are available, and resistant tomato rootstocks are available for grafting under eggplant. Use raised beds, staking, and mulch to improve drainage, air flow, and reduce splashing. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up. Anaerobic soil disinfection (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain this pathogen.

Pesticide
**Sectagon K42 (4.2L) (metam sodium)** *Eggplant, Pepper, Tomato* | 37.5-75 gals. per acre. Use high rates on muck, and lower rates on sands. In the fall, when soil at 6 inches is above 50 F and moist, place Sectagon K42 or VAPAM HL about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, it can be applied through drip irrigation under unperforated plastic beds. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC 8F, FRAC M3, WSSA 17. RUP.

**Sectagon K54 (5.63L) (metam potassium)** *Eggplant, Pepper, Tomato* | 30-62 gals. per acre. Use high rates on muck, and lower rates on sands. In the fall, when soil at 6 inches is above 50 F and moist, place Sectagon K54 or K-PAM HL about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, it can be applied through drip irrigation under unperforated plastic beds. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC 8F, FRAC M3, WSSA 17. RUP.

**Telone C-17 (L) (1,3-dichloropropene, chloropicrin)** *Eggplant, Pepper, Tomato* | Muck soils: Use C-17 formulation at 27.4-30 gals. per acre, and C-35 formulation at 33-36 gals. per acre. *Mineral soils*: Use C-17 formulation at 10.8-17.1 gals. per acre, and C-35 formulation at 13-20.5 gals. per acre. In the fall, when soil at 6 inches is above 50 F and moist, place Telone C-17 or C-35 about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing, irrigation, or plastic. Or, in the spring, it may be applied through drip irrigation under unperforated plastic beds at 13-20.5 gals. per acre, on mineral soils only. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 3-5-day. IRAC UN, FRAC NC, IRAC 8B. RUP.

Fruiting Vegetables - Insects
Reviewed by Laura Ingwell, Raymond Cloyd, Luis Cañas – Nov 2020

**Recommended Controls**

### Aphids
Aphids and thrips transmit viral diseases.

**Non-Pesticide**
*Eggplant, Pepper, Tomato* | For greenhouses, consider purchasing and releasing the predatory midge *Aphidoletes aphidimyza*, lady beetles *Adalia bipunctata* and *Hippodamia convergens*, and lacewings *Chrysopa carnea* and *Chrysoperla rygiflaboris*. Also depending on the aphid species, consider co-releasing a parasitoid wasps like *Aphelinus abdominalis*, *Aphidius colemani*, *Aphidius ervi*, or *Aphidius matricariae*. Avoid insecticides when deploying natural enemies.

**Pesticide**

**Actara (25WDG) (thiamethoxam)** *Eggplant, Pepper, Tomato* | 2-3 oz. per acre. Apply as a foliar spray. Do not exceed 11 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 4A.

**Admire Pro (4.6SC) (imidacloprid)** *Eggplant, Pepper, Tomato* | 1.3-2.2 fl. oz. per acre foliar application for eggplant, pepper, and tomato. 7.0-10.5 fl. oz. per acre soil application on eggplant and tomato, up to 14 fl. oz. per acre for pepper. Do not exceed 6.7 fl. oz. per acre for foliar applications. Do not exceed 10.5 fl. oz. per acre for soil applications on eggplant and tomato, or 14 fl. oz. for pepper. REI: 12-hour. PHI: 0-day for foliar application, or 21-day for soil application. IRAC 4A.

**Assail 30SG (acetamiprid)** *Eggplant, Pepper, Tomato* | Use 30SG formulations at 2.0-4.0 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 0.8-1.7 oz. per acre and do not exceed 6.8 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Beleaf (50SG) (flonicamid)** *Eggplant, Pepper, Tomato* | 2.0-4.28 fl. oz. per acre. Do not exceed 8.4 oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 29.

**Dimethoate 4EC (dimethoate)** *Pepper, Tomato* | Use 4EC, LV-4, and 400EC formulations at 0.5-1.0 pt. per acre on peppers, or 0.5-1.0 pt. per acre on tomatoes and do not exceed 3.33 pts. per acre per season on peppers, or 2 pts. per acre per season on tomatoes. REI: 48-hour. PHI: 0-day for pepper, 7-day for tomato. IRAC 1B.
Fruiting Vegetables - Insects

**Fulfill (50WDG) (pyometrozine)** Eggplant, Pepper, Tomato | 2.75 oz. per acre. Do not exceed 5.5 oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 9B.

**Lannate LV (2.4L) (methomyl)** Eggplant, Pepper, Tomato | 0.75-3.0 pts. per acre. Do not exceed 21 pts. per acre per season. REI: 48-hour. PHI: 1-day for tomato, 3-day for pepper, 5-day for eggplant. IRAC 1A. RUP.

**M-Pede (3.8) (potassium salts of fatty acids)** Eggplant, Pepper, Tomato | 1-2% by volume. Must contact target insects to be effective. REI: 12-hour. PHI: 0-day. IRAC UN, FRAC NC. OMRI-listed.

**Malathion 5EC (malathion)** Eggplant, Pepper, Tomato | Use 5EC formulations at 1.5-2.5 pts. per acre for eggplant, 1.0-2.5 pts. per acre for pepper, 1.5 pts. per acre for tomato. Use 57EC formulations at 1.0-1.5 pts. per acre on eggplant, 1.25-1.5 pts. per acre on pepper, 1.0-1.25 pts. per acre for tomato. Do not exceed 2 applications per season on peppers, or 4 applications per season on tomatoes. REI: 12 to 24-hour. PHI: 1-day for tomato, 3-day for eggplant and pepper. IRAC 1B.

**Movento (2SC) (spirotetramat)** Eggplant, Pepper, Tomato | 4-5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 23.

**Orthene 97 (S) (acephate)** Pepper | For Bell Pepper: Application rate is 0.5-1 lb. per acre. For all other peppers: Application rate is 0.5 lb. per acre. REI: 24-hour. PHI: 7-day. IRAC 1B.

**Platinum 2SC (thiamethoxam)** Eggplant, Pepper, Tomato | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12 to 24-hour. PHI: 1-day for tomato, 3-day for eggplant and pepper. IRAC 4A.

**Sivanto 200 (1.67SL) (flupyridifurone)** Eggplant, Pepper, Tomato | 7-12 fl. oz. per acre foliar application, or 21-28 fl. oz. per acre soil application. REI: 4-hour. PHI: 1-day for foliar application, or 45-day for soil application. IRAC 4D.

**Vydate L (2WSL) (oxamyl)** Eggplant, Pepper, Tomato | 2-4 pts. per acre. Apply as a foliar spray. Drip application allowed in peppers. For eggplants, do not exceed 16 pts. per acre per season. For peppers, do not exceed 24 pts. per acre per season. For tomatoes, do not exceed 32 pts. per acre per season. In Kansas, only low rate allowed for peppers, and do not exceed 12 pts. per acre per season. REI: 48-hour. PHI: 1-day for eggplant, 3-day for tomato, 7-day for pepper. IRAC 1A. RUP.

**Pesticide**

**Asana XL (0.66EC) (esfenvalerate)** Eggplant, Pepper, Tomato | 2.9-9.6 fl. oz. per acre. For armyworms, corn borers, cutworms, fruitworms, hornworms, loopers, and pinworms in tomatoes. For corn borers, fruitworms, and loopers in eggplants. For armyworms, corn borers, fruitworms, and loopers in peppers. Do not exceed 67.8 fl. oz. per acre per season for eggplant and pepper. Do not exceed 96.9 fl. oz. per acre per season for tomato. REI: 12-hour. PHI: 1-day for tomato, 7-day for eggplant and pepper. IRAC 3A. RUP.

**Avant (30WDG) (indoxacarb)** Eggplant, Pepper, Tomato | 2.5-3.5 fl. oz. per acre. For armyworms, fruitworms, hornworms, and loopers in tomatoes, peppers and eggplants. For corn borers in bell peppers only. Do not exceed 14 oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 22.

**Baythroid XL (1EC) (beta-cyfluthrin)** Eggplant, Pepper, Tomato | 1.6-2.8 fl. oz. per acre. For armyworms, corn borers, cutworms, fruitworms, hornworms, loopers, and pinworms. Various Bt products are available for control of young caterpillars (Agree, Biobit, Dipel, Javelin, etc.) Different Bt subspecies have different control properties. Check labels for rates, timing of application and required safety equipment. REI: 4-hour. PHI: 0-day. IRAC 11A.

**Brigade 2EC (bifenthrin)** Eggplant, Pepper, Tomato | For armyworms, corn borers, cutworms, fruitworms, hornworms, loopers, and pinworms. Do not exceed 16.8 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 0-day for tomato, 7-day for eggplant and pepper. IRAC 3A. RUP.

**Coragen (1.67SC) (chlorantraniliprole)** Eggplant, Pepper, Tomato | 2.0-7.5 fl. oz. per acre. For armyworms, corn borers, fruitworms, hornworms, loopers, and pinworms. Can be applied as either a foliar application or via drip chemigation. Chemigation will provide up to 30 days of control. Do not exceed 15.4 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

**Danitol 2.4EC (30.9) (fenpropatrin)** Eggplant, Pepper, Tomato | 10.67 fl. oz. per acre. For armyworms, cutworms,

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**Caterpillars**

There are many caterpillar pests of fruiting vegetables, including corn earworm/tomato fruitworm, tomato hornworm, tomato pinworm, European corn borer, cutworms, loopers, and armyworms. Always check the label for the specific list of caterpillars that the product can be used on.
fruitworms, hornworms, and loopers. Do not exceed 42.67 fl. oz. per acre per season. REI: 24-hour. PHI: 3-day. IRAC 3A. RUP.

**Diazinon AG500 (4ES) (diazinon)** For cutworms. Use 50W formulations at 4-8 lbs. per acre as a pre-plant incorporation and do not exceed 8 lbs. per acre per season. Use AG500 formulations at 64-128 fl. oz. per acre as a pre-plant incorporation and do not exceed 128 fl. oz. per acre per season. Use AG600 formulations at 51-102 fl. oz. per acre as a pre-plant incorporation and do not exceed 102 fl. oz. per acre per season. REI: 2 to 4-day. IRAC 1B. RUP.

**Diazinon AG500 (4ES) (diazinon)** *Tomato* | For cutworms. Use 50W formulations at 4-8 lbs. per acre as a pre-plant incorporation and do not exceed 8 lbs. per acre per season. Use AG500 formulations at 64-128 fl. oz. per acre as a pre-plant incorporation and do not exceed 128 fl. oz. per acre per season. Use AG600 formulations at 51-102 fl. oz. per acre as a pre-plant incorporation and do not exceed 102 fl. oz. per acre per season. REI: 2 to 4-day. IRAC 1B. RUP.

**Empire 25L (imidacloprid)** *Eggplant, Pepper, Tomato* | For armyworms, fruitworms, corn borers, hornworms, loopers, and pinworms. Do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 1.0-2.5 oz. per acre and do not exceed 9 oz. per acre per season. Allow 4 days between applications. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

**Lannate LV (2.4L) (methomyl)** *Eggplant, Pepper, Tomato* | 10.9-16.4 fl. oz. per acre. For armyworms, corn borers, fruitworms, hornworms, loopers, and pinworms. Use with adjutant. Do not exceed 65.6 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

**Mustang Maxx (0.8) (zeta-cypermethrin)** *Eggplant, Pepper, Tomato* | 2.24-4.0 fl. oz. per acre. For armyworms, corn borers, cutworms, fruitworms, hornworms, loopers, and pinworms. Do not exceed 24 fl. oz. per acre per season. Allow at least 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Orthene 97 (S) (acephate)** *Pepper* | 0.75-1.0 lb. per acre. For corn borers, hornworms, and loopers in bell pepper only. REI: 24-hour. PHI: 7-day. IRAC 1B.

**Perm-Up 25DF (permethrin)** *Eggplant, Pepper, Tomato* | For armyworms, fruitworms, hornworms, loopers, and pinworms. Use 25W, 25WP or 25DF formulations at 3.2-12.8 fl. oz. per acre for tomato, 9.6 fl. oz. per acre for eggplant, or 6.4-12.8 fl. oz. per acre for pepper and do not exceed 38.4 fl. oz. per acre per season for eggplant and tomato or 51.2 fl. oz. per acre per season for pepper. Use 3.2EC formulations at 2-8 fl. oz. per acre for tomato, 6 fl. oz. per acre for eggplant, or 4-8 fl. oz. per acre for pepper and do not exceed 24 fl. oz. per acre per season for eggplant and tomato or 32 fl. oz. per acre per season for pepper. PHI: 12-hour. PHI: 0-day for tomato, 3-day for eggplant and pepper. IRAC 3A. RUP.

**Radiant 1SC (spinetoram)** *Eggplant, Pepper, Tomato* | 5-10 fl. oz. per acre. For armyworms, corn borers, fruitworms, hornworms, loopers and pinworms. Do not exceed 34 fl. oz. per acre per season. PHI: 4-hour. PHI: 1-day. IRAC 5.

**Verimark (1.67SC) (cytaniliprole)** *Eggplant, Pepper, Tomato* | 0.96-1.92 fl. oz. per acre. For armyworms, corn borers, cutworms, fruitworms, hornworms, loopers, and pinworms. Do not exceed 20.5 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

**Warrior II (2.08CS) (lambda-cyhalothrin)** *Eggplant, Pepper, Tomato* | 0.96-1.92 fl. oz. per acre. For eggplant, pepper, and tomato. 7.0-10.5 fl. oz. per acre soil application on eggplant and tomato, or 14 fl. oz. per acre for pepper. Do not exceed 17.5 fl. oz. per acre for foliar applications. Do not exceed 10 fl. oz. per acre for soil applications on eggplant and tomato, or 14 fl. oz. per acre for pepper. PHI: 12-hour. PHI: 0-day for foliar application, or 21-day for soil application. IRAC 4A.

**Agri-Mek SC (0.7) (abamectin)** *Eggplant, Pepper, Tomato* | Use 0.7SC formulations at 1.75-3.5 fl. oz. per acre and do not exceed 3.5 fl. oz. per acre per season. Use 0.15SC formulations at 0.35-0.75 fl. oz. per acre and do not exceed 1 fl. oz. per acre per season. For eggplant and tomato. 7.0-10.5 fl. oz. per acre soil application on eggplant and tomato, or 14 fl. oz. per acre for pepper. Do not exceed 6.7 fl. oz. per acre for foliar applications. Do not exceed 10 fl. oz. per acre for soil applications on eggplant and tomato, or 14 fl. oz. per acre for pepper. PHI: 12-hour. PHI: 0-day for foliar application, or 21-day for soil application. IRAC 4A.
Fruiting Vegetables - Insects

at 8-16 fl. oz. per acre and do not exceed 10.25 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 6. RUP.

**Asana XL (0.66EC) (esfenvalerate)** Eggplant, Tomato | 5.8-9.6 fl. oz. per acre. Do not apply more than 67.2 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day for tomato, 7-day for eggplant. IRAC 3A. RUP.

**Asiss 30SG (acetamiprid)** Eggplant, Pepper, Tomato | Use 30SG formulations at 1.5-2.5 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 0.6-1.1 oz. per acre and do not exceed 6.8 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Baythroid XL (1EC) (beta-cyfluthrin)** Eggplant, Pepper, Tomato | 1.6-2.8 fl. oz. per acre. Do not exceed 16.8 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 0-day for tomato, 7-day for eggplant and pepper. IRAC 3A. RUP.

**Brigade 2EC (bifenthrin)** Eggplant, Pepper, Tomato | For armyworms, corn borers, cutworms, fruitworms, and loopers in tomatoes, peppers, and eggplants. For hornworms, and pinworms in peppers and eggplants only. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 25.6 fl. oz. per acre per season for tomatoes or 12.8 fl. oz. per acre on eggplants or pepper. Use 10DF, 10WP, or 10WSB formulations at 5.3-12.8 oz. per acre and do not exceed 51.2 oz. per acre on tomatoes or 32 oz. per acre on eggplants or peppers. Allow 7 days between applications. REI: 12-hour. PHI: 1-day for tomato, 7-day for eggplant and pepper. IRAC 1A. RUP.

**Coragen (1.67SC) (chlorantraniliprole)** Eggplant, Pepper, Tomato | 3.5-5 fl. oz. per acre. REI: 4-hour. PHI: 1-day. IRAC 28.

**Entrust SC (2) (spinosad)** Eggplant, Pepper, Tomato | Use 2SC formulations at 3.0-6.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 1.0-2.0 oz. per acre and do not exceed 9 oz. per acre per season. Allow 4 days between applications. Observe resistance management restrictions. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

**Exirel (0.83E) (cyantraniliprole)** Eggplant, Pepper, Tomato | 7.0-13.5 fl. oz. per acre. Do not exceed 61.7 fl. oz. per acre per season REI: 12-hour. PHI: 1-day. IRAC 28.

**Harvanta (0.42SL) (cyclaniliprole)** Eggplant, Pepper, Tomato | 10.9-16.4 fl. oz. per acre. Do not exceed 65.6 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

**Mustang Maxx (0.8) (zeta-cypermethrin)** Eggplant, Pepper, Tomato | 2.24-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. Allow at least 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Novodor FC (10) (Bacillus thuringiensis tenebrionis strain NB-176)** Eggplant, Tomato | 1-4 qts. per acre. Effective on small (up to 1/4 inch) larvae only. Use higher rate for mixed sizes or heavier infestations. REI: 4-hour. PHI: 0-day. IRAC 1A.

**Perm-Up 25DF (permethrin)** Eggplant, Tomato | Use 25W, 25WP or 25DF formulations at 3.2-12.8 fl. oz. per acre for tomato or 9.6 fl. oz. per acre for eggplant and do not exceed 38.4 fl. oz. per acre per season. Use 3.2EC formulations at 2-8 fl. oz. per acre for tomato, or 6 fl. oz. per acre for eggplant and do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day for tomato, 3-day for eggplant. IRAC 3A. RUP.

**Platinum 2SC (thiamethoxam)** Eggplant, Pepper, Tomato | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SS formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

**Radiant 1SC (spinetoram)** Eggplant, Pepper, Tomato | 5-10 fl. oz. per acre. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 5.

**Rimon 0.83EC (novaluron)** Eggplant, Pepper, Tomato | 9-12 fl. oz. per acre. Do not exceed 36 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 15.

**Scorpion 35SL (3.24) (dinofuran)** Eggplant, Pepper, Tomato | Soil application: Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-7.5 oz. per acre. Foliar application: Use Scorpion 35SL at 2.0-7.0 fl. oz. per acre, or Venom 70SG at 1-4 oz. per acre. See pollination precautions. REI: 12-hour. PHI: 21-day as soil application, 7-day as foliar application IRAC 4A.

**Sivanto 200 (1.67SL) (fluropyridifurone)** Eggplant, Pepper, Tomato | 10.5-14 fl. oz. per acre. REI: 4-hour. PHI: 1-day. IRAC 4D.

**Trident (14.32) (Bacillus thuringiensis tenebrionis strain SA-10)** Eggplant, Pepper, Tomato | 3-6 qts. per acre. For control of young larvae. REI: 4-hour. PHI: 0-day. IRAC 11A. OMRI-listed.

**Vermark (1.67SC) (cyantraniliprole)** Eggplant, Pepper, Tomato | 5-10 fl. oz. per acre. REI: 4-hour. PHI: 1-day. IRAC 28.

**Vydate L (2WSL) (oxamyl)** Eggplant, Tomato | 2-4 pts. per acre. For eggplants, do not exceed 16 pts. per acre per season. For peppers, do not exceed 24 pts. per acre per season. For tomatoes, do not exceed 32 pts. per acre per season. REI: 48-hour. PHI: 1-day for eggplant, 3-day for tomato. IRAC 1A. RUP.

**Warrior II (2.08CS) (lambda-cyhalothrin)** Eggplant, Pepper, Tomato | 1.28-1.92 fl. oz. per acre. Do not exceed 23 fl. oz. per acre per season. Not for use against western flower thrips. REI: 24-hour. PHI: 5-day. IRAC 3A. RUP.

### Flea Beetles

**Pesticide**

**Actara (25WDG) (thiamethoxam)** Eggplant, Pepper, Tomato | 2-3 oz. per acre. Apply as a foliar spray. Do not exceed 11 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 4A.
Admire Pro (4.6SC) (imidacloprid) Eggplant, Pepper, Tomato | Soil Application. 7.0-10.5 fl. oz per acre for eggplant and tomato. 7-14 fl. oz. per acre for pepper. Do not exceed 10.5 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 4A.

Asana XL (0.66EC) (esfenvalerate) Eggplant, Pepper, Tomato | 5.8-9.6 fl. oz. per acre. Do not apply more than 67.2 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day for tomato, 7-day for eggplant and pepper. IRAC 3A. RUP.

Baythroid XL (1EC) (beta-cyfluthrin) Eggplant, Pepper, Tomato | 2.8 fl. oz. per acre. Do not exceed 16.8 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 0-day for tomato, 7-day for eggplant and pepper. IRAC 3A. RUP.

Brigade 2EC (bifenthrin) Eggplant, Pepper, Tomato | For armyworms, corn borers, cutworms, fruitworms, and loopers in eggplants, peppers, and eggplants. For hornworms, and pinworms in peppers and eggplants only. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 25.6 fl. oz. per acre per season for tomatoes or 12.8 fl. oz. per acre per season on eggplants or pepper. Use 10DF, 10WP, or 10WSB formulations at 5.3-12.8 oz. per acre and do not exceed 51.2 oz. per acre on tomatoes or 32 oz. per acre per season on eggplants or peppers. Allow 7 days between applications. REI: 12-hour. PHI: 1-day for tomato, 7-day for eggplant and pepper. IRAC 3A. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) Eggplant, Pepper, Tomato | 2.24-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. Allow at least 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Perm-Up 25DF (permethrin) Eggplant, Pepper | Use 25W, 25WP or 25DF formulations at 9.6 fl. oz. per acre for eggplant, or 6.4-12.8 fl. oz. per acre for pepper and do not exceed 38.4 fl. oz. per acre per season for eggplant or 51.2 fl. oz. per acre per season for pepper. Use 0.75EC formulations at 6 fl. oz. per acre for eggplant, or 4-8 fl. oz. per acre for pepper and do not exceed 24 fl. oz. per acre per season for eggplant or 32 fl. oz. per acre per season for pepper. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

Platinum 2SC (thiamethoxam) Eggplant, Pepper, Tomato | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

Sevin XLR Plus (4SC) (carbaryl) Eggplant, Pepper, Tomato | 0.5-1 qt. per acre. Do not exceed 8 qt. per acre per crop. REI: 12-hour. PHI: 3-day. IRAC 1A.

Warrior II (2.08CS) (lambda-cyhalothrin) Eggplant, Pepper, Tomato | 1.28-1.92 fl. oz. per acre. Do not exceed 23 fl. oz. per acre per season. Not for use against western flower thrips. REI: 24-hour. PHI: 5-day. IRAC 3A. RUP.

Fruit Flies

Pesticide

EverGreen Pro 60-6 (L) (piperonyl butoxide, pyrethrins) Tomato | 1 tsp. per 12.5 pts. water. Starting 2 weeks before harvest, place bait fruits in fields in late afternoon, and examine next morning. If half of the baits show eggs, spray fields immediately at 4-6 day intervals. Treat harvested fruit and hampers as soon as filled, and move hampers to processing plant as soon as possible. REI: 12-hour. PHI: 0-day. IRAC UN, IRAC 3A.

Malathion 5EC (malathion) Eggplant, Pepper, Tomato | Use 5EC formulations at 1.5-2.5 pts. per acre for eggplant, 1.0-2.5 pts. per acre for pepper, 1.5 pts. per acre for tomato. Use 57EC formulations at 1.0-1.5 pts. per acre on eggplant, 1.25-1.5 pts. per acre on pepper, 1.0-1.25 pts. per acre for tomato. Do not exceed 2 applications per season on peppers, or 4 applications per season on tomatoes. REI: 12 to 24-hour. PHI: 1-day for tomato, 3-day for eggplant and pepper. IRAC 1B.

Mites

Non-Pesticide

Eggplant, Pepper, Tomato | For greenhouses, consider purchasing and releasing the predatory mites Amblyseius andersonii, Amblyseius californicus, Amblyseius fallacis, Galendromus occidentalis and Phytoseiulus persimilis. Also consider co-releasing a flying predator such as the predatory midge Feltiella acarisuga, and lady beetle Stethorus punctillum. Avoid insecticides when deploying natural enemies.

Pesticide

Acramite 50WS (bifenthrin) Eggplant, Pepper, Tomato | 0.75-1 lb. per acre. Two-spotted spider mites only. Do not exceed 1 application per season. REI: 12-hour. PHI: 3-day. IRAC UN.

Agri-Mek SC (0.7) (abamectin) Eggplant, Pepper, Tomato | Use 0.75SC formulations at 1.75-3.5 fl. oz. per acre and do not exceed 3.5 fl. oz. per acre per season. Use 0.15SC formulations at 8-16 fl. oz. per acre and do not exceed 10.25 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 6. RUP.

Kanemite 15SC (1.25) (acequinocyl) Eggplant, Pepper, Tomato | 31 fl. oz. per acre. Spider mites only. REI: 12-hour. PHI: 1-day. IRAC 20B.

Microthiol Dispers (80W) (sulfur) Tomato | 5-20 lb. per acre. Russet mites and broad mites only. Do not exceed 10 lb. per acre. REI: 24-hour. PHI: . FRAC M2, IRAC UN. OMRI-listed.

Movento (2SC) (spirotetramat) Eggplant, Pepper, Tomato | 4-5 fl. oz. per acre. Russet mites and broad mites only. Do not exceed 10 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 23.
Stink Bugs

Pesticide

Actara (25WDG) (thiamethoxam) Eggplant, Pepper, Tomato | 3.0-5.5 oz. per acre. Apply as a foliar spray. Do not exceed 11 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 4A.

Azeran (C) (azadirachtin, pyrethrins) Eggplant, Pepper, Tomato | 1-3.5 pts. per acre. REI: 12-hour. PHI: 0-day. IRAC UN, IRAC 3A. OMRI-listed.

Baythroid XL (1EC) (beta-cyfluthrin) Eggplant, Pepper, Tomato | 1.6-2.8 fl. oz. per acre. Do not exceed 16.8 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 0-day for tomato, 7-day for eggplant and pepper. IRAC 3A. RUP.

Brigade 2EC (bifenthrin) Eggplant, Pepper, Tomato | For armyworms, corn borers, cutworms, fruitworms, and loopers in tomatoes, peppers, and eggplants. For hornworms, and pinworms in peppers and eggplants only. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 25.6 fl. oz. per acre per season for tomatoes or 12.8 fl. oz. per acre per season on eggplants or pepper. Use 10DF, 10WP, or 10WSB formulations at 5.3-12.8 oz. per acre and do not exceed 51.2 oz. per acre on tomatoes or 32 oz. per acre per season on eggplants or peppers. Allow 7 days between applications. REI: 12-hour. PHI: 1-day for tomato, 7-day for eggplant and pepper. IRAC 3A. RUP.

Danitol 2.4EC (30.9) (fenpropatrin) Eggplant, Pepper, Tomato | 10.67 fl. oz. per acre. Do not exceed 42.67 fl. oz. per acre per season. REI: 24-hour. PHI: 3-day. IRAC 3A. RUP.

Lannate LV (2.4L) (methomyl) Pepper, Tomato | 1.5-3.0 pts. per acre. Brown Marmorated Stink Bugs only. Do not exceed 21 pts. per acre per season. REI: 48-hour. PHI: 1-day for tomato, 3-day for pepper. IRAC 1A. RUP.

Oberon 2SC (spiremesifen) Eggplant, Pepper, Tomato | 7-8.5 fl. oz. per acre. Do not exceed 25.5 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 23.

Portal (0.4EC) (fenpyroximate) Eggplant, Pepper, Tomato | 2 pt. per acre. Do not exceed 2 applications per season. REI: 12-hour. PHI: 1-day. IRAC 3A.

Vydate L (2WSL) (oxamyl) Eggplant, Pepper, Tomato | 2-4 pts. per acre. REI: 12-hour. PHI: 0-day. IRAC 4A.

Mustang Maxx (0.8) (zeta-cypermethrin) Eggplant, Pepper, Tomato | 3.2-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Scorpion 35SL (3.24) (dinotefuran) Eggplant, Pepper, Tomato | Soil application: Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-7.5 oz. per acre. Foliar application: Use Scorpion 35SL at 2.0-7.0 fl. oz. per acre, or Venom 70SG at 1-4 oz. per acre. See pollination precautions. REI: 12-hour. PHI: 21-day as soil application, 7-day as foliar application IRAC 4A.

Warrior II (2.08CS) (lambda-cyhalothrin) Eggplant, Pepper, Tomato | 1.28-1.92 fl. oz. per acre. Do not exceed 23 fl. oz. per acre per season. Not for use against western flower thrips. REI: 24-hour. PHI: 5-day. IRAC 3A. RUP.

Thrips

Aphids and thrips transmit viral diseases.

Non-Pesticide

Eggplant, Pepper, Tomato | For greenhouses, consider purchasing and releasing the predatory mites Amblyseius swirskii, Neoseiulus cucumeris and Stratiolaelaps scimitus, minute pirate bug Orius spp. and beneficial nematode Steinernema feltiae.
for tomatoes or 12.8 fl. oz. per acre per season on eggplants or pepper. Use 10DF, 10WP, or 10WSB formulations at 5.3-12.8 oz. per acre and do not exceed 51.2 oz. per acre on tomatoes or 32 oz. per acre per season on eggplants or peppers. Allow 7 days between applications. REI: 12-hour. PHI: 1-day for tomato, 7-day for eggplant and pepper. IRAC 3A. RUP.

**Exirel (0.83SE) (cyantraniliprole)** *Eggplant, Pepper, Tomato* | Use 2SC formulations at 4.0-8.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 1.25-2.5 oz. per acre and do not exceed 9 oz. per acre per season. Allow 4 days between applications. Observe resistance management restrictions. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

**Grandeo (30) (Chromobacterium subtisugae strain PRAA-1)** *Eggplant, Pepper, Tomato* | 2-3 lb. per acre. REI: 12-hour. PHI: 1-day. IRAC 28, IRAC 6. RUP.

**Movento (2SC) (spirotetramat)** *Eggplant, Pepper, Tomato* | 4-5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 23.

**Mustang Maxx (0.8) (zeta-cypermethrin)** *Eggplant, Pepper, Tomato* | 3.2-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 5A. RUP.

**Neemix (0.39) (azadirachtin)** *Eggplant, Pepper, Tomato* | 4-16 fl. oz. per acre. REI: 4-hour. PHI: 0-day. IRAC UN. OMRI-listed.

**Platinum 2SC (thiamethoxam)** *Eggplant, Pepper, Tomato* | 5-11 fl. oz. per acre. REI: 12-hour. PHI: 30-day. IRAC 4A.

**Radiant 1SC (spinetoram)** *Eggplant, Pepper, Tomato* | 6-10 fl. oz. per acre. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 5.

**Rimon 0.83EC (novaluron)** *Eggplant, Pepper, Tomato* | 12 oz. per acre. Do not exceed 36 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 15.

**Torac (1.29SC) (tolfenpyrad)** *Eggplant, Pepper, Tomato* | 21 fl. oz. per acre. Do not exceed 42 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 21A, FRAC 39.

**Transform WG (50) (sulfoxaflor)** *Eggplant, Pepper, Tomato* | Use Transform 50WG at 2.0-2.25 oz. per acre or Closer 2SC at 4.25-4.5 fl. oz. per acre. REI: 24-hour. PHI: 1-day. IRAC 4C.

**Venerate (94.46) (Burkholderia spp. strain A396)** *Eggplant, Pepper, Tomato* | 1-8 qts. per acre. REI: 4-hour. PHI: 0-day. IRAC UNB. OMRI-listed.

**Warrior II (2.08CS) (lamba-cyhalothrin)** *Eggplant, Pepper, Tomato* | 1.28-1.92 fl. oz. per acre. thrilDo not exceed 23 fl. oz. per acre per season. Not for use against western flower thrips. REI: 24-hour. PHI: 5-day. IRAC 3A. RUP.

### Whiteflies

**Non-Pesticide**

*Eggplant, Pepper, Tomato* | For greenhouses, consider purchasing and releasing the predatory mite *Amblyseius swirskii*, lady beetle *Delphastus catalinae*, and mirid bug *Dicyphus hesperus*. Also consider co-releasing a parasitoid wasps like *Encarsia formosa*, or *Eretmocerus e remicus*. Avoid insecticides when deploying natural enemies.

**Pesticide**

**Actara (25WDG) (thiamethoxam)** *Eggplant, Pepper, Tomato* | 3.0-5.5 oz. per acre. Apply as a foliar spray. Do not exceed 11 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 4A.

**Admire Pro (4.6SC) (imidacloprid)** *Eggplant, Pepper, Tomato* | 1.3-2.2 fl. oz. per acre foliar application for eggplant, pepper, and tomato. 7.0-10.5 fl. oz. per acre soil application on eggplant and tomato, up to 14 fl. oz. per acre for pepper. Do not exceed 6.7 fl. oz. per acre for foliar applications. Do not exceed 10.5 fl. oz. per acre for soil applications on eggplant and tomato, or 14 fl. oz. for pepper. REI: 12-hour. PHI: 0-day for foliar application, or 21-day for soil application. IRAC 4A.

**Asana XL (0.66EC) (esfenvalerate)** *Tomato* | 5.8-9.6 fl. oz. per acre. Do not apply more than 67.2 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Assail 30SG (acetamiprid)** *Eggplant, Pepper, Tomato* | Use 30SG formulations at 2.5-4.0 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 1.1-1.7 oz. per acre and do not exceed 6.8 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Brigade 2EC (bifenthrin)** *Eggplant, Pepper, Tomato* | For armyworms, corn borers, cutworms, fruitworms, and loopers in tomatoes, peppers, and eggplants. For hornworms, and pinworms in peppers and eggplants only. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 25.6 fl. oz. per acre per season for tomatoes or 12.8 fl. oz. per acre per season on eggplants or pepper. Use 10DF, 10WP, or 10WSB formulations at 5.3-12.8 oz. per acre and do not exceed 51.2 oz. per acre on tomatoes or 32 oz. per acre per season on eggplants or peppers. Allow 7 days between applications. REI: 12-hour. PHI: 1-day for tomato, 7-day for eggplant and pepper. IRAC 3A. RUP.

**Coragen (1.67SC) (chlorantraniliprole)** *Eggplant, Pepper, Tomato* | 5.0-7.5 fl. oz. per acre. Can be applied as either a foliar
application or via drip chemigation. Chemigation will provide up to 30 days of control. Do not exceed 15.4 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

Exirel (0.83SE) (cyantraniliprole) Eggplant, Pepper, Tomato 13.5-20.5 fl. oz. per acre. Do not exceed 61.7 fl. oz. per acre per season REI: 12-hour. PHI: 1-day. IRAC 28.

Knack (0.86) (pyriproxyfen) Eggplant, Pepper, Tomato 8-10 fl. oz. per acre. Do not exceed 2 applications per season. REI: 12-hour. PHI: 1-day. IRAC 7C.

Movento (2SC) (spirotetramat) Eggplant, Pepper, Tomato 4-5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 23.

Neemix (0.39) (azadirachtin) Eggplant, Pepper, Tomato 4-16 fl. oz. per acre. For nymph (immature) control. REI: 4-hour. PHI: 0-day. IRAC UN. OMRI-listed.

Oberon 2SC (spipomesifen) Eggplant, Pepper, Tomato 7-8.5 fl. oz. per acre. Do not exceed 25.5 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 23.

Platinum 2SC (thiamethoxam) Eggplant, Pepper, Tomato Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

Portal (0.4EC) (fenpyroximate) Eggplant, Pepper, Tomato 2 pt. per acre. Do not exceed 2 applications per season. REI: 12-hour. PHI: 1-day. IRAC 21A.

Sivanto 200 (1.67SL) (flupyridifurone) Eggplant, Pepper, Tomato 10.5-14 fl. oz. per acre foliar application, or 21-28 fl. oz. per acre soil application. REI: 4-hour. PHI: 1-day for foliar application, or 45-day for soil application. IRAC 4D.

Transform WG (50) (sulfoxaflor) Eggplant, Pepper, Tomato Use Transform WG at 2.0-2.25 oz. per acre or Closer 2SC at 4.25-4.5 fl oz. per acre. REI: 24-hour. PHI: 1-day. IRAC 4C.

Vermark (1.67SC) (cyantraniliprole) Eggplant, Pepper, Tomato 6.75-13.5 fl. oz. per acre. Apply via drip chemigation or soil injection. REI: 4-hour. PHI: 1-day. IRAC 28.

Fruiting Vegetables - Weeds

There are several herbicides labeled for the control of weeds preemergence, applied before crops are transplanted, or directed between the rows only after transplanting.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

Non-Pesticide

Eggplant, Pepper, Tomato Because these are warm-season, transplanted crops, there should be enough time in the spring to prepare a stale seedbed before planting, which should reduce weed pressure in the crop. These crops can also benefit from the soil warming properties of plastic mulch in addition to the in-row weed control. Mulches provide good weed control when planted into, when used for between row spaces, or in combination in-row and between-row. Materials include landscape cloth, plastic, biodegradable plastic. Straw mulch can delay growth by suppressing soil temperatures. Weeds between beds and along the edges of beds can be controlled with a combination of cultivation, mowing, or hand hoeing/pulling. Weeds along the edge of the mulches can be a particular challenge to avoid ripping the mulch. Some fresh market plantings are often small enough to accommodate some hand hoeing or pulling. For larger plantings it may make more sense to mechanically cultivate with tow-able tools between plastic rows or between bare-soil rows.

Broadleaf and Grass Weeds - Postemergence

Pesticide

glyphosate products (glyphosate) Eggplant, Pepper, Tomato 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations containing 3 lbs. ae per gal. (4 lbs. isopropylamine salt per gal.) at 1-5 qts. per acre, or formulations containing 4.5 lbs. ae per gal. (5 lbs. potassium salt per gal) at 0.66-3.3 qts. per acre. Broadcast 3 days before transplanting, or apply between crop rows with hooded or shielded sprayers. Use low rate for annuals and higher rates for perennials. Remove herbicide residue from plastic mulch prior to transplanting. Do not use row-middle applications for tomatoes grown on sandy soils because crop injury may occur. REI: 4 to 12-hour. PHI: 14-day. WSSA 9.

paraquat products (paraquat) Eggplant, Pepper, Tomato 2-4 pt. per acre of 2.0 lb. per gal. formulation or 1.3-2.7 pt. per acre of 3 lb. per gal. formulation. Add 1 qt. COC (1% v/v) or 0.5 pt NIS (0.25% v/v) per 25 gal. of solution and apply to weeds less than 6 in. tall. Apply prior to transplanting. The lowest rate can be applied directed between rows. Do not make more than 3 applications per year. Certified applicators must successfully complete an EPA-approved training program before mixing, loading, and/or applying paraquat. REI: 12 to 24-hour. PHI: 30-day for tomato WSSA 22. RUP.

Fruiting Vegetables - Weeds

Recommended Controls

All Weeds

The fruiting vegetables are warm-season crops nearly always started as transplants. When growers transplant crops into plastic mulch, they sometimes use herbicides underneath the mulch.

Reviewed by Stephen Meyers, Ben Phillips – Nov 2020
Broadleaf and Grass Weeds - Preemergence

Pesticide

Command 3ME (clomazone) *Pepper* | 0.67-2.67 pt. per acre. Not for banana pepper. Use lower rate on coarse soils, and higher rate on fine soils. Apply before transplanting. Set plant roots below herbicide. May cause temporary bleaching of crop leaves. For banana peppers in Michigan only (MI 24c exp 05/13/24): follow instructions for other peppers. REI: 12-hour. WSSA 13.

Daetal W-75 (DCPA) *Eggplant, Tomato* | Daetal W-75 at 6-14 lbs. per acre, or Daetal Flowable at 6-14 pts. per acre. Apply 4-6 weeks after transplanting when growing conditions favor good plant growth. May be applied over the top of transplants. REI: 12-hour. WSSA 3.

Devrinol DF-XT (50) (napropamide) *Eggplant, Pepper, Tomato* | 2-4 lbs. per acre. Use lower rate on coarse sandy soils and higher rate on heavy clay soils and between rows. Apply and incorporate before transplanting. Applied prior to laying plastic mulch. After harvest or prior to planting succeeding crops, deep moldboard or disk plow. Do not seed alfalfa, small grains, sorghum, corn, or lettuce for 12 months after application. REI: 24-hour. WSSA 15.

Dual Magnum (7.62EC) (s-metolachlor) *Eggplant, Pepper, Tomato* | For tomatoes in all states: Apply 1-2 pts. per acre. For peppers in Illinois (IL 24c exp. 03/25/24), Indiana, Michigan (MI 24c exp. 12/31/21), Minnesota (MN 24c exp. 12/31/20), and Ohio (OH 24c exp. 12/31/22): apply 0.5-1.0 pt. per acre. For eggplants in all states listed above except Ohio: 0.5-1.33 pts. per acre. Apply to soil before transplanting or within 48 hours after transplanting. Do not incorporate. Reduce risk of crop injury by applying after transplanting and by using a directed spray rather than spraying over the top of transplants. Crop injury may occur under unfavorable growing conditions. See label for additional precautions. Do not exceed 1 application per crop. REI: 24-hour. PHI: 30-day for tomatoes at rates less than 1.33 pts. per acre; 60-day for eggplants, and peppers; 90-day for tomatoes at rates greater than 1.33 pts. per acre. WSSA 15.

pendimethalin products (pendimethalin) *Eggplant, Pepper, Tomato* | 1 to 3 pts. per acre. Use 3.8 formulations. For use under plastic, apply as a band to top of bed after bed formation and before laying plastic, and/or apply to row middles after transplanting. On bare ground, apply and incorporate before transplanting, or apply before transplanting without incorporation, or apply to established plants as a directed spray. Avoid root contact with treated soil and avoid any contact with leaves or stems of crop. REI: 24-hour. PHI: 21-day for tomato, 70-day for pepper and eggplant. WSSA 3.

Prefar 4E (bensulide) *Eggplant, Pepper* | 5-6 qts. per acre. Use low rate on soils with less than 1% organic matter. Apply and incorporate before planting. REI: 12-hour. WSSA 8.

trifluralin products (trifluralin) *Pepper, Tomato* | Use 4EC formulations at 1-2 pts. per acre and do not exceed 4 pts. per acre per season on fine soils. Use 10G formulations at 5-10 lbs. per acre and do not exceed 20 lbs. per acre per season on fine soils. For peppers: broadcast and incorporate before transplanting. For tomatoes: apply as in peppers or apply directed spray between rows after transplanting and incorporate. May cause early stunting if growing conditions are unfavorable. To minimize injury, dip transplant roots in carbon slurry (2 lbs. per gal.) prior to planting, or include 2 oz. of carbon per gal. of transplant water. Use higher rates on heavier soils. 4-6 weeks of residual activity. Not effective on muck or high organic matter soils. REI: 12-hour. WSSA 3.

Broadleaf Weeds Only - Postemergence

Pesticide

Aim EC (2) (carfentrazone) *Eggplant, Pepper, Tomato* | 0.5-2 fl. oz. per acre. Apply a minimum of 1 day prior to transplanting, or apply between crop rows with hooded sprayer. Do not allow spray to contact crop. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gal. of spray solution (0.25% v/v). Weeds must be actively growing and less than 4 inches tall. Do not exceed 6.1 fl. oz. per acre per season. REI: 12-hour. WSSA 14.

League (75WDG) (imazosulfonyl) *Pepper, Tomato* | 4.0-6.4 oz. per acre. For peppers: apply to row middles after peppers are well-established and at least 10 inches tall. Avoid contact with crop and plastic mulch if present. Or apply as a directed spray under the pepper canopy and contacting no more than the lower 2 inches of stem and avoiding contact with fruit. For tomatoes: Apply to prepared bed at least 1 day before transplanting just prior to laying plastic, if applicable. Or apply over the top or directed to row middles of transplanted tomatoes from 3-5 days after transplanting through early bloom stage. If small, emerged weeds are present include a manufacturer-approved surfactant. REI: 12-hour. PHI: 21-day. WSSA 2.

Matrix SG (25WSG) (rimsulfuron) *Tomato* | 1-4 oz. per acre. Can be applied at 2-4 oz. per acre for preemergence weed control. Apply at 1-2 oz. per acre for postemergence weed control to tomato plants of at least the cotyledon stage. Add 0.5 pt. of NIS per 25 gals. of spray solution (0.25% v/v) if emerged weeds are present. Apply when weeds are less than 1 inch tall. Soil activity requires rainfall within 5 days of application. If crop is stressed, chlorosis may occur. Do not exceed 4 oz. per acre per year. REI: 4-hour. PHI: 45-day. WSSA 2.

meftalubiz products (metribuzin) *Tomato* | 4F formulations: 0.5-1 pt. per acre. 75DF formulations: 0.33-0.66 lb. per acre. Broadcast and incorporate before transplanting, or broadcast after transplants are established. Or, use 4F formulations at up to 2 pts. per acre, or 75DF formulations at 1.33 lbs. per acre and apply a directed spray between crop rows after transplants are established. May be applied preplant incorporated with trifluralin products for improved weed control. Crop injury may occur if applied over the top of plants within 3 days of cool, wet, or cloudy weather. Wait at least 14 days between applications. Do not exceed 2 pts. of 4F formulations, or 1.33 lbs. of 75DF
Broadleaf Weeds Only - Preemergence

Pesticide

League (75WDG) (imazosulfuron) Pepper, Tomato | 4.0-6.4 oz. per acre. For peppers: apply to row middles after peppers are well-established and at least 10 inches tall. Avoid contact with crop and plastic mulch if present. Or apply as a directed spray under the pepper canopy and contacting no more than the lower 2 inches of stem and avoiding contact with fruit. For tomatoes: apply to prepared bed at least 1 day before transplanting. Do not incorporate. For use under plastic, apply after bed formation and before laying plastic. Use only once in two years on the same soil. See rotational crop restrictions. Use on transplanted tomato and pepper only. REI: 12-hour. PHI: 30-day. WSSA 2.

Matrix SG (25WSG) (rimsulfuron) Tomato | 1-4 oz. per acre. Can be applied at 2-4 oz. per acre for preemergence weed control. Apply at 1-2 oz. per acre for postemergence weed control to tomato plants of at least the cotyledon stage. Add 0.5 pt. of NIS per 25 gals. of spray solution (0.25% v/v) if emerged weeds are present. Apply when weeds are less than 1 inch tall. Soil activity requires rainfall within 5 days of application. If crop is stressed, chlorosis may occur. Do not exceed 4 oz. per acre per year. REI: 4-hour. PHI: 45-day. WSSA 2.

metribuzin products (metribuzin) Tomato | 4F formulations: 0.5-1 pt. per acre. 75DF formulations: 0.33-0.66 lb. per acre. Broadcast and incorporate before transplanting, or broadcast after transplanting are established. Or, use 4F formulations at up to 2 pts. per acre, or 75DF formulations at 1.33 lbs. per acre and apply a directed spray between crop rows after transplants are established. May be applied preplant incorporated with trifluralin products for improved weed control. Crop injury may occur if applied over the top of plants within 3 days of cool, wet, or cloudy weather. Wait at least 14 days between applications. Do not exceed 2 pts. of 4F formulations, or 1.33 lbs. of 75DF formulations per acre per season. REI: 12-hour. PHI: 7-day. WSSA 5.

Sandea (75) (halosulfuron) Eggplant, Pepper, Tomato | 0.5-1.0 oz. per acre. For tomato: apply 0.5-1.0 oz. per acre to the soil surface after final soil preparation or bed shaping and just before applying plastic mulch. Wait at least 7 days before transplanting. Or apply a minimum of 14 days after transplanting over the top or as a directed/shielded spray, avoiding contact with crop and plastic mulch, if present. For eggplant and pepper: apply 0.5-1.0 oz per acre to row middles, avoiding contact with crop and plastic mulch, if present. If weeds are present, add 0.5 pt. NIS per 25 gal. of solution (0.25% v/v). Do not exceed 2 applications or 2 oz. per acre per 12 month period. REI: 12-hour. PHI: 30-day. WSSA 2.

Eggplant, Pepper, Tomato

For tomato:

Poast (1.5EC) (sethoxydim) Eggplant, Pepper, Tomato | Use 2EC formulations at 6-8 fl. oz. per acre with 1 qt. COC per 25 gals. of spray solution (1% v/v). For tomatoes, use up to 16 fl. oz. per acre. Do not exceed 32 fl. oz. per acre per season. Use Select Max at 9-16 fl. oz. per acre with 0.5 pt. NIS per 25 gals. of spray solution (0.25% v/v). For tomatoes, use up to 32 fl. oz. per acre. Do not exceed 64 fl. oz. per acre per season. Use low rates for annual grasses, the high rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. REI: 24-hour. PHI: 20-day. WSSA 1.

Spartan 4F (sulfentrazone) Tomato | 2.25-8.0 fl. oz. per acre. Apply before transplanting as a broadcast or banded application. Will also control nutsedge. Do not use on soils classified as sand, which have less than 1% organic matter. Do not exceed 12 fl. oz. per year. REI: 12-hour. WSSA 14.

Grass Weeds Only - Postemergence

Pesticide

clethodim products (clethodim) Eggplant, Pepper, Tomato | Use 2EC formulations at 6-8 fl. oz. per acre with 1 qt. COC per 25 gals. of spray solution (1% v/v). For tomatoes, use up to 16 fl. oz. per acre. Do not exceed 32 fl. oz. per acre per season. Use Select Max at 9-16 fl. oz. per acre with 0.5 pt. NIS per 25 gals. of spray solution (0.25% v/v). For tomatoes, use up to 32 fl. oz. per acre. Do not exceed 64 fl. oz. per acre per season. Use low rates for annual grasses, the high rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. REI: 24-hour. PHI: 20-day. WSSA 1.

Poast (1.5EC) (sethoxydim) Eggplant, Pepper, Tomato | 1.0-1.5 pt. per acre. Add 1 qt. COC per 25 gal. of spray solution (1% v/v). Spray on actively growing grass. Use high rate on quackgrass. Do not exceed 4.5 pt. per acre per season. REI: 12-hour. PHI: 20-day for eggplant and tomato, 7-day for peppers. WSSA 1.
Leafy Vegetables and Herbs - Horticulture

Reviewed by Ben Phillips, Liz Maynard – Dec 2020

Crop Description

Most leafy vegetables and herbs grow well under the same sunlight, fertility, soil and growing conditions, and cultural techniques similar to many other vegetable crops. Pay special attention to drainage and moisture requirements of certain herbs, as many are very sensitive to soil moisture conditions. Using plastic mulches, trickle irrigation, and raised beds may provide the necessary moisture and drainage requirements for the herb crop.

It is important to know the botanical relationships of leafy greens and herbs because similar pests will go to related plants. Herbs and leafy greens come from at least six botanical families. Within those family groups you can expect similar pests. In this guide we try to provide some precision to this. However, when using pesticides, you must abide by the EPA Crop Groupings on pesticide labels.

Amaryllidaceae, the Amaryllis family, contains all the onion-type aromatic plants. However, Chives are classified as a “herb” in EPA Crop Group 19. The pests for plants in this family are shared with the Onions chapter.

Apiaceae, the Carrot family, contains Cilantro, Coriander, Dill, Fennel, and Parsley classified as “herbs” or “spices” EPA Crop Group 19. Celery, Parsley and Florence Fennel are also classified as a “leafy green” or “leafy petiole” in EPA Crop Group 4. But this family also includes Carrots, and Parsnips (EPA Crop Group 1). The pests for plants in this family are shared with the Celery, and Root Crops chapters.

Asteraceae, the Sunflower family, contains Chicory, Endive, Escarole, Lettuce, and Radicchio classified as “leafy greens” in EPA Crop Group 4. But this family also includes Tarragon, classified as a “herb” in EPA Crop Group 19.

Brassicaceae, the Mustard family, contains Arugula and Cress classified as “leafy greens” in EPA Crop Group 4. But this family also includes cole crop and mustard-type plants (EPA Crop Group 5), some of which are root crops (EPA Crop Group 1). The pests for plants in this family are shared with the Cole Crops and Brassica Leafy Greens, and Root Crops chapters.

Chenopodiaceae, the Goosefoot family, contains Spinach and Swiss chard classified as “leafy green” or “leafy petiole” in EPA Crop Group 4. The pests for plants in this family are shared with Beets (EPA Crop Group 1) in the Root Crops chapter.

Lamiaceae, the Mint family, contains Basil, Lavender, Marjoram, Mint, Oregano, Rosemary, Sage, Savory, and Thyme classified as “herbs” in EPA Crop Group 19.

Marketing Herbs

Fresh herbs certainly make excellent cash crops. However, growers should be cautious before beginning herb production. Establish markets and buyers need before purchasing any seed. Some of the most popular culinary herbs include basil, chives, dill, French tarragon, mints, oregano, parsley, rosemary, and thyme. However, growers should do their own marketing study to determine which herbs are suited for their areas. Possible outlets for culinary herbs include health food stores, grocery stores, upscale restaurants, farmers markets, and food manufacturing companies. Growers are also strongly encouraged to have greenhouses for year-round production. Detailed management descriptions of some popular herbs follow.

Planting, Spacing, and Harvesting

Basil

Basil, French basil, or sweet basil (Ocimum basilicum) is a popular, tender, annual herb native to India and Asia. Basil is commercially grown for its green, aromatic leaves, which are used fresh or dried as a flavoring. The common pests of basil are plant bugs, Japanese beetle, and downy mildew.

Basil can be direct-seeded or transplanted to the field in late spring after all danger of frost is over. Basil seeds normally germinate in 8 to 14 days. Basil requires full sun and prefers moist, well-drained soil with a pH of 6.0. Typical spacing for basil is 12 inches between plants, 24 to 36 inches between rows.

Trickle or overhead irrigation is necessary. Basil grown for dried leaves or essential oil is cut just prior to the appearance of flowers. The foliage should be cut at least four to six leaves above the ground to allow for regrowth and a subsequent crop.

Chives

Chives (Allium schoenoprasum) is a perennial native to Asia. It was first used by the Chinese and then the ancient Greeks. Fresh leaves are excellent for making herbal vinegars and butter. It is also used in salad, soup, and cheese. Chives are also used to add a mild onion flavor to fish, salads, steamed vegetables, soups, and omelets. No serious pests or diseases were reported, although chives can get downy mildew and rust.

Chives require full sun and well-drained soil with a pH of 6.0. Chive seeds require darkness, constant moisture, and a temperature of 60° F to 70° F for best results. Sow them 1/2 inch deep in pots or flats. Germination occurs in 2 to 3 weeks. Transplant seedlings to the field when they are 4 weeks old. Chives reach a height of 18 inches, a width of 1 to 2 inches the first year from seed, and 10 to 14 inches in subsequent years.

To harvest chives, cut chive leaves 2 inches above the ground.

Cilantro

Cilantro (Coriandrum sativum) is an herb with a unique scent and flavor. Native to Egypt, cilantro is one of the most ancient herbs still cultivated. It is also known as Mexican parsley, Chinese parsley, or coriander. The dried seedpod is known as coriander and is usually used as a spice in baking and desserts.
Leafy Vegetables and Herbs - Horticulture

Cilantro leaves are a well-known salsa ingredient. Cabbage looper and green peach aphid sometimes cause economic damage by curling and twisting leaves, and stunting the plant. Bacterial leaf spot, which is seedborne, and Fusarium wilt are common diseases in cilantro production. Effective management strategies involve using clean seed material and avoiding fields that have a history of Fusarium.

This annual plant does best in cool weather and should be planted in the early spring or in the fall. Optimum growing temperatures are between 50° F to 85° F. Plant seeds 1/2 inch deep and 2 to 3 inches apart. Germination may take 10 to 14 days. Cilantro grows 2 to 3 feet tall and thrives in moderately rich, light, well-drained soil in full to partial sun. Cilantro is highly salt sensitive, and soil electrical conductivity values exceeding 1 dS/m could reduce yields. Plants have shallow root systems, so frequent irrigation is needed.

To harvest, cut cilantro either just below the soil or 1-1/2 to 2 inches above the crown, bunch, and tie together with a rubber band.

Dill

Dill (Anethum graveolens) is native to the Mediterranean area and southern Russia. It is a hardy annual and sometimes is grown as a biennial. Dill is commonly used as a seasoning for soups, fish, and pickles. Its aromatic leaves, seeds, flowers, and stems can also be used to flavor cabbage, vinegar, butter, apple pie, cakes, and bread. Dill does not have any serious pest or disease problems. However, phoma blight, rusty root, and stem rot have been reported.

Direct-seed in spring at 1/4 to 1/2 inches deep in rows that are 2-3 feet apart. In-row spacing should be 10 to 12 inches. Since dill has long taproots, it should not be transplanted.

Fresh leaves should be harvested before flowering begins. Harvest seeds as soon as seed heads are brown and dry. Stalks with immature seed heads are frequently harvested for direct sales, paired with pickling cucumbers.

Chicory, Endive, Escarole, Radicchio

This group of leafy crops come from two species (Cichorium endivia, and C. intybus), with a diverse appearance and color in immature and mature plants. Some are all green, others are red, and other have white stalks. They are used as a salad green. Witloof, or Belgian endive, is a type of endive that is harvested in the fall as a root, and forced indoors for a tender head of tightly wrapped and blanched leaves, called a chicon. Common pest problems are leafminers and white mold.

Direct seed or transplant in rows 12 to 15 inches apart. Plants 10 to 16 inches apart in row. Seed 1 to 2 pounds per acre. For forcing endive, seed so that after 150 days roots can be dug and stored in a cool environment.

To harvest, cut whole heads from the base of the plants. Some varieties will regenerate harvestable leaves, for loose leaf mixes. Plants will not regenerate new marketable heads.

To force endive, harvest roots in the late fall when they are 1-1/4 to 2-1/4 inches in diameter and 7 inches long and plant them indoors upright in soil about half as deep as the root. They must go through a cold conditioning of 32° to 34° F for at least a week before raising the temperature to allow new growth to occur. Maintain soil moisture and harvest when new sprouts are about 3 inches long.

Fennel

Fennel (Foeniculum vulgare) is a cool-season aromatic herb that originated in the Mediterranean region. It is a perennial but is usually grown as an annual that grows to about 3 to 4 feet tall. Leaves are used as potherbs and for seasoning and garnishing purposes along with the bulb, which could be used as a fresh salad. Leaf blight and stem rot are two major diseases affecting fennel.

Plant in full sun in rich and well-drained soil. Plant seeds 1/4 to 1/2 inches deep in rows that are 2 to 3 feet apart. In-row spacing should be 10 to 12 inches. Transplant to the field early in the spring. Planting to harvest for direct-seeded fennel could range from 90 to 150 days; and 110 to 125 days for transplanted fennel.

Harvest by cutting just above the bulb near the leaf bases. Bulbs are further trimmed by cutting away most of the top growth.

French Tarragon

French tarragon (Artemisia dracunculus) originates from southern Europe. Do not confuse it with Russian tarragon (Artemisia dracunculoides) which is much coarser, and has paler leaves, and a bitter taste. French tarragon is used to flavor vinegar, herbal butter, shellfish, pork, beef, poultry, many vegetables, and rice. Fresh leaves can also be used in salads, tartar sauce, and French dressing. French tarragon is prone to root rot in heavy and wet soils.

It produces few seeds and must be propagated by stem cuttings or division. Plant in full sun in rich, well-drained soil with a pH of 6.9. French tarragon is a woody perennial that eventually grows 2 feet tall. Divide the plants every three to four years.

Two harvests can generally be made each year, the first six to eight weeks after setting out. Harvest until leaves turn yellow in the fall.

Lettuce

Lettuce (Lactuca sativus) varieties fall into four main types; leaf, romaine/cos, crispage/iceberg, and butterhead/bibb. They are all used similarly as a fresh green eaten raw, and rarely cooked.

For full size head production, direct-seed or transplant in rows 12 to 15 inches apart. Plants 10 to 16 inches apart in row. Seed 1 to 2 pounds per acre. For harvest of small leaves with one or more cuttings, seed in bands 2 to 4 inches wide with about 60 seeds per foot.

Romaine, crispage and bibb lettuces form heads that are harvested one time. Leaf lettuces can be harvested as heads once, or leaves can be cut two or three times, with about 4 to 6 weeks
Mint

Mints ( Mentha spp. ) are a group of perennial herbs that are mostly native to Europe and Asia. Some are indigenous to South America, America, and Australia. Mint is naturalized throughout North America from southern Canada to Mexico. Japanese mint ( M. arvensis var. piperascens ), peppermint ( M. x piperita ), and spearmint ( M. spicata ) are the mint species mostly cultivated. Mint is susceptible to verticillium wilt, mint rust, and mint anthracnose. Pests that could bother mint include spider mites, loopers, mint flea beetles, mint root borers, cutworms, root weevils, and aphids.

Mints can be propagated by cuttings or seeds, except peppermint can only be propagated through cuttings. Peppermint is a sterile F1 hybrid of M. aquatica and M. spicata and does not produce seeds. Mints can be planted in full sun or partial shade, and require rich, well-drained soil with a pH of 6.5. Spaced 18 to 24 inches apart, mints can reach a height of 12 to 24 inches and grow into a thick perennial row.

Mint can be harvested almost as soon as it comes up in the spring. Young, tender leaves and stems are the best.

Oregano

Oregano ( Origanum vulgare subsp. hirtum or O. vulgare subsp. viridulum ) is native to the Mediterranean region and naturalized in the eastern United States. It is added to tomato sauce for a hot and peppery taste. It adds dimension to yeast breads, marinated vegetables, roasted meats, and fish. Some of the pest and disease problems for oregano include aphids, leafminers, spider mites, and root rot.

Oregano is a perennial that requires a site with full sun and well-drained soil that has a pH of 6.8. Direct-seed in the field and do not cover seeds; oregano seeds need sunlight to germinate. However, flavor can greatly vary among seed propagated plants. It is better to propagate by root divisions or cuttings from plants that are known to have strong flavor. Oregano reaches a height of 12 to 24 inches and a width of 10 to 20 inches.

Oregano sprigs can be cut off when the plant is at least 6 inches high. In June, vigorously grown plants can be cut back to the lowest set of leaves. Plants generally leaf out after two weeks and can be cut back again in August.

Parsley

Parsley ( Petroselinum crispum ) is grown exclusively for its green leaves, or tops. The curled-leaf and Italian flat-leaf types are the most popular. Popular curled-leaf parsley cultivars include Moss Curled, Dark Moss Curled, Banquet, Decorator, Deep Green, Forest Green, Improved Market Gardener, Sherwood, and Perfection. Plain-leaf type cultivars include Plain and Plain Italian Dark Green. Hamburg type, which is grown for its enlarged edible root consists of the Hamburg cultivar.

Field-seeding begins in early April and ends in May. Row spacing should be 12 to 16 inches. In row plant spacing should be 4 to 8 inches. Direct-seeding rate will depend on direct seeding equipment and could require 14 to 30 pounds per acre. Germination is enhanced by presoaking seeds in water for 24 hours and then allowing them to partially dry.

Parsley is cut 1-1/2 to 2 inches from ground level to allow regrowth. About three or four cuttings are made, depending on the length of the growing season.

Rosemary

Rosemary ( Rosmarinus officinalis ) is a tender perennial hardy to zones 8 to 10. It is native to the Mediterranean, Portugal, and northeastern Spain. It is pungent, somewhat piney, mint-like yet sweeter, with a slight ginger flavor that harmonizes with poultry, fish, lamb, beef, veal, pork, and game. Rosemary also enhances vegetables, cheese, and eggs. Pest and disease problems include aphids, spider mites, scale, mealybugs, root rot, and Botrytis gray mold.

Plant rosemary in a sunny location with well-drained and slightly acidic soil. Rosemary can be started from seeds, but germination rates are very low. Use fresh seeds, preferably less than two weeks old. Start plants from cuttings or by layering from existing plants. Rosemary eventually reaches a height of 72 inches and a width of 36 to 72 inches.

Harvesting can be done throughout the year. Cut about 4-inch pieces from the tips of the branches, being careful not to remove more than 20 percent of the growth at one time.

Spinach

Spinach ( Spinacia oleracea ) is a nutritious leafy green made popular as a canned product by the cartoon ‘Popeye the Sailor Man,’ but currently is more commonly eaten raw as a salad green. Common problems are white rust, flea beetles, and bolting.

In the Midwest, spinach is commonly seeded in late summer or fall, and grown through the winter under row cover or in hoophouses. But, late winter and early spring plantings are also successful. Direct seed or transplant in rows 12 to 18 inches apart, with 2 to 6 plants per foot of row. Or for baby leaf spinach seed in bands 2 to 4 inches wide with about 40 seeds per foot. Seed 12 to 20 pounds per acre. Plants bolt in response to increasing daylength so overwintered and spring crops are usually finished by late spring.

Harvest spinach with sequential cuttings when leaves are 4 to 6 inches long, or desired length for your market. Depending on the time of year, they will be ready for another harvest in 4 to 6 weeks. Or do a once-over harvest when plants reach full size.

Thyme

Thyme ( Thymus vulgaris ) is native to the western Mediterranean region. It is a small, many-branched, and perennial shrub. Thyme tastes delicately green with a faint clover aftertaste. It ranks as one of the finest herbs of French cuisine. Thyme leaves and sprigs are used in clam chowder, meats, herbal butter, and
Leafy Vegetables and Herbs - Diseases

vinegar. Use it with vegetables, cheese, eggs, and rice. The pest and disease problems include spider mites and root rot.

Start seeds indoors and transplant seedlings into the field once the danger of frost is over. Thyme reaches a height of 12 inches and a width of 10 to 12 inches. Thyme can be propagated from cuttings, by layering, and division.

Harvest the entire plant by cutting it back to 2 inches above ground in midsummer. One more harvest can be expected before the season ends.

Fertilizing

**pH:** Maintain a soil pH of 6.5 to 6.8 for leafy greens, and 6.0 to 7.0 for herbs. On muck soils maintain the pH at 5.5 to 6.0. Spinach is particularly sensitive to soil acidity.

Before planting apply 40 to 60 pounds N per acre, 0 to 150 pounds P₂O₅ per acre, and 0 to 200 pounds K₂O per acre. Adjust according to soil type, previous management, and soil test results for your state. For direct-seeded crops band an additional 40 pounds N and 40 pounds P₂O₅ per acre 2 inches to the side and 2 inches below the seed.

Sidedress with 30 to 60 pounds N per acre three to four weeks after thinning or transplanting, and again after each cutting.

Reduce the total amount of fertilizer N applied by the value of N credits from green manures, legume crops grown in the previous year, compost and animal manures, and soils with more than 3 percent organic matter. The total amount of N from fertilizer (including starter) and other credits should be 90 to 120 pounds N per acre for culinary herbs, up to 140 pounds N per acre for lettuce, and up to 170 pounds N per acre for spinach. For herbs grown for seeds, such as coriander, fennel, and dill, use 60 to 90 pounds N per acre.

Leafy Vegetables and Herbs - Diseases

Reviewed by Dan Egel – Nov 2020

Recommended Controls

**Aster Yellows (Purple-Top Wilt) of Multiple Crops - Phytoplasma Mollicutes**

This pathogen is transmitted by leafhoppers. Infection rates can jump when adjacent crops are harvested mid-season, such as alfalfa or wheat.

**Pesticide**

**Insecticides** Head Lettuce, Leaf Lettuce | Use an insecticide to control leafhoppers that transmit the disease. Leafhoppers must be controlled before they feed. See Insect section.

**Bottom Rot of Lettuce - Rhizoctonia Fungus**

**Non-Pesticide**

Chicory, Endive, Escarole, Head Lettuce, Leaf Lettuce, Radicchio | Clean and sanitize transplant trays, benches, and tools. Rogue infected transplants. Avoid working field under wet conditions. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

azoxy strebin products (azoxy strebin) Chicory, Endive, Escarole, Head Lettuce, Leaf Lettuce, Radicchio | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

Endura (WG) (boscalid) Head Lettuce, Leaf Lettuce | 8-11 oz. per acre. Suppresses Bottom Rot. REI: 12-hour. PHI: 14-day. FRAC 7.

iprodione products (iprodione) Head Lettuce, Leaf Lettuce | 1.5-2 pts. per acre. Formulations of iprodione include Nevada and Rovral. REI: 24-hour. PHI: 14-day. FRAC 2.

Luna Sensation (fluopyram, trifloxystrobin) Chicory, Endive, Escarole, Head Lettuce, Leaf Lettuce, Radicchio | 7.6 fl. oz. per acre. Bottom rot and downy mildew suppression only. Can be applied as a band over lettuce. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

Damping-Off Seed and Seedling Rots of Multiple Crops - Multiple Pathogens

**Non-Pesticide**

Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme | Practice good greenhouse sanitation of equipment, tools propagation trays/pots, and surfaces. Avoid excess moisture to the transplants in the greenhouse by monitoring irrigation frequency. Plant in warm field soils. The fungi responsible for damping-off in field soils cause more loss when the seedling is slow to emerge.

**Pesticide**

Orondis Gold (DC) (oxathiapiprolin, mefenoxam) Head Lettuce, Leaf Lettuce | 13.9-27.8 fl. oz. per acre. Use as an at-plant soil drench, banded spray in furrow, or through drip irrigation. Do not follow soil applications of Orondis Gold with
foliar applications of Orondis Opti, or Orondis Ultra. REI: 4-hour. PHI: 7-day. FRAC 49, FRAC 4.

**Previcur Flex (6) (propamocarb)** Head Lettuce, Leaf Lettuce | For damping-off of lettuce caused by Pythium and Phytophthora only. REI: 12-hour. PHI: 0-day. FRAC 28.

### Downy Mildew of Lettuce - Bremia Oomycete

#### Non-Pesticide

*Chicory, Endive, Escarole, Head Lettuce, Leaf Lettuce, Radicchio* | Use disease-free seed and transplants. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 118°F for 30 minutes for lettuce. Rotate to non-host crops for 3 years. Varieties with partial resistance are available. Use raised beds and adequate plant spacing to improve drainage, air flow. Monitor humidity in the hoophouse and vent appropriately. Good weed control of Aster weeds like dandelion, groundsel, and thistles is important to limit other hosts near the crop.

#### Pesticide

*Actigard (0.5WDG) (acibenzolar-s-methyl)* Head Lettuce, Leaf Lettuce | 0.75-1 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC P1.

*azoxystrobin products (azoxystrobin)* Chicory, Endive, Escarole, Head Lettuce, Leaf Lettuce, Radicchio | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heron) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

*Curzate 60DF (cymoxanil)* Head Lettuce, Leaf Lettuce | 5.0 oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 27.

*Luna Sensation (fluopyram, trifloxystrobin)* Chicory, Endive, Escarole, Head Lettuce, Leaf Lettuce, Radicchio | 7.6 fl. oz. per acre. Bottom rot and downy mildew suppression only. Can be applied as a band over lettuce. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

*mancozeb products (mancozeb)* Head Lettuce, Leaf Lettuce | Several formulations of mancozeb (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 10-day for head lettuce, 14-day for leaf lettuce. FRAC M3.

*Merivon (fluxapyroxad, pyraclostrobin)* Head Lettuce, Leaf Lettuce | 6-11 fl. oz. per acre. Downy mildew suppression only. REI: 12-hour. PHI: 1-day. FRAC 7, FRAC 11.

*Orondis Ultra Premix (SC) (oxathiapiprolin, mandipropamid)* Head Lettuce, Leaf Lettuce | 5.5-8.0 fl. oz. per acre. REI: 4-hour. PHI: 1-day. FRAC 49, FRAC 40.

### Downy Mildew of Multiple Crops - Peronospora Oomycete

#### Non-Pesticide

*Arugula, Basil, Cress* | Use disease-free seed and transplants. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122°F for 25 minutes for spinach, and 122°F for 15 minutes for cress. Rotate to non-host crops for 3 years. Varieties with partial resistance are available. Use raised beds and adequate plant spacing to improve drainage, air flow. Monitor humidity in the hoophouse and vent appropriately.

#### Pesticide

*azoxystrobin products (azoxystrobin)* Basil, Chive, Spinach | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heron) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.
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**Curzate 60DF (cymoxanil)** *Spinach* | 3.2-5.0 oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 27.

**Merivol (fluxapyroxad, pyraclostrobin)** *Chive, Spinach* | 6-11 fl. oz. per acre. Downy mildew suppression only. REI: 12-hour. PHI: 1-day. FRAC 7, FRAC 11.

**Topguard EQ (SC) (flutriafol, azoxystrobin)** *Spinach* | 5.5-8.0 fl. oz. per acre. REI: 4-hour. PHI: 1-day. FRAC 49, FRAC 40.

**Tanos (DF) (famoxadone, cymoxanil)** *Chive, Spinach* | 8-10 oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC 27.

**Revus (2.08SC) (mandipropamid)** *Basil, Chive, Spinach* | 8 fl. oz. per acre. REI: 4-hour. PHI: 1-day. FRAC 40.

**Ranman 400SC (34.5) (cyazofamid)** *Basil, Chive, Spinach* | 2.75-3.0 fl. oz. per acre. High rate only allowed on basil. REI: 12-hour. PHI: 0-day. FRAC 21.

**Presidio (4SC) (fluopicolide)** *Chive, Spinach* | 3-4 fl. oz. per acre. REI: 12-hour. PHI: 2-day. FRAC 43.

**Fontelis (1.67SC) (penthiopyrad)** *Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme* | 14-24 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 7.

**Switch 62.5WG (cyprodinil, fludioxonil)** *Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme* | 11-14 oz. per acre. Powdery mildew suppression only. REI: 12-hour. PHI: 0-day. FRAC 9, FRAC 12.

**Endura (WG) (boscalid)** *Head Lettuce, Leaf Lettuce* | 8-11 oz. per acre. Suppresses Bottom Rot. REI: 12-hour. PHI: 14-day. FRAC 7.

**Pesticide**

**Botran 75W (dichloro-nitroaniline)** *Endive, Head Lettuce, Leaf Lettuce* | Rate depends on crop and application method. Flowable formulations may be available. REI: 12-hour. PHI: 14-day. FRAC 14.

**Nematodes**

**Non-Pesticide**

*Head Lettuce, Leaf Lettuce* | Collect soil samples for nematodes in the fall and avoid fields with high numbers. Rotate to a non-broadleaf crop, such as grass grains or sweet corn for >3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue and displace nematodes is an important method to prevent nematode build-up. Anaerobic soil disinfestation (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain nematodes.

**Powdery Mildew of Multiple Crops - Erysiphe Fungus**

Powdery mildew is more likely to be a problem in greenhouse lettuce than in open fields.

**Non-Pesticide**

*Arugula, Basil, Chicory, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme* | Rotate to non-host crops for 2 years. Use raised beds and adequate plant spacing to improve drainage, air flow. Monitor humidity in the hoophouse and vent appropriately. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.
**Pesticide**

**Fontelis (1.67SC) (penthiopyrad)** *Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme* | 14-24 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 7.

**Luna Sensation (fluopyram, trifloxystrobin)** *Arugula, Chicory, Cress, Endive, Escarole, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach* | 7.6 fl. oz. per acre. Can be applied as a band over lettuce. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.

**Merivon (fluxapyroxad, pyraclostrobin)** *Basil, Cilantro, Coriander, Dill, Fennel, Florence Fennel, Marjoram, Oregano, Parsley, Rosemary, Sage, Savory, Thyme* | 4-11 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 7, FRAC 11.

**Procure 480SC (4) (triflumizole)** *Head Lettuce, Leaf Lettuce* | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 3.

**Quintec (2.08) (quinoxyfen)** *Head Lettuce, Leaf Lettuce* | 4-6 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 13.

**Switch 62.5WG (cyprodinil, fludioxonil)** *Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme* | 11-14 oz. per acre. Powdered mildew suppression only. REI: 12-hour. PHI: 0-day. FRAC 9, FRAC 12.

**Topguard EQ (SC) (flutriafol, azoxystrobin)** *Fennel, Florence Fennel, Parsley* | 6-8 fl. oz. per acre. REI: 12-hour to 3-day. PHI: 1-6 lbs. per acre. Apply immediately after harvest or 3-4 months before planting. REI: 4-hour. FRAC NC. OMRI-listed.

**Viruses of Multiple Crops - Multiple Pathogens**

Lettuce Mosaic Virus (LMV) can be carried in infected seed and is spread by aphids.

**Non-Pesticide**

**Chicory, Endive, Escarole, Head Lettuce, Leaf Lettuce, Radicchio** | For LMV: use only mosaic-free indexed seed (sold as MTO). Greenhouse sanitation and good weed control of Aster weeds like dandelion, groundsel, and thistles is important to limit other hosts near the crop. Use a monitoring program to time the release of natural enemies of aphids (see insect section). Keep new lettuce plantings as far as possible with the previous production area. Remove infected transplants and do not plant them out into fields. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**White Mold (Timber Rot, Drop, Stem Rot) of Multiple Crops - Sclerotinia Fungus**

This soil pathogen is long-lived in the soil, and has a wide host range on broadleaved crops and weeds, including beans, vine crops, lettuce, tomatoes, peppers, and cole crops. It goes by other names in other crops, such as Drop, White Mold, Stem Rot, and Timber Rot.

It is more commonly found in greenhouses and high tunnels where humidity and temperatures are high. The fungus often infects flowers, which then drop off and infect the stems that they land on. The stems take on a woody appearance and can split open. On lettuce, the pathogen infects the root crown and heart of the plant, which makes the leaves drop and rot. Inspection of the stems, or lettuce hearts, will reveal small black pellets that are the overwintering body of the pathogen.

**Non-Pesticide**

**Botran 75W (dichloro-nitroaniline)** *Endive, Head Lettuce, Leaf Lettuce* | Rate depends on crop and application method. Flowable formulations may be available. REI: 12-hour. PHI: 14-day. FRAC 14.

**Contans WG (5) (Coniothyrium minitans strain CON/M/91-08)** *Head Lettuce, Leaf Lettuce* | 1-6 lbs. per acre. Apply immediately after harvest or 3-4 months before planting. REI: 4-hour. FRAC NC. OMRI-listed.

**Endura (WG) (boscalid)** *Head Lettuce, Leaf Lettuce* | 8-11 oz. per acre. Suppresses Bottom Rot. REI: 12-hour. PHI: 14-day. FRAC 7.

**Fontelis (1.67SC) (penthiopyrad)** *Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage,
### Leafy Vegetables and Herbs - Insects

**Savory, Spinach, Swiss Chard, Tarragon, Thyme** | 14-24 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 7.

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**iprodione products (iprodione)** **Head Lettuce, Leaf Lettuce** | 1.5-2 pts. per acre. Formulations of iprodione include Nevado and Rovral. REI: 12-hour. PHI: 3-day. FRAC 2.

**Kenja 400SC (3.33) (isofetamid)** **Head Lettuce, Leaf Lettuce** | 12.3 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 7.

**Luna Sensation (fluopyram, trifloxystrobin)** **Arugula, Chicory, Cress, Endive, Escarole, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach** | 7.6 fl. oz. per acre. Can be applied as a band over lettuce. REI: 12-hour. PHI: 0-day. FRAC 7, FRAC 11.


**Switch 62.5WG (cyprodinil, fludioxonil)** **Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme** | 11-14 oz. per acre. Powdery mildew suppression only. REI: 12-hour. PHI: 0-day. FRAC 9, FRAC 12.

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**Wilt of Multiple Crops - Fusarium Fungus**

**Non-Pesticide**

**Basil** | Avoid fields with a history of the disease. Rotate to non-host crops for >6 years. Varieties with Fusarium wilt resistance are available. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up. Anaerobic soil disinfection (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain this pathogen.

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**Leafy Vegetables and Herbs - Insects**

Reviewed by Laura Ingwell, Raymond Cloyd, Luis Cañas – Nov 2020

**Recommended Controls**

**Aphids**

**Seedlings:** 2 aphids per plant.

**Established Plants:** 7 aphids per plant.

**Pesticide**

**Actara (25WDG) (thiamethoxam)** **Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard** | 1.5-3.0 oz. per acre. Apply as a foliar spray. Do not exceed 11 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Admire Pro (4.6SC) (imidacloprid)** **Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme** | 4.4-10.5 fl. oz. per acre soil application, or 1.3 fl oz. per acre foliar application on leafy greens. 4.4-10.5 fl. oz. per acre soil application for fennel and swiss chard. 7.0-10.5 fl. oz. per acre soil application, or 1.2 fl oz. per acre foliar application on herbs. Do not exceed 10.5 fl. oz. per acre per season from soil applications. Do not exceed 3.6 fl. oz. per acre per season from foliar applications. REI: 12-hour. PHI: 45-day for soil application on fennel and swiss chard, 14-day for soil application on herbs, 21-day for soil application on leafy greens, 7-day for foliar applications on leafy greens and herbs IRAC 4A.

**Assail 30SG (acetamiprid)** **Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard** | Use 30SG formulations at 2.0-4.0 oz. per acre and do not exceed 20 oz. per acre per season. Use 70WP formulations at 0.8-1.7 oz. per acre and do not exceed 8.5 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

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**White Rust of Multiple Crops - Albugo Oomycete**

**Non-Pesticide**

**Arugula, Cress, Spinach** | Use disease-free seed and transplants. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122 F for 25 minutes for spinach. Rotate to non-host crops for 3 years. Varieties with partial resistance are available. Use raised beds and adequate plant spacing to improve drainage, air flow. Monitor humidity in the hoophouse and vent appropriately.

**Pesticide**

**Merivon (fluxapyroxad, pyraclostrobin)** **Arugula, Cress, Spinach** | 4-11 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 7, FRAC 11.

**Presidio (4SC) (fluopicolide)** **Arugula, Cress, Spinach** | 3-4 fl. oz. per acre. REI: 12-hour. PHI: 2-day. FRAC 43.

**Tanos (DF) (famoxadone, cymoxanil)** **Arugula, Cress, Spinach** | 8-10 oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC 27.

**Topguard EQ (SC) (flutriafol, azoxystrobin)** **Arugula, Cress, Spinach** | 6-8 fl. oz. per acre. REI: 12-hour to 3-day. PHI: 7-day. FRAC 3, FRAC 11.
**Leafy Vegetables and Herbs - Insects**

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**Belay (2.13SC) (clothianidin)** *Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard* | Soil applications: 9-12 fl. oz. per acre. Foliar applications: 3-4 fl. oz. per acre. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day for soil application, or 7-day for foliar application. IRAC 4A.

**Beleaf (50SG) (flonicamid)** *Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard* | 2.0-2.8 oz. per acre. Do not exceed 8.4 oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 29.

**Brigade 2EC (bifenthrin)** *Cilantro, Coriander, Head Lettuce* | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre and do not exceed 80 oz. per acre. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

**Capture LFR (1.5) (bifenthrin)** *Head Lettuce* | 3.4-6.8 fl. oz. per acre. *Lettuce root aphid only.* See label for application methods. Do not exceed 0.1 lb. per acre per season as an at-plant application. Do not exceed 0.5 lb. per acre per season including at-plant plus foliar applications of other bifenthrin products (such as Brigade 2EC). REI: 12-hour. PHI: see label. IRAC 3A. RUP.

**Dimethoate 4EC (dimethoate)** *Endive, Leaf Lettuce, Swiss Chard* | Use 2.67EC formulations at 0.75 pt. per acre and do not exceed 2.2 pts. per acre per season. Use 4EC, LV-4, and 400 formulations at 0.5 pt. per acre and do not exceed 1 pt. per acre per season. REI: 48-hour. PHI: 14-day. IRAC 1B.

**Fulfill (50WDG) (pymehrozine)** *Arugula, Chicory, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard* | 2.75 oz. per acre. Do not exceed 5.5 oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 9B.

**M-Pede (3.8) (potassium salts of fatty acids)** *Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme* | 1-2% by volume. Must contact aphids to be effective. Avoid spraying under hot conditions to minimize potential for plant injury. REI: 12-hour. PHI: 0-day. IRAC UN, FRAC NC. OMRI-listed.

**Malathion 5EC (malathion)** *Endive, Head Lettuce, Leaf Lettuce, Parsley, Spinach* | Use 5EC formulations at 1.0-2.0 pts. per acre on parsley, 1.6 pts. per acre for spinach, 2.0 pts. per acre on lettuce, or 1.5-2.0 pts. per acre on endive. Use 57EC formulations at 1.5-2.4 pts. per acre on parsley, 1.6 pts. per acre for parsley, 2.0-3.0 pts. per acre on lettuce, or 1.5-2.0 pts. per acre on endive. Do not exceed 2 applications per season. Allow 5-7 days between applications depending on crop. REI: 12 to 24-hour. PHI: 7-day for endive, parsley, and spinich; 14-day for head and leaf lettuce. IRAC 1B.

**Movento (2SC) (spirotetramat)** *Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard* | 4-5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. REI: 24-hour. PHI: 3-day. IRAC 23.

**Orthene 97 (S) (acephate)** *Head Lettuce* | 8-16 oz. per acre. Do not exceed 2-1/8 lb. per acre per season. REI: 24-hour. PHI: 21-day. IRAC 1B.

**Platinum 2SC (thiamethoxam)** *Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard* | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 fl. oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

**PQZ (1.87SC) (pyrifluquinazon)** *Arugula, Chicory, Cilantro, Cress, Dill, Endive, Escarole, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard* | 2.4-3.2 fl. oz. per acre. Do not exceed 4.8 fl. oz. per acre per crop cycle. REI: 12-hour. PHI: 1-day. IRAC 9B.

**Sivanto 200 (1.67SL) (flupyradifurone)** *Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard* | 10.5-12 fl. oz. per acre. Do not exceed 28 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 4D.

**Torac (1.29SC) (tolifenpyrad)** *Arugula, Chicory, Cilantro, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard* | 17-21 fl. oz. per acre. Do not exceed 42 fl. oz. per acre per crop, or 2 applications per season. REI: 12-hour. PHI: 1-day. IRAC 21A, FRAC 39.

**Versys Inscalis (0.83DC) (afidopyropen)** *Arugula, Chicory, Cress, Dill, Endive, Escarole, Head Lettuce, Leaf Lettuce, Parsley, Spinach, Swiss Chard* | 1.5 fl. oz. per acre. Do not exceed 1.5 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 9D.

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**Caterpillars**

There are many caterpillar pests of leafy vegetables and herbs, including cutworms, loopers, and armyworms. Always check the label for the specific list of caterpillars that the product can be used on.

Treat when 5% of plants are infested.

**Pesticide**

**Avaunt (30WDG) (indoxacarb)** *Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard* | 2.5-6.0 oz. per acre. For armyworms, and loopers. Do not exceed 24 oz. per acre per season for leaf greens and herbs. Do not exceed 14 oz. per acre for spinach. REI: 12-hour. PHI: 3-day. IRAC 22.

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**Bacillus thuringiensis products for caterpillars** (Bacillus thuringiensis aizawai strain ABTS-1857, Bacillus thuringiensis kurstaki strain EVB-113-19, Bacillus thuringiensis kurstaki strain ABTS-351, Bacillus thuringiensis kurstaki strain SA-11)

- **Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme** | For armyworms, cutworms, and loopers. Various Bt products are available for control of young caterpillars (Agree, Biobit, Dipel, Javelin, etc.) Different Bt subspecies have different control properties. Check labels for pest insects controlled before use. Follow label directions for rates, timing of application and required safety equipment. REI: 4-hour. PHI: 0-day. IRAC 1A.

**Baythroid XL (1EC) (beta-cyfluthrin)**

- **Arugula, Chicory, Cress, Endive, Escarole, Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard** | 0.8-3.2 fl. oz. per acre. For armyworms, cutworms, and loopers. Do not exceed 12.8 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Brigade 2EC (bifenthrin)**

- **Cilantro, Coriander, Head Lettuce, Spinach** | For armyworms, cutworms, and loopers. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season for cilantro, coriander, or head lettuce or 25 fl. oz. per acre per season on spinach. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre and do not exceed 80 oz. per acre on cilantro, coriander, or head lettuce or 64 oz. per acre per season on spinach. Allow 7 days between applications. REI: 12-hour. PHI: 3-day for cilantro and coriander; 7-day for head lettuce, 40-day for spinach. IRAC 3A. RUP.

**Confirm 2F (tebufenozide)**

- **Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard** | 6-8 fl. oz. per acre. For armyworms, cutworms, and loopers. Do not exceed 40 fl. oz. per acre per season. REI: 4-hour. PHI: 7-day. IRAC 18.

**Coragen (1.67SC) (chlorantraniliprole)**

- **Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme** | For armyworms, cutworms, and loopers. Use 3.5-7.5 fl. oz. per acre on leafy greens as a foliar spray or soil treatment. Use 3.5-5.0 fl. oz. per acre on herbs as a foliar application only. Allow 3 days between foliar applications and 10 days between soil applications. Do not exceed 15.4 fl. oz. per acre per crop or 61.7 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

**Entrust SC (2) (spinosad)**

- **Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme** | For armyworms, and loopers. Use 2SC formulations at 3.0-8.0 fl. oz. per acre for leafy greens or 4.0-6.0 fl. oz. per acre for herbs and do not exceed 29 fl. oz. per acre per season for leafy greens or 30 fl. oz. per acre per season for herbs. Use 80WP formulations at 1.0-2.5 oz. per acre for leafy greens or 1.25-2.0 oz. per acre for herbs and do not exceed 9 oz. per acre per season for leafy greens or 11 oz. per acre per season for herbs. Observe resistance management restrictions. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

**Exirel (0.83SE) (cyantraniliprole)**

- **Arugula, Chicory, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard** | 10-17 fl. oz. per acre. For armyworms, and loopers. Do not use adjuvants in tank mix in spinach. Do not exceed 61.7 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 28.

**Intrepid 2F (methoxyfenozide)**

- **Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme** | For armyworms, cutworms, and loopers. Early season applications: 4-8 fl. oz. per acre. Mid-to late-season applications: 8-10 fl. oz. per acre. Do not exceed 64 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 18.

**Lannate LV (2.4L) (methomyl)**

- **Head Lettuce, Leaf Lettuce, Parsley, Spinach, Swiss Chard** | For armyworms, cutworms, and loopers. 1.5-3.0 pts. per acre for parsley, spinach, and swiss chard. 0.75-3.0 pts. per acre for head and leaf lettuce. Do not exceed 12 pts. per acre for leaf lettuce, parsley, spinach, or swiss chard. Do not exceed 21 pts. per acre per season for head lettuce. REI: 48-hour. PHI: 7-day for spinach and lettuce under 1.5 pts. per acre, 10-day for parsley and swiss chard, 10-day for lettuce over 1.5 pts. per acre. IRAC 1A. RUP.

**Mustang Maxx (0.8) (zeta-cypermethrin)**

- **Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard** | 2.24-4.0 fl. oz. per acre. For armyworms, cutworms, and loopers. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Orthene 97 (S) (acephate)**

- **Head Lettuce** | 1 lb. per acre. For armyworms, and loopers. Do not exceed 2.2 lb. per acre per season. REI: 24-hour. PHI: 21-day. IRAC 1B.

**Pert-Up 25DF (permethrin)**

- **Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard** | 6.4-12.8 oz. per acre. For armyworms, and loopers. Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 64 oz. per acre per season for leafy greens and herbs or 38.4 oz. per acre per season for spinach. Use 3.2EC formulations at 2-8 fl. oz. per acre and do not exceed 80 fl. oz. per acre per season for leafy greens and herbs or 24 fl. oz. per acre per season for spinach. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Radiant 1SC (spinetoram)**

- **Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme** | 5-10 fl. oz. per acre.
For armyworms, cutworms, and loopers. Do not exceed 34 fl. oz. per acre per season for leafy greens. Do not exceed 39 fl. oz. per acre per season for herbs. REI: 4-hour. PHI: 1-day. IRAC 5.

**Sevin XLR Plus (4SC) (carbaryl)** Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Spinach, Swiss Chard | 0.96-1.92 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 5-day. IRAC 3A. RUP.

**Flea Beetles**

*Seedlings:* >50% plants infested and defoliation is >30%.

**Pesticide**

**Actara (25WDG) (thiamethoxam)** Arugula, Chicory, Cress, Endive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme | 4.4-10.5 fl. oz. per acre soil application, or 1.3 fl. oz. per acre foliar application on leafy greens. 4.4-10.5 fl. oz. per acre soil application for fennel and swiss chard. 7.0-10.5 fl. oz. per acre soil application, or 1.2 fl. oz. per acre foliar application on herbs. Do not exceed 10.5 fl. oz. per acre per season from soil applications. Do not exceed 3.6 fl. oz. per acre per season from foliar applications. REI: 12-hour. PHI: 45-day for soil application on fennel and swiss chard, 14-day for soil application on herbs, 21-day for soil application on leafy greens, 7-day for foliar applications on leafy greens and herbs IRAC 4A.

**Admire Pro (4.6SC) (imidacloprid)** Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme | 0.5-2 qts. per acre. Do not exceed 6 qt. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 1A.

**Baythroid XL (1EC) (beta-cyfluthrin)** Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | 2.4-3.2 fl. oz. per acre. Do not exceed 12.8 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Beleaf (2.13SC) (clothianidin)** Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | Soil applications: 9-12 fl. oz. per acre. Foliar applications: 3-4 fl. oz. per acre. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day for soil application, or 7-day for foliar application. IRAC 4A.

**Brigade 2EC (bifenthrin)** Cilantro, Coriander, Head Lettuce | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre and do not exceed 80 oz. per acre. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

**Capture LFR (1.5) (bifenthrin)** Cilantro, Coriander | 3.4-6.8 fl. oz. per acre. Soil application: See label for application methods. Do not exceed 0.1 lb. a.i. per acre per season as an at-plant application. Do not exceed 0.5 lb. a.i. per acre per season including at-plant plus foliar applications of other bifenthrin products (such as Brigade 2EC). REI: 12-hour. PHI: see label. IRAC 3A. RUP.

**Mustang Maxx (0.8) (zeta-cypermethrin)** Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme, Watermelon | 2.24-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 5-day. IRAC 3A. RUP.

**Platinum 2SC (thiamethoxam)** Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | Use 2SC formulations as a soil treatment at 5-11 oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

**Sevin XLR Plus (4SC) (carbaryl)** Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Spinach, Swiss Chard | 1.5-3.0 oz. per acre. Do not exceed 80 oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Torac (1.29SC) (tolifenpyrad)** Arugula, Chicory, Cilantro, Coriander, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | 14-21 fl. oz. per acre. Do not exceed 42 fl. oz. per acre per crop, or 2 applications per season. REI: 12-hour. PHI: 1-day. IRAC 21A, FRAC 39.

**Up-Cyde 2.5EC (cypermethrin)** Head Lettuce | 2.5-5.0 fl. oz. per acre. Do not exceed 30 fl. oz. per acre per season. REI: 12-hour. PHI: 5-day. IRAC 3A. RUP.

**Warrior II (2.08CS) (lambda-cyhalothrin)** Head Lettuce, Leaf Lettuce | 0.96-1.92 fl. oz. per acre. Do not exceed 19.2 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 3A. RUP.

**Leafhoppers**

**Pesticide**

**Actara (25WDG) (thiamethoxam)** Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | 1.5-3.0 oz. per acre. Do not exceed 80 oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Admire Pro (4.6SC) (imidacloprid)** Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme, Watermelon | 2.24-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 5-day. IRAC 3A. RUP.
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Savory, Spinach, Swiss Chard, Tarragon, Thyme | 4.4-10.5 fl. oz. per acre soil application, or 1.3 fl. oz. per acre foliar application on leafy greens. 4.4-10.5 fl. oz. per acre soil formulation for fennel and swiss chard. 7.0-10.5 fl. oz. per acre soil application, or 1.2 fl. oz. per acre foliar application on herbs. Do not exceed 10.5 fl. oz. per acre per season from soil applications. Do not exceed 3.6 fl. oz. per acre per season from foliar applications. REI: 12-hour. PHI: 45-day for soil application on fennel and swiss chard, 14-day for soil application on herbs, 21-day for soil application on leafy greens, 7-day for foliar applications on leafy greens and herbs IRAC 4A.

Baythroid XL (1EC) (beta-cyfluthrin) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | 2.4-3.2 fl. oz. per acre. Do not exceed 12.8 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

Belay (2.13SC) (clothianidin) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | Soil applications: 9-12 fl. oz. per acre. Foliar applications: 3-4 fl. oz. per acre. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day for soil application, or 7-day for foliar application. IRAC 4A.

Dimethoate 4EC (dimethoate) Endive, Leaf Lettuce, Swiss Chard | Use 2.67EC formulations at 0.75 pt. per acre and do not exceed 2.2 pts. per acre per season. Use 4EC, LV-4, and 400 formulations at 0.5 pt. per acre and do not exceed 1 pt. per acre per season. REI: 48-hour. PHI: 14-day. IRAC 1B.

Mustang Maxx (0.8) (zeta-cypermethrin) Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme, Watermelon | 2.24-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 5-day. IRAC 3A. RUP.

Neemix (0.39) (azadirachtin) Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme | 7-16 fl. oz. per acre. Nymphs only. REI: 4-hour. PHI: 0-day. IRAC UN. OMRI-listed.

Orthene 97 (S) (acephate) Head Lettuce | 8-16 oz. per acre. Do not exceed 2-1/8 lb. per acre per season. REI: 24-hour. PHI: 21-day. IRAC 1B.

Perrm-Up 25DF (permethrin) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 64 oz. per acre per season for leafy greens and herbs or 38.4 oz. per acre per season for spinach. Use 3.2EC formulations at 2-8 fl. oz. per acre and do not exceed 80 fl. oz. per acre per season for leafy greens and herbs or 24 fl. oz. per acre per season for spinach. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Platinum 2SC (thiamethoxam) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

Scorpion 35SL (3.24) (dinitofuran) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | Soil treatment: Use Scorpion 35SL at 9:0-10.5 oz. per acre, or Venom 70SG at 5.0-5.5 oz. per acre. Foliar treatment: Use Scorpion 25SL at 2.0-5.25 oz. per acre, or Venom 70SG at 1-3 oz. per acre. Allow 7 days between applications. REI: 12-hour. IRAC 4A.

Sevin XLR Plus (4SC) (carbaryl) Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Spinach, Swiss Chard | 0.5-2 qts. per acre. Do not exceed 6 qt. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 1A.

Sivanto 200 (1.67SL) (flupyridafurone) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | 14-21 fl. oz. per acre. Do not exceed 42 fl. oz. per acre per crop, or 2 applications per season. REI: 4-hour. PHI: 1-day. IRAC 4D.


Up-Cyde 2.5EC (cypermethrin) Head Lettuce | 2.5-5.0 fl. oz. per acre. Do not exceed 30 fl. oz. per acre per season. REI: 12-hour. PHI: 5-day. IRAC 3A. RUP.

Warrior II (2.08CS) (lambda-cyhalothrin) Head Lettuce, Leaf Lettuce | 0.96-1.92 fl. oz. per acre. Do not exceed 19.2 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 3A. RUP.

Leafminers

Seedlings: 50% of plant infested.
Near Harvest: 5% of leaves infested.

Pesticide

Agri-Mek SC (0.7) (abamectin) Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme | 1.75-3.5 fl. oz. per acre. Use 0.7SC formulations at 1.75-3.5 fl. oz. per acre and do not exceed 10.5 fl. oz. per acre. Use 0.15EC formulations at 8-16 fl. oz. per acre for 0.15EC formulations and do not exceed 48 fl.
oz. per acre per season. Use with NIS adjuvant. Do not use binder or sticker-type surfactants. REI: 12-hour. PHI: 7-day for leafy greens, 14-day for herbs. IRAC 6. RUP.

Belay (2.13SC) (clothianidin) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | Soil applications: 9-12 fl. oz. per acre. Foliar applications: 3-4 fl. oz. per acre. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day for soil application, or 7-day for foliar application. IRAC 4A.

Brigade 2EC (bifenthrin) Cilantro, Coriander, Head Lettuce | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre and do not exceed 80 oz. per acre. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

Dimethoate 4EC (dimethoate) Endive, Leaf Lettuce, Swiss Chard | Use 2.67EC formulations at 0.75 pt. per acre and do not exceed 2.2 pts. per acre per season. Use 4EC, LV-4, and 400 formulations at 0.5 pt. per acre and do not exceed 1 pt. per acre per season. REI: 48-hour. PHI: 14-day. IRAC 1B.

Entrust SC (2) (spinosad) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | For armyworms, and loopers. Use 2SC formulations at 6.0-10.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 2.0-3.0 oz. per acre and do not exceed 9 oz. per acre per season. Observe resistance management restrictions. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

Movento (2SC) (spirotetramat) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | 4-5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. REI: 24-hour. PHI: 3-day. IRAC 23.

Neemix (0.39) (azadirachtin) Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme | 4-7 fl. oz. per acre. Mix with oil-based adjuvant for best results. REI: 4-hour. PHI: 0-day. IRAC UN. OMRI-listed.

Perm-Up 25DF (permethrin) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 64 oz. per acre per season for leafy greens and herbs or 38.4 oz. per acre per season for spinach. Use 3.2EC formulations at 2-8 fl. oz. per acre and do not exceed 80 fl. oz. per acre per season for leafy greens and herbs or 24 fl. oz. per acre per season for spinach. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Platinum 2SC (thiamethoxam) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

Radiant 1SC (spinetoram) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | 5-10 fl. oz. per acre. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 5.

Scorpion 35SL (3.24) (dinotefuran) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | Soil treatment: Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-5.5 oz. per acre. Foliar treatment: Use Scorpion 25SL at 2.0-5.25 oz. per acre, or Venom 70SG at 1-3 oz. per acre. Allow 7 days between applications. REI: 12-hour. IRAC 4A.

Trigard (75WP) (cyromazine) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard | 2.66 oz. per acre. Do not exceed 6 applications per season. REI: 12-hour. PHI: 7-day. IRAC 17.

Mites

Pesticide

Agri-Mek SC (0.7) (abamectin) Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme | 1.75-3.5 fl. oz. per acre. Use 0.7SC formulations at 1.75-3.5 fl. oz. per acre and do not exceed 10.5 fl. oz. per acre. Use 0.15EC formulations at 8-16 fl. oz. per acre for 0.15EC formulations and do not exceed 48 fl. oz. per acre per season. Use with NIS adjuvant. Do not use binder or sticker-type surfactants. REI: 12-hour. PHI: 7-day for leafy greens, 14-day for herbs. IRAC 6. RUP.

Brigade 2EC (bifenthrin) Head Lettuce, Spinach | Use 2EC formulations at 5.12-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on head lettuce or 25 fl. oz. per acre per season on spinach. Use 10DF, 10WP, or 10WSB formulations at 12.8-16 oz. per acre and do not exceed 80 oz. per acre on head lettuce or 64 oz. per acre per season on spinach. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Capture LFR (1.5) (bifenthrin) Head Lettuce | 3.4-6.8 fl. oz. per acre. Bulb mites only. See label for application methods. Do not exceed 0.1 lb. per acre per season as an at-plant application. Do not exceed 0.5 lb. per acre per season including at-plant plus foliar applications of other bifenthrin products (such as Brigade 2EC). REI: 12-hour. PHI: see label. IRAC 3A. RUP.
Slugs

Prevent infestation by scattering bait products to the soil surface around the perimeter of the planting. Make a rescue treatment by scattering the bait products on the soil as a band between rows.

Pesticide

Deadline M-Ps (4P) (metaldehyde) *Florence Fennel, Spinach, Swiss Chard* | 25 lbs. per acre. Scatter bait around the perimeter of plantings. Do not exceed 3 applications per crop cycle for spinach. Do not exceed 4 applications per crop cycle for Florence fennel and swiss chard. REI: 12-hour. PHI: 0-day for spinach, 1-day for Florence fennel and swiss chard. IRAC UN.

**Sluggo 1B (iron phosphate)** *Head Lettuce, Leaf Lettuce, Spinach, Swiss Chard* | 20-44 lb. per acre, or 0.5-1 lb. per 1,000 sq. ft. Scatter bait around the perimeter of plantings. REI: 0-hour. PHI: 0-day. IRAC UN. OMRI-listed.

Tarnished Plant Bug

Tarnished plant bug (TPB) damage to lettuce and spinach can reduce the marketability of these crops and can make them more susceptible to bacterial diseases. TPB adults and nymphs also feed on the youngest growth in the heart of the plant, which may lead to symptoms similar to blackheart.

No formal economic thresholds have been developed for this insect pest in leafy vegetables. However, in Canada, the thresholds used in celery have proven to be a suitable guideline for management decisions. Insecticide treatment is recommended whenever a threshold of 0.2 TPB per plant is reached from transplanting until three weeks before harvest. Note that in many cases, TPB damage is observed before large numbers of TPB nymphs and/or adults are detected.

Pesticide

**Baythroid XL (1EC) (beta-cyfluthrin)** *Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard* | 2.4-3.2 fl. oz. per acre. Do not exceed 12.8 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 0-day. IRAC 3A. *RUP.*

**Beleaf (50SG) (flonicamid)** *Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio, Spinach, Swiss Chard* | 2.0-2.8 oz. per acre. Do not exceed 8.4 oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 29.

**Brigade 2EC (bifenthrin)** *Head Lettuce, Spinach* | Use 2EC formulations at 5.12-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on head lettuce or 25 fl. oz. per acre per season on spinach. Use 10DF, 10WP, or 10WSB formulations at 12.8-16 oz. per acre and do not exceed 80 oz. per acre on head lettuce or 64 oz. per acre per season on spinach. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. *RUP.*

Mustang Maxx (0.8) (zeta-cypermethrin) *Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme* | Weed control in leafy vegetables and herbs often relies on systemic insecticides labeled for use on specific crops. For directed-seed crops, prepare a stale seedbed several weeks in advance of planting, allowing weeds to emerge, and then kill them just before the crop emerges. For crops like cilantro, dill and parsley that take a long time to emerge, controlling these weeds is especially useful, but it can also pay off for faster-emerging species like lettuce or spinach.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

**Non-Pesticide**

Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme | Weed control in leafy vegetables and herbs often relies on systemic insecticides labeled for use on specific crops. For directed-seed crops, prepare a stale seedbed several weeks in advance of planting, allowing weeds to emerge, and then kill them just before the crop emerges. For crops like cilantro, dill and parsley that take a long time to emerge, controlling these weeds is especially useful, but it can also pay off for faster-emerging species like lettuce or spinach.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

Non-Pesticide

Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Oregano, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme | Weed control in leafy vegetables and herbs often relies on systemic insecticides labeled for use on specific crops. For directed-seed crops, prepare a stale seedbed several weeks in advance of planting, allowing weeds to emerge, and then kill them just before the crop emerges. For crops like cilantro, dill and parsley that take a long time to emerge, controlling these weeds is especially useful, but it can also pay off for faster-emerging species like lettuce or spinach.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.
heavily on cultivation and hand weeding for full season weed control. These operations are most efficient when planting arrangement is designed with weed control in mind and is designed to work with available weed control equipment. Specialized weeding equipment for leafy vegetables includes basket weeders, narrow-bladed hoes, finger weeders, and others. Prepare a stale seedbed with flaming or very shallow cultivation, instead of herbicides. Using transplants is helpful for weed control because the size difference between weeds and crop early in the season make mechanical control easier. Plastic and paper mulches have been used with success for transplanted crops.

**Broadleaf and Grass Weeds - Postemergence**

**Pesticide**

**Caparol 4L (prometryn)** Cilantro, Dill, Florence Fennel, Parsley | For cilantro: apply 2.0-3.2 pts. per acre after seeding but before crop emergence. For dill in Michigan only (MI 24c exp. 12/31/24): apply 3.2 pts. per acre once after seeding and before crop emergence or apply after crop emerges. Do not exceed one application or 3.2 pts. per acre per season. For Florence fennel: apply 2.4-4.0 pts. per acre after seeding but before crop emergence or apply 1.6-2.0 pts. per acre after seeded crop has 2-5 true leaves and before weeds are 2 inches tall, or apply 2.4-4.0 pts. per acre after transplanting. Do not exceed one application to seeded fennel, or two applications in transplanted fennel. For parsley: apply 1 pt. per acre up to 14 days after planting. A second application can be made up to 30 days before harvest. A third application can be made up to 30 days before second harvest. Maximum 3 applications per year and 3 pts. per acre per year. To avoid crop injury, do not use on sand or loamy sand, or use lower rate. REI: 12-hour. PHI: 30-day for cilantro, dill, and parsley; 40-day for Florence fennel. WSSA 5.

**glyphosate products (glyphosate)** Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Parsley, Radicchio, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme | See product label for rates, application volume, and adjuvants. Use 4L formulations at 1-3 qts. per acre. Apply to emerged annual and perennial weeds before planting. Transplants that contact freshly sprayed weeds can be seriously injured. Or apply between rows with a hooded or shielded sprayer. Crop will be injured if any spray contacts it. Use low rate for annuals and higher rates for perennials. REI: 4 to 12-hour. PHI: 14-day. WSSA 9.

**paraquat products (paraquat)** Endive, Escarole, Head Lettuce, Leaf Lettuce | Applications of 1-4 pts. per acre can be made as a banded or broadcast treatment before, during or after planting but prior to emergence. For head and leaf lettuce in Michigan only (MI 24c exp. 06/08/21): make one shielded application of 1.5 pts. per acre to row middles 2-3 weeks after seeding. Include 0.25% NIS v/v. Use a minimum of 40 gals. water per acre. REI: 12 to 24-hour. WSSA 22. RUP.

**Scythe (4.5EC) (pelargonic acid)** Arugula, Basil, Chive, Cress, Dill, Endive, Escarole, Fennel, Head Lettuce, Leaf Lettuce, Oregano, Parsley, Rosemary, Sage, Savory, Spinach, Swiss Chard, Tarragon, Thyme | 5-10 gals. per acre. For leafy greens (including herbs): Apply as a burndown, or as a directed or hooded spray between rows in 75-200 gals. of water per acre. Use higher rate for large and mature weeds. For herbs (not including leafy greens): Apply prior to emergence of plants from seed or perennial rootstock, ensuring applications are made before crop emerges from the soil. REI: 12-hour. WSSA 26.

**Broadleaf and Grass Weeds - Preemergence**

**Pesticide**

**Balan DF (60) (benefin)** Head Lettuce, Leaf Lettuce | 2-2.5 lbs. per acre. Apply and incorporate before seeding or transplanting. REI: 12-hour. WSSA 3.

**Caparol 4L (prometryn)** Cilantro, Dill, Florence Fennel, Parsley | For cilantro: apply 2.0-3.2 pts. per acre after seeding but before crop emergence. For dill in Michigan only (MI 24c exp. 12/31/24): apply 3.2 pts. per acre once after seeding and before crop emergence or apply after crop emerges. Do not exceed one application or 3.2 pts. per acre per season. For Florence fennel: apply 2.4-4.0 pts. per acre after seeding but before crop emergence or apply 1.6-2.0 pts. per acre after seeded crop has 2-5 true leaves and before weeds are 2 inches tall, or apply 2.4-4.0 pts. per acre after transplanting. Do not exceed one application to seeded fennel, or two applications in transplanted fennel. For parsley: apply 1 pt. per acre up to 14 days after planting. A second application can be made up to 30 days before harvest. A third application can be made up to 30 days before second harvest. Maximum 3 applications per year and 3 pts. per acre per year. To avoid crop injury, do not use on sand or loamy sand, or use lower rate. REI: 12-hour. PHI: 30-day for cilantro, dill, and parsley; 40-day for Florence fennel. WSSA 5.

**Devrinol DF-XT (50) (napropamide)** Basil, Marjoram, Rosemary, Savory | 2-4 lbs. per acre. Apply before or after seeding and incorporate into soil, or water-in with 0.2-0.4 inch of water. REI: 24-hour. WSSA 15.

**Dual Magnum (7.62EC) (s-metolachlor)** Chive, Cilantro, Head Lettuce, Leaf Lettuce, Spinach, Swiss Chard | Illinois, Indiana, Michigan, Minnesota, and Ohio only. IL 24c exp. 03/25/24. MI 24c exp. 12/31/21. MN 24c exp. 12/31/2020. OH 24c exp. 12/31/22. For chive in all states listed above except IL: apply 0.67-1.33 pts. per acre postemergence starting when the crop has 2 true leaves. For cilantro in all states listed above except IL: apply 0.67-1 pt. per acre to soil surface after seeding before crop emerges. For head and leaf lettuce in all states listed above except IL: apply 0.67-1 pt. per acre preplant, preemergence, or after emergence or transplanting. For spinach in all states listed above: apply 0.33-1 pt. per acre to soil surface after seeding before crop emerges. For Swiss chard in all states listed above: apply 0.5-1.0 pt. per acre to soil surface after seeding before crop emerges. In all cases, use lower rate on sandy soil. Do not incorporate. Do not application per crop per season. REI: 24-hour. PHI: 20-day for head lettuce; 21-day for chives, 25 day for...
Leafy Vegetables and Herbs - Weeds

leaf lettuce; 30-day for cilantro; 50-day for spinach, 62-day for swiss chard. WSSA 15.

Kerb SC (3.3) (pronamide) Endive, Escarole, Head Lettuce, Leaf Lettuce, Radicchio | 1.25-5 pts. per acre. Apply before or after seeding. Must be incorporated or irrigated into soil. Can be applied after crop emerges, but weed control will be marginal on muck soils. For head lettuce on muck soils in Michigan only (MI 24c expires 04/06/22): use 9.6-14.4 pts. per acre. REI: 24-hour. PHI: 55-day for head lettuce. WSSA 3. RUP.

Lorox DF (50) (linuron) Cilantro, Coriander, Dill, Parsley | 1-3 lbs. per acre. For cilantro and coriander: apply 1-2 lbs. per acre after seeding and before crop emergence, or make up to 2 postemergence applications after crop has 3 true leaves. Do not exceed 4 lbs. per acre per year. For dill: apply 1-2 lbs. per acre after seeding and before crop emergence, or make one postemergence application after crop has 3 true leaves. Do not exceed 4 lbs. per acre per year. For parsley: apply 1-3 lbs. per acre after seeding and before crop emergence. Use lower rate on sandy soil, or make one postemergence application at 1 lb. per acre after crop has 3 true leaves (postemergence application allowed on muck soils only). Do not exceed 3 lbs. per acre per year. Use lower rate on sandy soil. Do not apply to soil with less than 1% organic matter. Do not spray when temperatures exceed 85F. REI: 24-hour to 8-day. PHI: 21-day for cilantro, coriander, and dill; 30-day for parsley. WSSA 7.

pendimethalin products (pendimethalin) Chive | Use 3.8 formulations at 2 pts. per acre after seeding but before crop emerges, or when crop has 2-3 true leaves. The 3.3 formulations are not labeled for chive. If both pre and post applications are used, wait 30 days after pre application before making a post application. Only apply pre to muck soils (organic matter greater than 20%) or mineral soils with greater than 3% organic matter. Do not exceed 4 pts. per acre per year. Michigan only. MI 24c exp. 04/16/24. For mineral soils with more than 5% organic matter, use 3.8 formulations up to 4 pts. per acre or 3.3 formulations up to 4.8 pts. per acre. Use low rates on course soils. Heavy rain or excessive irrigation soon after application may cause crop injury. Will not control emerged weeds. REI: 24-hour. PHI: 30-day. WSSA 3.

Prefar 4E (bensulide) Arugula, Chicory, Cress, Endive, Escarole, Florence Fennel, Head Lettuce, Leaf Lettuce, Parsley, Radicchio | 5-6 qts. per acre. Mineral soils only. Apply and incorporate before planting or apply after seeding (before crop emerges) and incorporate with irrigation. REI: 12-hour. WSSA 8.

Ro-Neet (6) (cyclolate) Spinach | 2 qts. per acre. Illinois and Ohio only. Apply before planting and incorporate 2-3 inches immediately. Use on sandy mineral soils only. PHI: 48-hour. WSSA 8.

trifluralin products (trifluralin) Chicory, Endive, Escarole, Radicchio | 0.5-1 lb. a.i. per acre. Use 4EC formulations at 1-2 pts. per acre. Use 10G formulations at 5-10 lbs. per acre. Broadcast and incorporate 1-2 inches before seeding or transplanting. Use low rate on coarse soils with less than 2% organic matter. Not effective on muck or high organic matter soils. REI: 12-hour. WSSA 3.

Broadleaf Weeds Only - Postemergence

Pesticide

Aim EC (2) (carfentrazone) Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Parsley, Radicchio, Rosemary, Savory, Spinach, Swiss Chard, Tarragon, Thyme | 1-2 fl. oz. per acre. For leafy vegetables (not including herbs): Apply as burndown treatment at least 1 day before transplanting or at least 7 days before seeding. Tank-mix with another labeled burndown product for best control. For leafy vegetables and herbs: Apply to row middles with a hooded sprayer to control weeds up to 4 inches tall. Add COC, NIS, or MSO. AMS will improve weed control. Do not exceed 6.1 fl. oz. per acre per year or 2 applications per crop per year. REI: 12-hour. WSSA 14.

Spin-Aid (1.3) (phenmedipham) Spinach | 3-4 pts. per acre. For spinach grown for processing or seed only: Apply to spinach with 4-6 leaves when temperature is below 75F. Do not spray when dew is present. Apply in 11-22 gals per acre. May cause crop stunting. REI: 12-hour. PHI: 21-day. WSSA 5. RUP.

Stinger (3) (clopyralid) Spinach, Swiss Chard | For spinach: apply 2.7-5.3 fl. oz. per acre when spinach is in the 2-5 leaf stage. Do not exceed 2 applications and 8 fl. oz. per acre per year. For Swiss chard in Michigan only (MI 24c exp. 12/31/25): apply 4-8 fl. oz. per acre in one broadcast application per season. Kills composite weeds, legumes, nightshade and smartweeds. REI: 12-hour. PHI: 21-day for spinach; 30-day for Swiss chard. WSSA 4.

Grass Weeds Only - Postemergence

Pesticide

clethodim products (clethodim) Arugula, Basil, Chicory, Chive, Cilantro, Coriander, Cress, Dill, Endive, Escarole, Fennel, Florence Fennel, Head Lettuce, Lavender, Leaf Lettuce, Marjoram, Parsley, Radicchio, Rosemary, Savory, Spinach, Swiss Chard, Tarragon, Thyme | Use 2EC formulations at 6-8 fl. oz. per acre with 1 qt. of COC per 25 gals. of spray solution (1% v/v). Do not exceed 32 fl. oz. of 2EC formulations per acre per season. Use Select Max at 9-16 fl. oz. per acre with 8 fl. oz. of NIS per 25 gals. of spray solution (0.25% v/v). Do not exceed 64 fl. oz. of Select Max per acre per season. Use low rates for annual grasses, the high rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. Try on small area before spraying whole field. REI: 24-hour. PHI: 14-day. WSSA 1.

Fusilade DX (2EC) (fluazifop-P) Head Lettuce, Leaf Lettuce | 10-24 fl. oz. per acre. Use 1-2 pts. of COC or 0.5-1 pt. of NIS per 25 gals. of spray solution. Apply to actively growing grasses. Effective against perennial grasses. Do not exceed 48 fl. oz. per acre per year. REI: 12-hour. PHI: 14-day. WSSA 1.
Legumes - Horticulture

Reviewed by Ben Phillips, Liz Maynard – Oct 2020

Crop Description

Fresh or Snap Bean (Phaseolus vulgaris): These are edible podded beans that are usually green (green beans) or yellow (wax beans), but they also come in red and purple podded varieties as well. They are harvested while pods and seeds are still tender. Older varieties (string beans) had a fibrous “string” the length of the pod that was removed during preparation for eating. Flat-podded Romano beans are also harvested while pods and seeds are tender. Within this category are “vining”, “pole”, or “runner” beans that need trellising, and “bush” beans that are short and sturdy.

Dry Bean (Phaseolus vulgaris): Dry beans refers to a wide variety of beans harvested after the seeds are mature and pods have dried down. Kidney, navy, black turtle, white, and pinto beans are examples. Within this category are “vining”, “pole”, or “runner” beans that need trellising, and “bush” beans that are short and sturdy.

Lima Bean (Phaseolus lunatus): Lima beans represent a different species than fresh beans and dry beans. They can be harvested when completely dry (like dry beans) or as “baby limas” before the seed has matured (similar to the southern pea described below). Some lima bean varieties will readily climb a trellis, but other varieties are more bush-like.

Fresh Pea (Pisum sativum): These peas are cool-season crops grown for their immature edible seeds or pods. Snow peas have flattened, tender, edible pods and seeds. Snap peas have edible pods and plump seeds. Shell peas have pods that are too tough to eat and the peas must be removed for eating. Some pea varieties will readily climb a trellis, but other varieties have a sprawling bush-like architecture.

Dry Pea (Pisum sativum): These peas are cool-season crops grown for their mature edible seeds, like dry beans. Dry pea varieties are more bush-like to facilitate machine harvest.

Southern Pea, Cowpea (Vigna unguiculata): These peas are heat-loving crops more commonly grown in southern states, though they can be grown in the north. They include black-eyed peas, cream peas and crowder peas. They are grown for their immature and dried shelled seeds, and are well-accepted in markets where customers are familiar with them. Southern peas have a sprawling bush-like architecture.

Planting and Spacing

Fresh or Snap Bean, Dry Bean, Lima Bean, Southern Pea:
Rows 18 to 36 inches apart, 5 to 7 seeds per foot of row for bush types (70 to 100 pounds per acre), or 2 to 3 seeds per foot of row for vining types (35 to 50 pounds per acre). Larger inter-row spacing helps limit white mold development. These warm-season vegetables should be sown after soil temperatures average 60°F and frost danger is past. Sequential plantings of bush snap beans are possible. Vining types will readily climb a trellis of horticultural netting up to 8 feet tall without much training.

Fresh Pea and Dry Pea: Rows 32 to 36 inches apart, 6 to 8 seeds per foot of row for bush types (100 to 150 pounds per acre), or 3 to 4 seeds per foot of rows for vining types (50 to 75 pounds per acre). These cool-season vegetables should be sown in early spring for a spring crop or in mid to late summer for a fall crop. Plants deteriorate quickly in the heat of summer. Vining types will readily climb a trellis of horticultural netting up to 5 feet tall without much training.

Fertilizing

pH: Maintain a soil pH of 6.0 to 6.5.

Before planting, apply 20 to 40 pounds N per acre for peas and 30 to 60 pounds N per acre for beans, 0 to 100 pounds P2O5 per acre, and 0 to 100 pounds K2O per acre based on soil test results and recommendations from your state. Or apply some or all of that amount at planting in bands at least 2 inches below and 2 inches to the side of the row, except the rate of K2O should not exceed 40 pounds per acre when applied this way because peas and beans are sensitive to injury from fertilizer salts. Reduce the preplant fertilizer by the amount applied in bands at planting.

Beans are prone to zinc and manganese deficiency when pH is over 6.5. Include up to 1 pound of zinc per acre and 2 pounds of manganese per acre in the banded planting time fertilizer. If banding is not possible zinc may be broadcast up to 10 pounds of zinc per acre. Broadcasting manganese is not recommended. Foliar sprays of 0.5 pounds zinc per acre or 1 to 2 pounds manganese per acre can be used if needed.

Sidedressing is not needed for legume crops. Reduce the amount of fertilizer N applied by the value of N credits from green manures, legume crops grown in the previous year, compost and animal manures, and soils with more than 3 percent organic matter. The total amount of N from fertilizer (including starter) and other credits should be 40 to 60 pounds per acre.

Harvesting

Fresh or Snap Beans and Fresh Peas: Harvests can take place every few days once plants start producing pods that are of the desirable size. More picking generates more flowers and more pods later. Bush-type beans are commonly machine harvested and sorted with a once-over pass. Time from seeding to harvest ranges from 50 to 60 days for beans, or 60-70 days for peas.
Legumes - Diseases

Dry Peas and Dry Beans: Harvests can take place as once-over harvests when pods are dry. Machine harvests should take place before noon when plants are slightly damp to avoid pod shatter. Time from seeding to harvest ranges from 70 to 120 days for beans, or 80 to 100 days for peas.

Southern Peas and Lima Beans: Target harvests for fresh products when the seeds are succulent, and the pods are juicy. When the first beans are ready plants can be hand harvested for fresh product about once per week. A once-over harvest is used for dry seeds. Time from seeding to fresh harvest ranges from 60 to 70 days for southern peas, or 60 to 90 days for lima beans. For dried seeds, time from seeding to harvest can be over 100 days.

Legumes - Diseases
Reviewed by Dan Egel – Nov 2020

Recommended Controls

Anthracnose of Legumes - Colletotrichum Fungus

Non-Pesticide

Beans (Dry), Southern Peas/Cowpeas | Use disease-free seed. Rotate to non-host crops for 3 years. Varieties with partial resistance are available, depending on the race of the pathogen. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Aproach (2.08SC) (picoxystrobin) Beans (Dry), Peas (Dry) | 6-12 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 11.

Aprovia Top (difenoconazole, benzovindiflupyr) Beans (Dry), Peas (Dry) | 10.5-11 fl. oz. per acre. A spreader sticker is recommended. REI: 12-hour. PHI: 14-day. FRAC 3, FRAC 7.

azoxystrobin products (azoxystrobin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. REI: 4-hour. PHI: 0-day for fresh legumes, 14-day for dry legumes. FRAC 11.

chlorothalonil products (chlorothalonil) Beans (Dry), Beans (Fresh), Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 7-day for fresh legumes, 14-day for dry legumes. FRAC M5.

Fontelis (1.67SC) (penthiopyrad) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 14-30 fl. oz. per acre. Rates above 20 fl. oz. per acre are for fresh legumes only. REI: 12-hour. PHI: 0-day for fresh legumes, 21-day for dry legumes. FRAC 7.

Headline (SC) (2.08) (pyraclostrobin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 6-9 fl. oz. per acre. REI: 12-hour. PHI: 7-day for fresh. 21-days for dry. FRAC 11.

Priaxor (fluxapyroxad, pyraclostrobin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 4-8 fl. oz. per acre. REI: 12-hour. PHI: 7-day for fresh legumes, 21-day for dry legumes. FRAC 7, FRAC 11.

propiconazole products (propiconazole) Beans (Dry), Beans (Fresh), Lima Beans, Southern Peas/Cowpeas | 4 fl. oz. per acre. ProPliMax EC and Tilt are labeled. REI: 12-hour. PHI: 7-day for fresh legumes. FRAC 3.

Quadris Opti (SC) (azoxystrobin, chlorothalonil) Beans (Dry) | 1.6-2.4 pts. per acre. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC M5.

Quadris Top (SC) (azoxystrobin, difenoconazole) Beans (Dry), Peas (Dry) | 12-14 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC 3.

Quilt (SE) (azoxystrobin, propiconazole) Beans (Dry), Beans (Fresh), Southern Peas/Cowpeas | 14 fl. oz. per acre. REI: 12-hour. PHI: 7-day for fresh legumes, 14-day for dry legumes. FRAC 11, FRAC 3.

Topsin 4.5FL (thiophanate-methyl) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 4FL formulation or Cercobin at 20-40 fl. oz. per acre, or 70WSB formulation at 1-2 lb. per acre. REI: 24-hour to 3-day. PHI: 14-day for fresh legumes, 28-day for dry legumes. FRAC 1.

Vertisan (1.67EC) (penthiopyrad) Beans (Dry), Southern Peas/Cowpeas | 14-20 fl. oz. per acre. REI: 12-hour. PHI: 21-day. FRAC 7.

Common Bacterial Blight of Beans - Xanthomonas Bacteria

Non-Pesticide

Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Plant western-grown, certified disease-free seed. Rotate to non-host crops for 2 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Several formulations of copper (Badge, Champ, Kocide) are
labelled for use and may slow the spread of bacterial blights. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

Damping-Off Seed and Seedling Rots of Multiple Crops - Multiple Pathogens

Non-Pesticide

Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Plant western-grown, certified disease-free seed. Avoid planting in prolonged wet conditions.

Pesticide

Ridomil Gold SL (4SC) (mefenoxam) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 0.5-1.0 pt. per acre. Apply at planting if Pythium is a significant problem. REI: 48-hour. FRAC 4.

Seed treatments (thiamethoxam, mefenoxam, fludioxonil, azoxystrobin, thiabendazole, spinosad, abamectin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Purchase seed commercially treated with a product such as Apron Maxx, Captan or Thiram. IRAC 4A, FRAC 4, FRAC 12, FRAC 11, FRAC 1, IRAC 5, IRAC 6.

Gray Mold of Multiple Crops - Botrytis Fungus

Non-Pesticide

Beans (Dry), Beans (Fresh), Southern Peas/Cowpeas | Avoid fields with a history of the problem. Rotate to a non-broadleaf crop, such as grass grains or sweet corn for >6 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Cannonball WG (50) (fludioxonil) Beans (Dry), Beans (Fresh), Southern Peas/Cowpeas | 7 oz. per acre. Do not exceed 28 oz. per year. REI: 12-hour. PHI: 7-day. FRAC 12.

chlorothalonil products (chlorothalonil) Beans (Fresh) | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labelled at various rates. See label for directions. REI: 7-day. PHI: 12-hour. FRAC M5.

Endura (WG) (bosalid) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 8-11 oz. per acre. REI: 12-hour. PHI: 7-day for fresh legumes, 21-day for dry legumes. FRAC 7.

Fontelis (1.67SC) (penthiopyrad) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 14-30 fl. oz. per acre. Rates above 20 fl. oz. per acre are for fresh legumes only. REI: 12-hour. PHI: 0-day for fresh legumes, 21-day for dry legumes. FRAC 7.

iprodione products (iprodione) Beans (Dry), Beans (Fresh), Lima Beans | 1.5-2 pts. per acre. Formulations of iprodione include Nevado and Rovral. Make up to two applications starting at first flower, and ending no later than peak bloom. REI: 24-hour. FRAC 2.

Omega 500F (4.17) (fluazinam) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 8-13.6 fl. oz. per acre. Do not exceed 27.2 fl. oz. per crop cycle. REI: 12-hour. PHI: 14-day for fresh legumes, 30-day for dry legumes. FRAC 29.

Switch 62.5WG (cyprodinil, fludioxonil) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 11-14 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 9, FRAC 12.

Topsin 4.5FL (thiophanate-methyl) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 4FL formulation or Cercobin at 20-40 fl. oz. per acre, or 70WSB formulation at 1-2 lb. per acre. REI: 24-hour to 3-day. PHI: 14-day for fresh legumes, 28-day for dry legumes. FRAC 1.

Halo Blight of Beans - Pseudomonas Bacteria

Non-Pesticide

Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Plant western-grown, certified disease-free seed. Rotate to non-host crops for 2 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diaminimonium diacetate complex, cuprous oxide) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Several formulations of copper (Badge, Champ, Kocide) are labelled for use and may slow the spread of bacterial blights. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

Nematodes

Non-Pesticide

Beans (Dry), Beans (Fresh), Lima Beans, Southern Peas/Cowpeas | Collect soil samples for nematodes in the fall and avoid fields with high numbers. Rotate to a non-broadleaf crop, such as grass grains or sweet corn for >3 years. Rotation interval depends on the nematode count in soil samples. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue and displace nematodes is an important method to prevent nematode build-up.
Legumes - Diseases

Rust of Legumes - Uromyces Fungus

Non-Pesticide

Beans (Dry), Southern Peas/Cowpeas | Rotate to non-host crops for 3-4 years. Resistant varieties are available.

Pesticide

Aproach (2.08SC) (picoxystrobin) Beans (Dry), Peas (Dry) | 6-12 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 11.

Aprovia Top (difenconazole, benzovindiflupyr) Beans (Dry), Peas (Dry) | 10.5-11 fl. oz. per acre. A spreader sticker is recommended. REI: 12-hour. PHI: 14-day. FRAC 3, FRAC 7.

azoxystrobin products (azoxystrobin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. REI: 4-hour. PHI: 0-day for fresh legumes, 14-day for dry legumes. FRAC 11.

chlorothalonil products (chlorothalonil) Beans (Fresh) | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 7-day. FRAC M5.

Headline (SC) (2.08) (pyraclostrobin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 6-9 fl. oz. per acre. REI: 12-hour. PHI: 7-day for fresh. 21-days for dry. FRAC 11.

Priaxor (fluxapyroxad, pyraclostrobin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 4-8 fl. oz. per acre. REI: 12-hour. PHI: 7-day for fresh legumes, 21-day for dry legumes. FRAC 7, FRAC 11.

Proline 480SC (4) (prothioconazole) Beans (Dry), Southern Peas/Cowpeas | 5.7 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 3.

propiconazole products (propiconazole) Beans (Dry), Beans (Fresh), Lima Beans, Southern Peas/Cowpeas | 4 fl. oz. per acre. PropiMax EC and Tilt are labeled. REI: 12-hour. PHI: 7-day for fresh legumes. FRAC 3.

Quadris Opti (SC) (azoxystrobin, chlorothalonil) Beans (Dry) | 1.6-2.4 pts. per acre. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC M5.

Quilt (SE) (azoxystrobin, propiconazole) Beans (Dry), Beans (Fresh), Southern Peas/Cowpeas | 14 fl. oz. per acre. REI: 12-hour. PHI: 7-day for fresh legumes, 14-day for dry legumes. FRAC 11, FRAC 3.

Rally 40WSP (myclobutanil) Beans (Fresh) | 4-5 fl. oz. per acre. Snap beans only. REI: 24-hour. PHI: 0-day. FRAC 3.

Vertisan (1.67EC) (penthiopyrad) Beans (Dry), Southern Peas/Cowpeas | 14-20 fl. oz. per acre. REI: 12-hour. PHI: 21-day. FRAC 7.

Viruses of Multiple Crops - Multiple Pathogens

Bean Yellow Mosaic Virus (BYMV) overwinters in wild legumes, like sweet clover, and is spread by aphids.

Non-Pesticide

Beans (Dry), Beans (Fresh), Lima Beans | For BYMV: Keep new plantings as far as possible with the previous production area. Eliminating overwintering host plants such as wild sweet clover may reduce infection. Monitor for aphids and avoid broad-spectrum insecticides that might kill natural enemies and flare aphid populations. Some tolerant varieties are available. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up and transfer back to overwintering wild legumes.

Pesticide

Insecticides Beans (Dry), Beans (Fresh), Lima Beans | For BYMV: use aphid-specific insecticides to lower the population without also reducing the population of natural enemies. See insect section.

White Mold (Timber Rot, Drop, Stem Rot) of Multiple Crops - Sclerotinia Fungus

This soil pathogen is long-lived in the soil, and has a wide host range on broadleaved crops and weeds, including beans, vine crops, lettuce, tomatoes, peppers, and cole crops. It goes by other names in other crops, such as Drop, White Mold, Stem Rot, and Timber Rot.

It is more commonly where humidity and temperatures are high. The fungus often infects flowers, which then drop off and infect the stems that they land on. The stems take on a woody appearance and can split open. Inspection of the stems will reveal small black pellets that are the overwintering body of the pathogen.

Non-Pesticide

Beans (Dry), Beans (Fresh), Southern Peas/Cowpeas | Avoid fields with a history of the problem. Rotate to a non-broadleaf crop, such as grass grains or sweet corn for >6 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.
Pesticide

Approach (2.08SC) (picoxystrobin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 8-12 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 11.

Cannonball WG (50) (fludioxonil) Beans (Dry), Beans (Fresh), Southern Peas/Cowpeas | 7 oz. per acre. Do not exceed 28 oz. per year. REI: 12-hour. PHI: 7-day. FRAC 12.

Contans WG (5) (Coniothyrium minitans strain CON/M/91-08) Beans (Fresh) | 1-6 lbs. per acre. Apply immediately after harvest or 3-4 months before planting. REI: 4-hour. PHI: 7-day. FRAC NC. OMRI-listed.

Endura (WG) (boscalid) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 8-11 oz. per acre. REI: 12-hour. PHI: 7-day for fresh legumes, 21-day for dry legumes. FRAC 7.

Fontelis (1.67SC) (penthiopyrad) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 16-30 fl. oz. per acre. Rates above 20 fl. oz. per acre for fresh legumes only. REI: 12-hour. PHI: 0-day for fresh legumes, 21-day for dry legumes. FRAC 7.

iprodione products (iprodione) Beans (Dry), Beans (Fresh), Lima Beans | 1.5-2 pts. per acre. Formulations of iprodione include Nevado and Rovral. Make up to two applications starting at first flower, and ending no later than peak bloom. REI: 24-hour. FRAC 2.

Omega 500F (4.17) (fluazinam) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 8-13.6 fl. oz. per acre. Do not exceed 27.2 fl. oz. per crop cycle. REI: 12-hour. PHI: 14-day for fresh legumes, 30-day for dry legumes. FRAC 29.

Proline 480SC (4) (prothioconazole) Beans (Dry), Southern Peas/Cowpeas | 5.7 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 3.

Switch 62.5WG (cyprodinil, fludioxonil) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 11-14 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 9, FRAC 12.

Topsin 4.5FL (thiophanate-methyl) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 4FL formulation or Cercobin at 20-40 fl. oz. per acre, or 70WSB formulation at 1-2 lb. per acre. REI: 24-hour to 3-day. PHI: 14-day for fresh legumes, 28-day for dry legumes. FRAC 1.

Vertisian (1.67EC) (penthiopyrad) Beans (Dry), Southern Peas/Cowpeas | 16-20 fl. oz. per acre. REI: 12-hour. PHI: 21-day. FRAC 7.

Wilt of Multiple Crops - Fusarium Fungus

Non-Pesticide

Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Avoid fields with a history of the disease. Rotate to non-Legume crops for >6 years. Resistant varieties are available. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Legumes - Insects

Reviewed by Laura Ingwell, Anthony Hanson – Nov 2020

Recommended Controls

Aphids

Pesticide

Admire Pro (4.6SC) (imidacloprid) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 7-10.5 fl. oz. per acre soil application, or 1.2 fl. oz. per acre foliar application. Do not exceed 1 soil application per season or 3 foliar applications per season. REI: 12-hour. PHI: 21-day for soil application, or 7-day for foliar application. IRAC 4A.

Asana XL (0.66EC) (esfenvalerate) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 5.8-9.6 fl. oz. per acre. Do not exceed 38.4 fl. oz. per acre per season. Do not feed or graze livestock on treated plants. REI: 12-hour. PHI: 3-day for fresh legumes, 21-day for dry legumes. IRAC 3A. RUP.

Assail 30SG (acetamiprid) Beans (Fresh), Lime Beans, Peas (Fresh), Southern Peas/Cowpeas | Use 30SG formulations at 2.5-5.3 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 1.0-2.3 oz. per acre and do not exceed 6.9 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

Brigade 2EC (bifenthrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season for fresh beans and fresh or dried peas or 19.2 fl. oz. per acre per season on dried beans. Use 10DF, 10WP, or 10WSB formulations at 5.3-0.16 oz. per acre on fresh beans and peas only and do not exceed 32 oz. per acre per season. Allow 7 days between applications on fresh beans and peas, and 7 days between applications on dry beans and peas. REI: 12-hour. PHI: 3-day for fresh legumes, or 14-day for dry legumes. IRAC 3A. RUP.

Cruiser 5FS (thiamethoxam) Beans (Dry), Beans (Fresh), Lime Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.28 fl. oz. per 100 lbs. of seed. Do not apply a neonicotinoid.
Legumes - Insects

insecticide within 45 days of planting treated seed. REI: 12-hour. IRAC 4A.

Dimethoate 4EC (dimethoate) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh) | Use 2.67EC formulations at 0.75-1.5 pts. per acre on beans, or 0.5 pt. per acre on peas and do not exceed 3 pts. per acre per season on beans or 0.5 pt. per acre on peas. Not for use on Cowpeas/Southern Peas. Do not feed or graze livestock on treated plants. See pollinator precautions. Mechanical harvest only on day of application. REI: 48-hour. PHI: 0-day. IRAC 1B.

Lannate LV (2.4L) (methomyl) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.5-3 pts. per acre. Do not exceed 15 pts. per acre per season. Do not feed or graze livestock on treated plants within 7 days of application for succulent legumes, or 14 days of application for dry legumes. REI: 48-hour. PHI: 1-day at rates less than 1.5 pts. per acre, or 3-day for rates over 1.5 pts. per acre on fresh legumes, or 14-day for any rate on dry legumes. IRAC 1A. RUP.

M-Pede (3.8) (potassium salts of fatty acids) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1-2% by volume. To achieve enhanced and residual pest control mix with a labeled companion insecticide. REI: 12-hour. PHI: 0-day. IRAC UN, FRAC NC. OMRI-listed.

Movento (2SC) (spirotetramat) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 4.0-5.0 fl. oz. per acre. Do not exceed 5 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day for fresh legumes, or 7-day for dry legumes. IRAC 23.

Mustang Maxx (0.8) (zeta-cypermethrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 2.72-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.

Orthene 97 (S) (acephate) Beans (Dry), Lima Beans | 0.5-1.0 lb per acre. Do not exceed 2 1/8 lbs. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 1-day for fresh Lima Beans, or 14-day for dry legumes. IRAC 1B.

Sivanto 200 (1.67SL) (flupyridifurone) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 7-10.5 fl. oz. per acre. Do not exceed 28 fl. oz. per acre per season. Allow 10 days between applications. REI: 4-hour. PHI: 7-day. IRAC 4D.

Thimet 20G (phorate) Beans (Dry), Beans (Fresh), Lima Beans | 4.5-7.0 oz. per 1,000 fl. of row. Drill granules to the side of the seed or in a band over the row and lightly incorporate with a drag chain. Granules must be incorporated into the soil. Do not place granules in direct contact with seed. Do not feed or graze livestock on treated plants. REI: 48-hour. PHI: 60-day. IRAC 1B. RUP.

Transform WG (50) (sulfoxaflor) Beans (Dry), Beans (Fresh), Lima Beans | 0.75-1.0 oz. per acre. Do not make applications less than 14 days apart or consecutively on the same crop. No more than four applications per crop. Maximum of 8.5 oz. per acre per year. REI: 24-hour. PHI: 7-day. IRAC 4C.

Warrior II (2.08CS) (lambda-cyhalothrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.28-1.92 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 7-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.

Bean Leaf Beetle

Treatment for Bean Leaf Beetle is warranted at a threshold of 1 beetle per foot of row.

Pesticide

Baythroid XL (1EC) (beta-cyfluthrin) Beans (Dry), Peas (Dry), Southern Peas/Cowpeas | 2.4-3.2 fl. oz. per acre. Do not exceed 6.4 fl. oz. per acre per season for succulent Cowpeas/Southern Peas, or 10.5 fl. oz. per acre per season for dry legumes. Allow 14 days between applications. Do not feed or graze livestock on treated plants. REI: 12-hour. PHI: 7-day for Cowpeas/Southern Peas, or 7-day for dry legumes. IRAC 3A. RUP.

Brigade 2EC (bifenthrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season for fresh beans and fresh or dried peas or 19.2 fl. oz. per acre per season on dried beans. Use 10DF, 10WP, or 10WSB formulations at 5.3.0-16 oz. per acre on fresh beans and peas only and do not exceed 32 oz. per acre per season. Allow 7 days between applications on fresh beans and peas, and 7 days between applications on dry beans and peas. REI: 12-hour. PHI: 3-day for Cowpeas/Southern Peas, or 7-day for dry legumes. IRAC 3A. RUP.

Cruiser 5FS (thiamethoxam) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.28 fl. oz. per 100 lbs. of seed. Do not apply a neonicotinoid insecticide within 45 days of planting treated seed. REI: 12-hour. IRAC 4A.

Dimethoate 4EC (dimethoate) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 2.67EC formulations at 0.75-1.5 pts. per acre on beans, or 0.5 pt. per acre on peas and do not exceed 3 pts. per acre per season on beans or 0.5 pt. per acre on peas. Not for use on Cowpeas/Southern Peas. Do not feed or graze livestock on treated plants. See pollinator precautions. Mechanical harvest only on day of application. REI: 48-hour. PHI: 0-day. IRAC 1B.

Mustang Maxx (0.8) (zeta-cypermethrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 2.72-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.
Orthene 97 (S) (acephate) Beans (Dry), Lima Beans | 0.5-1.0 lb per acre. Do not exceed 2 1/8 lbs. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 1-day for fresh Lima Beans, or 14-day for dry legumes. IRAC 1B.

Sevin XLR Plus (4SC) (carbaryl) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 0.5-1.0 qts. per acre. Do not exceed 6 qts. per acre per season. Do not use on shelled succulent peas and beans. Edible-pod succulent and dried shelled beans and peas only. REI: 12-hour. PHI: 3-day for fresh legumes, 14-day for dry legumes. IRAC 1A.

Warrior II (2.08CS) (lambda-cyhalothrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.28-1.92 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 7-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.

Caterpillars

There are many caterpillar pests of legumes, including European corn borer, corn earworm/tomato fruitworm, alfalfa caterpillars, cutworms, loops, and armyworms. Always check the label for the specific list of caterpillars that the product can be used on.

Pesticide

Asana XL (0.66EC) (esfenvalerate) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 5.8-9.6 fl. oz. per acre. For armyworms, corn borers, cutworms, earworms, and loopers. Do not exceed 38.4 fl. oz. per acre per season. Do not feed or graze livestock on treated plants. REI: 12-hour. PHI: 3-day for fresh legumes, 21-day for dry legumes. IRAC 3A. RUP.

Baythroid XL (1EC) (beta-cyfluthrin) Beans (Dry), Peas (Dry), Southern Peas/Cowpeas | 0.8-3.2 fl. oz. per acre. For armyworms, corn borers, earworms, and loopers. Do not exceed 6.4 fl. oz. per acre per season for succulent Cowpeas/Southern Peas, or 10.5 fl. oz. per acre per season for dry legumes. Allow 14 days between applications. Do not feed or graze livestock on treated plants. REI: 12-hour. PHI: 3-day for Cowpeas/Southern Peas, or 7-day for dry legumes. IRAC 3A. RUP.

Brigade 2EC (bifenthrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | For armyworms, corn borers, cutworms, earworms, and loopers. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season for fresh beans and fresh or dried peas or 19.2 fl. oz. per acre per season on dried beans. Use 10DF, 10WP, or 10WSB formulations at 5.3-0-16 oz. per acre on fresh beans and peas only and do not exceed 32 oz. per acre per season. Allow 7 days between applications on fresh beans and peas, and 7 days between applications on dry beans and peas. REI: 12-hour. PHI: 3-day for fresh legumes, or 14-day for dry legumes. IRAC 3A. RUP.

Coragen (1.67SC) (chlorantraniliprole) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 3.5-7.5 fl. oz. per acre. For armyworms, corn borers, cutworms, earworms, and loopers. Do not exceed 15.4 fl. oz. per acre per season. Allow 3 days between applications. REI: 4-hour. PHI: 1-day. IRAC 28.

Entrust SC (2) (spinosad) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 3-6 oz. per acre. For armyworms, corn borers, earworms, and loopers. Use 2SC formulations at 3.0-6.0 fl. oz. per acre and do not exceed 29 fl. oz. acre per season on succulent legumes or 12 fl. oz. on dried legumes. Use 80WP formulations at 1.0-2.0 oz. per acre and do not exceed 9 oz. per acre per season on succulent legumes or 3.75 oz. on dried legumes. Observe resistance management restrictions. Allow 5 days between applications. Do not feed or graze livestock on treated plants. REI: 4-hour. PHI: 3-day for fresh legumes, or 28-day for dry legumes. IRAC 5. OMRI-listed.

Intrepid 2F (methoxyfenozide) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 4-16 fl. oz. per acre. For armyworms, corn borers, earworms, and loopers. Use 4-8 fl. oz. on young plants in early season. Use 8-16 fl. oz. for mid- to late-season applications or heavier infestations. Do not exceed 64 fl. oz. per acre per season. Allow 7 days between applications. REI: 4-hour. PHI: 7-day. IRAC 18.

Lannate LV (2.4L) (methomyl) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.5-3 pts. per acre. For armyworms, corn borers, earworms, and loopers. Do not exceed 15 pts. per acre per season. Do not feed or graze livestock on treated plants within 7 days of application for succulent legumes, or 14 days of application for dry legumes. REI: 48-hour. PHI: 1-day at rates less than 1.5 pts. per acre, or 3-day for rates over 1.5 pts. per acre on fresh legumes, or 14-day for any rate on dry legumes. IRAC 1A. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 2.72-4.0 fl. oz. For armyworms, corn borers, earworms, and loopers. Do not exceed 24. fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.

Orthene 97 (S) (acephate) Beans (Dry), Lima Beans | 0.5-1.0 lb per acre. For armyworms, corn borers, cutworms, earworms, and loopers. Do not exceed 2 1/8 lbs. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 1-day for fresh Lima Beans, or 14-day for dry legumes. IRAC 1B.

Radiant 1SC (spinetoram) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 3-8 fl. oz. per acre. For armyworms, corn borers, earworms, and loopers. Do not exceed 28 fl. oz. per acre per season for succulent legumes, or 12 fl. oz. per acre for dry legumes. REI: 4-hour. PHI: 3-day for fresh legumes, or 28-day for dry legumes. IRAC 5.
Legumes - Insects

Sevin XLR Plus (4SC) (carbaryl) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 0.5-1.5 qts. per acre. For armyworms, corn borers, cutworms, and earworms. Do not exceed 6 qts. per acre per season. Do not use on shelled succulent peas and beans. Edible-pod succulent and dried shelled beans and peas only. REI: 12-hour. PHI: 3-day for fresh legumes, or 14-day for dry legumes. IRAC 1A.

Warrior II (2.08CS) (lambda-cyhalothrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.28-1.92 fl. oz. per acre. For armyworms, corn borers, cutworms, earworms, and loopers. Do not exceed 7.68 fl. oz. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 7-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.

Cowpea Curculio Beetle

Pesticide

Asana XL (0.66EC) (esfenvalerate) Beans (Dry), Peas (Dry) | 4.8-9.6 fl. oz. per acre. Do not exceed 38.4 fl. oz. per acre per season. Do not feed or graze livestock on treated plants. REI: 12-hour. PHI: 21-day. IRAC 3A. RUP.

Baythroid XL (1EC) (beta-cyfluthrin) Beans (Dry), Peas (Dry), Southern Peas/Cowpeas | 1.6-2.4 fl. oz. per acre. Do not exceed 6.4 fl. oz. per acre per season for succulent Cowpeas/Southern Peas, or 10.5 fl. oz. per acre per season for dry legumes. Allow 14 days between applications. Do not feed or graze livestock on treated plants. REI: 12-hour. PHI: 3-day for for Cowpeas/Southern Peas, or 7-day for dry legumes. IRAC 3A. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 2.72-4.0 fl. oz. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.

Sevin XLR Plus (4SC) (carbaryl) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 0.5-1.5 qts. per acre. Do not exceed 6 qts. per acre per season. Do not use on shelled succulent peas and beans. Edible-pod succulent and dried shelled beans and peas only. REI: 12-hour. PHI: 3-day for fresh legumes, 14-day for dry legumes. IRAC 1A.

Warrior II (2.08CS) (lambda-cyhalothrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.28-1.92 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 7-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.

Leafhoppers

Treatment for potato leafhopper is warranted at the following thresholds.

Seedlings: 0.5 per sweep, or 2 per row foot.
3rd trifoliate: 1 per sweep, or 5 per row foot.
Bud stage: 5 per row foot.

Pesticide

Admire Pro (4.6SC) (imidacloprid) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 7-10.5 fl. oz. per acre soil application, or 1.2 fl. oz. per acre foliar application. Do not exceed 1 soil application per season or 3 foliar applications per season. REI: 12-hour. PHI: 21-day for soil application, or 7-day for foliar application. IRAC 4A.

Asana XL (0.66EC) (esfenvalerate) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 30SG formulations at 2.5-5.3 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 1.0-2.3 oz. per acre and do not exceed 6.9 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

Baythroid XL (1EC) (beta-cyfluthrin) Beans (Dry), Peas (Dry), Southern Peas/Cowpeas | Use 2EC formulations at 1.6-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season for succulent Cowpeas/Southern Peas, or 19.2 fl. oz. per acre per season on dried beans. Use 10DF, 10WP, or 10WSB formulations at 4-16 oz. per acre on fresh beans and peas only and do not exceed 32 oz. per acre per season. Allow 7 days between applications. Do not feed or graze livestock on treated plants. REI: 12-hour. PHI: 3-day for fresh Cowpeas/Southern Peas, or 7-day for dry legumes. IRAC 3A. RUP.

Brigade 2EC (bifenthrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 2EC formulations at 1.6-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season for fresh beans and fresh or dried peas or 19.2 fl. oz. per acre per season on dried beans. Use 10DF, 10WP, or 10WSB formulations at 4-16 oz. per acre on fresh beans and peas only and do not exceed 32 oz. per acre per season. Allow 7 days between applications on fresh beans and peas, and 7 days between applications on dry beans and peas. REI: 12-hour. PHI: 3-day for fresh legumes, or 14-day for dry legumes. IRAC 3A. RUP.

Cruiser SFS (thiamethoxam) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.28 fl. oz. per 100 lbs. of seed. Do not apply a neonicotinoid insecticide within 45 days of planting treated seed. REI: 12-hour. IRAC 4A.
Dimethoate 4EC (dimethoate) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh) | Use 2.67EC formulations at 0.75-1.5 pts. per acre on beans, or 0.5 pt. per acre on peas and do not exceed 3 pts. per acre per season on beans or 0.5 pt. per acre on peas. Not for use on Cowpeas/Southern Peas. Do not feed or graze livestock on treated plants. See pollinator precautions. Mechanical harvest only on day of application. REI: 48-hour. PHI: 0-day. IRAC 1B.

Lannate LV (2.4L) (methomyl) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 0.75-3 pts. per acre. Do not exceed 15 pts. per acre per season. Do not feed or graze livestock on treated plants within 7 days of application for succulent legumes, or 14 days of application for dry legumes. REI: 48-hour. PHI: 1-day at rates less than 1.5 pts. per acre, or 3-day for rates over 1.5 pts. per acre on fresh legumes, or 14-day for any rate on dry legumes. IRAC 1A. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1-2% by volume. To achieve enhanced and residual pest control mix with a labeled companion insecticide. REI: 12-hour. PHI: 0-day. IRAC UN, FRAC NC. OMRI-listed.

Orthene 97 (S) (acephate) Beans (Dry), Lima Beans | 0.5-1.0 lb per acre. Do not exceed 2 1/8 lbs. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 1-day for fresh Lima Beans, or 14-day for dry legumes. IRAC 1B.

Sivanto 200 (1.67SL) (flupyradifurone) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 7-10.5 fl. oz. per acre. Do not exceed 28 fl. oz. per acre per season. Allow 10 days between applications. REI: 4-hour. PHI: 7-day. IRAC 4D.

Thimet 20G (phorate) Beans (Dry), Beans (Fresh), Lima Beans | 4.5-7.0 oz. per 1,000 ft. of row. Drill granules to the side of the seed or in a band over the row and lightly incorporate with a drag chain. Granules must be incorporated into the soil. Do not place granules in direct contact with seed. Do not feed or graze livestock on treated plants. REI: 48-hour. PHI: 60-day. IRAC 1B. RUP.

Warrior II (2.08CS) (lambda-cyhalothrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.28-1.92 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 7-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.

Mexican Bean Beetle

Treatment for Mexican Bean Beetle is warranted at a threshold of 0.5 beetle per plant.

Pesticide

Asana XL (0.66EC) (esfenvalerate) Beans (Fresh), Lima Beans, Peas (Fresh), Southern Peas/Cowpeas | 2.9-5.8 fl. oz. per acre. Do not exceed 38.4 fl. oz. per acre per season. Do not feed or graze livestock on treated plants. REI: 12-hour. PHI: 3-day for succulent legumes, 21-day for dry legumes. IRAC 3A. RUP.

Baythroid XL (1EC) (beta-cyfluthrin) Beans (Dry), Peas (Dry), Southern Peas/Cowpeas | 2.4-3.2 fl. oz. per acre. Do not exceed 6.4 fl. oz. per acre per season for succulent Cowpeas/Southern Peas, or 10.5 fl. oz. per acre per season for dry legumes. Allow 14 days between applications. Do not feed or graze livestock on treated plants. REI: 12-hour. PHI: 3-day for Cowpeas/Southern Peas, or 7-day for dry legumes.b IRAC 3A. RUP.

Brigade 2EC (bifenthrin) Beans (Dry), Lima Beans, Peas (Dry), Southern Peas/Cowpeas | 2.1-6.4 fl. oz. per acre. Treat Mexican Bean Leaf Beetle on dry peas and beans only. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season for dried peas or 19.2 fl. oz. per acre per season on dried beans. Do not use 10DF, 10WP, or 10WSB formulations as they are labeled for fresh beans and peas only. Allow 7 days between applications on dry beans and peas. REI: 12-hour. PHI: 14-day. IRAC 3A. RUP.

Cruiser 5FS (thiamethoxam) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.28 fl. oz. per 100 lbs. of seed. Do not apply a neonicotinoid insecticide within 45 days of planting treated seed. REI: 12-hour. IRAC 4A.

Dimethoate 4EC (dimethoate) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh) | Use 2.67EC formulations at 0.75-1.5 pts. per acre on beans, or 0.5 pt. per acre on peas and do not exceed 3 pts. per acre per season on beans or 0.5 pt. per acre on peas. Not for use on Cowpeas/Southern Peas. Do not feed or graze livestock on treated plants. See pollinator precautions. Mechanical harvest only on day of application. REI: 48-hour. PHI: 0-day. IRAC 1B.

Lannate LV (2.4L) (methomyl) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 0.75-3 pts. per acre. Do not exceed 15 pts. per acre per season. Do not feed or graze livestock on treated plants within 7 days of application for succulent legumes, or 14 days of application for dry legumes. REI: 48-hour. PHI: 1-day at rates less than 1.5 pts. per acre, or 3-day for rates over 1.5 pts. per acre on fresh legumes, or 14-day for any rate on dry legumes. IRAC 1A. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 2.72-4.0 fl. oz. Do not exceed 24 fl. oz. per acre
Legumes - Insects

Pea Weevil Beetle

Pesticide

Baythroid XL (1EC) (beta-cyfluthrin) Beans (Dry), Peas (Dry), Southern Peas/Cowpeas | 2.4-3.2 fl. oz. per acre. Do not exceed 6.4 fl. oz. per acre per season for succulent Cowpeas/Southern Peas, or 10.5 fl. oz. per acre per season for dry legumes. Allow 14 days between applications. Do not feed or graze livestock on treated plants. REI: 12-hour. PHI: 3-day for for Cowpeas/Southern Peas, or 7-day for dry legumes. IRAC 3A. RUP.

Orthene 97 (S) (acephate) Beans (Dry), Lima Beans | 0.5-1.0 lb per acre. Do not exceed 2 1/8 lbs. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 1-day for fresh Lima Beans, or 14-day for dry legumes. IRAC 1B.

Sevin XLR Plus (4SC) (carbaryl) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 0.5-1.0 qts. per acre. Do not exceed 6 qts. per acre per season. Do not use on shelled succulent peas and beans. Edible-pod succulent and dried shelled beans and peas only. REI: 12-hour. PHI: 3-day for fresh legumes, 14-day for dry legumes. IRAC 1A.

Thimet 20G (phorate) Beans (Dry), Beans (Fresh), Lima Beans | 4.9-9.4 oz. per 1,000 ft. of row. Drill granules to the side of the seed or in a band over the row and lightly incorporate with a drag chain. Granules must be incorporated into the soil. Do not place granules in direct contact with seed. Do not feed or graze livestock on treated plants. REI: 48-hour. PHI: 60-day. IRAC 1B. RUP.

Warrior II (2.08CS) (lambda-cyhalothrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 0.96-1.6 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 7-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.

Mites

Pesticide

Aramite 50WS (bifenazate) Beans (Fresh), Lima Beans, Peas (Fresh), Southern Peas/Cowpeas | 1-1.5 lbs. per acre. Do not exceed 2 applications per season. REI: 12-hour. PHI: 3-day. IRAC UN.

Agri-Mek SC (0.7) (abamectin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.75-3.5 fl. oz. per acre. Not for cowpeas grown for fresh use. Do not exceed 10.25 fl. oz. per acre per season and do not make more than 2 sequential applications. Do not feed or graze livestock on treated plants. REI: 12-hour. PHI: 7-day. IRAC 6. RUP.

Portal (0.4EC) (fenpyroximate) Beans (Fresh) | 2 pts. per acre. Do not exceed 4 pts. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 21A.

Non-Pesticide

Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Plant after the peak flight and egg-laying window of the first generation of flies looking to lay eggs around 360 GDD base 40. Handle seeds carefully to prevent cracking. Plow winter vegetation under early in the spring and thoroughly cover to limit attractiveness of rotting vegetation to the first generation of flies to lay eggs on.

Warrior II (2.08CS) (lambda-cyhalothrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.28-1.92 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 7-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.
insecticide within 45 days of planting treated seed. REI: 12-hour. IRAC 4A.

**Lorsban 4E (chlorpyrifos)** Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 4E formulations at 2 pts. per acre or 1.8 fl. oz. per 1,000 ft. of row. Use 75WG formulations at 1.33 lbs. per acre. For planting applications, spray 3-5 inch band over row behind planter show and in front of press wheel to achieve shallow incorporation. Do not make more than one application per year. REI: 24-hour to 3-day. IRAC 1B. RUP.

**Thimet 20G (phorate)** Beans (Dry), Beans (Fresh), Lima Beans | 4.5-7.0 oz. per 1,000 ft. of row. Drill granules to the side of the seed or in a band over the row and lightly incorporate with a drag chain. Granules must be incorporated into the soil. Do not place granules in direct contact with seed. Do not feed or graze livestock on treated plants. REI: 48-hour. PHI: 60-day. IRAC 1B. RUP.

**Stink Bugs**

**Pesticide**

**Baythroid XL (1EC) (beta-cyfluthrin)** Beans (Dry), Peas (Dry), Southern Peas/Cowpeas | 1.6-2.4 fl. oz. per acre. Do not exceed 6.4 fl. oz. per acre per season for succulent Cowpeas/Southern Peas, or 10.5 fl. oz. per acre per season for dry legumes. Allow 14 days between applications. Do not feed or graze livestock on treated plants. REI: 12-hour. PHI: 3-day for for Cowpeas/Southern Peas, or 7-day for dry legumes. IRAC 3A. RUP.

**Brigade 2EC (bifenthrin)** Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season for fresh beans and fresh or dried peas or 19.2 fl. oz. per acre per season on dried beans. Use 10DF, 10WP, or 10WSB formulations at 5.3-0-16 oz. per acre on fresh beans and peas only and do not exceed 32 oz. per acre per season. Allow 7 days between applications on fresh beans and peas, and 7 days between applications on dry beans and peas. REI: 12-hour. PHI: 3-day for fresh legumes, or 14-day for dry legumes. IRAC 3A. RUP.

**Lannate LV (2.4L) (methomyl)** Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.5-3 pts. per acre. Do not exceed 15 pts. per acre per season. Do not feed or graze livestock on treated plants within 7 days of application for succulent legumes, or 14 days of application for dry legumes. REI: 48-hour. PHI: 1-day at rates less than 1.5 pts. per acre, or 3-day for rates over 1.5 pts. per acre on fresh legumes, or 14-day for any rate on dry legumes. IRAC 1A. RUP.

**Mustang Maxx (0.8) (zeta-cypermethrin)** Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 2.72-4.0 fl. oz. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.

**Sevin XLR Plus (4SC) (carbaryl)** Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 0.5-1.5 qts. per acre. Do not exceed 6 qts. per acre per season. Do not use on shelled succulent peas and beans. Edible-pod succulent and dried shelled beans and peas only. REI: 12-hour. PHI: 3-day for fresh legumes, 14-day for dry legumes. IRAC 1A.

**Transform WG (50) (sulfoxaflor)** Beans (Dry), Beans (Fresh), Lima Beans | 2.25 oz. per acre. Suppression only. Do not make applications less than 14 days apart or consecutively on the same crop. No more than four application per crop. Maximum of 8.5 oz. per acre per year. REI: 24-hour. PHI: 7-day. IRAC 4C.

**Warrior II (2.08CS) (lambda-cyhalothrin)** Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.28-1.92 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 7-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.

**Thrips**

**Pesticide**

**Admire Pro (4.6SC) (imidacloprid)** Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 7-10.5 fl. oz. per acre soil application. Do not exceed 1 soil application per season. REI: 12-hour. PHI: 21-day. IRAC 4A.

**Assail 30SG (acetamiprid)** Beans (Fresh), Lima Beans, Peas (Fresh), Southern Peas/Cowpeas | Use 30SG formulations at 4.5-5.3 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 1.9-2.3 oz. per acre and do not exceed 6.9 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Brigade 2EC (bifenthrin)** Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season for fresh beans and fresh or dried peas or 19.2 fl. oz. per acre per season on dried beans. Use 10DF, 10WP, or 10WSB formulations at 5.3-0-16 oz. per acre on fresh beans and peas only and do not exceed 32 oz. per acre per season. Allow 7 days between applications on fresh beans and peas, and 7 days between applications on dry beans and peas. REI: 12-hour. PHI: 3-day for fresh legumes, or 14-day for dry legumes. IRAC 3A. RUP.

**Entreat SC (2) (spinosad)** Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 2SC formulations at 4.5-6.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season on succulent legumes or 12 fl. oz. on dried legumes. Use 80WP formulations at 1.0-2.5 oz. per acre and do not exceed 9 oz. per acre per season on succulent legumes or 3.75 oz. on dried legumes. Observe resistance management restrictions. Allow 5 days between applications. Do not feed or graze livestock on treated plants. REI: 4-hour. PHI: 3-day for fresh legumes, or 28 day for dry legumes. IRAC 5. OMRI-listed.
Legumes - Weeds

Mustang Maxx (0.8) (zeta-cypermethrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 2.72-4.0 fl oz. Do not exceed 24 fl oz. per acre per season. REI: 12-hour. PHI: 1-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.

Radiant I SC (spinetoram) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 5-8 fl oz. per acre. Do not exceed 28 fl oz. per acre. per season for succulent legumes, or 12 fl oz. per acre for dry legumes. REI: 4-hour. PHI: 3-day for fresh legumes, or 28-day for dry legumes. IRAC 5.

Sevin XLR Plus (4SC) (carbaryl) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 0.5-1.5 qts. per acre. Do not exceed 6 qts. per acre per season. Do not use on shelled succulent peas and beans. Edible-pod succulent and dried shelled beans and peas only. REI: 12-hour. PHI: 3-day for fresh legumes, or 14-day for dry legumes. IRAC 3A. RUP.

Transform WG (50) (sulfoxaflor) Beans (Dry), Beans (Fresh), Lima Beans | 2.25 oz. per acre. suppression only. Do not make applications less than 14 days apart or consecutively on the same crop. No more than four application per crop. Maximum of 8.5 oz. per acre per year. REI: 24-hour. PHI: 7-day. IRAC 4C.

Warrior II (2.08CS) (lambda-cyhalothrin) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.28-1.92 fl oz. per acre. Do not exceed 7.68 fl oz. per acre per season. Do not feed or graze livestock on treated plants. REI: 24-hour. PHI: 7-day for fresh legumes, or 21-day for dry legumes. IRAC 3A. RUP.

Wireworms

Pesticide

Cruiser 5FS (thiamethoxam) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1.28 fl oz. per 100 lbs. of seed. Do not apply a neonicotinoid insecticide within 45 days of planting treated seed. REI: 12-hour. IRAC 4A.

Legumes - Weeds

Reviewed by Stephen Meyers, Ben Phillips – Nov 2020

Recommended Controls

All Weeds

Weed control methods in legumes vary by production system and crop. The challenges for those who rely on herbicides include the chance of injuring crops under adverse weather, the relatively short residual of preemergence herbicides, and replant restrictions for other vegetable crops for certain legume herbicides that are shared with field crops.

For legumes that are no-till direct-seeded into a killed crop (such as after a rye cover crop, or wheat) growers often use a burndown herbicide with a preemergence herbicide. If residue is not sufficient to suppress later-emerging weeds, growers may use postemergence herbicides, or shielded applications of nonselective herbicides.

For legumes direct-seeded into tilled soil, growers often combine one or more preemergence herbicides at planting with one or more cultivations. Sometimes, growers also apply a preemergence herbicide at the last cultivation to improve control of late-emerging weeds. If needed, growers may use postemergence herbicides or shielded applications of nonselective herbicides.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

Non-Pesticide

Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Weed pressure may be substantially reduced when growers prepare seedbeds several weeks in advance of planting and kill the first one or two flushes of weeds before planting without stirring up new weed seeds. Legumes lend themselves to this stale seedbed practice because they are often planted after common weeds have emerged in tilled soil. Uniform and close plant spacing in the row promotes rapid canopy cover, and fresh market growers can keep larger between row spacing clean with between row cultivation tools for hand-picking or towable mechanical harvesters. For densely populated broad acre mechanically-harvested processing crops, rolling cultivators on wide tool-bars offer effective high-speed cultivation.

Broadleaf and Grass Weeds - Postemergence

Pesticide

glyphosate products (glyphosate) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations of 3 lbs. ae per gal. (4 lbs. isopropylamine salt per gal.) at 1-5 qts. per acre, or formulations containing 4.5 lbs. ae per gal. (5 lbs. potassium salt per gal.) at 0.66-3.3 qts. per acre. Broadcast before or after planting but before crop emerges, or apply up to 0.75 lb. acid equivalent between crop rows with wipers, hooded or shielded sprayers. Use low rate for annuals and higher rates for perennials. See label for suggested application volume and adjuvants. REI: 4 to 12-hour. PHI: 14-day. WSSA 9.

Lorox DF (50) (linuron) Peas (Dry) | 1-2 lbs. per acre. For dry peas and dry southern peas/cowpeas: apply after seeding but before crop emerges. Do not apply to sand or loamy sand. Do not use on soils with less than 1% organic matter. REI: 24-hour to 8-day. WSSA 7.
Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas

For succulent legumes: apply 2-4 pts. per acre before seeding or after seeding but before crop emergence. For dry legumes: apply 1.2-2.0 pts. per acre as a harvest-aid. Use 4-8 fl. oz. of NIS per 25 gals. of spray solution. REI: 12 to 24-hour. PHI: 7-day for dry legume harvest-aid applications. WSSA 22. RUP.

**Pursuit (2) (imazethapyr)**

Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Southern Peas/Cowpeas

For fresh beans in Illinois, Indiana, Iowa, Michigan, and Minnesota only: apply and 1.5 fl. oz. per acre and incorporate within 1 week of planting, or apply within 1 day after planting. In Missouri only, a postemergence application can be mixed with Basagran after crop has at least one true leaf. Apply before July 31. For dry beans and peas, Lima beans, and Southern peas/cowpeas: apply 3 fl. oz. per acre and incorporate within 1 week of planting, or apply within 3 days after planting before crop emerges, or apply after crop has 1 fully expanded trifoliate leaf or peas or cowpeas are at least three inches tall. Early postemergence application not allowed on lima beans. Use 8 oz. of NIS per 25 gals. of spray solution if emerged weeds are present. If using COC or N fertilizer on dry beans to improve weed control, add Basagran at 6-16 fl. oz. per acre or Rezult at 12-24 fl. oz. per acre to minimize crop injury. In all cases, do not apply to fields treated with trifluralin or injury may occur. In Minnesota north of Highway 210 and in Michigan on sandy or sandy loam soils do not apply more than 2 fl. oz. per acre. REI: 4-hour. PHI: 30-day for succulent legumes, 60-day for dry legumes. WSSA 2.

**Raptor (1) (imazamox)**

Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh) | 4 fl. oz. per acre. For dry beans and peas: apply 4 fl. oz. per acre after the first trifoliate is fully expanded for beans, or first three pairs of leaves for peas. May add NIS, COC or N fertilizer. Must add Basagran or Rezult for dry peas. For fresh peas: apply 3 fl. oz. per acre when crop is at least 3 inches tall but prior to 5 nodes before flowering. Must add NIS. May add COC or N fertilizer. If using COC, you must add Basagran or Rezult. For fresh beans in Illinois, Indiana, Iowa, Michigan, and Minnesota: apply 4 fl. oz. per acre after the first trifoliate is fully expanded and before bloom. Must add NIS. Do not add COC. May add N fertilizer. Must add Basagran or Rezult. For succulent Lima beans: apply 4 fl. oz. per acre when first or second trifoliate is fully expanded and before bloom. Must add NIS. Must add Basagran or Rezult. Notes: Use NIS with at least 80% active ingredient at 1 qt. per 100 gals. of spray solution, or 1 gal. COC per 100 gals, of spray solution, or 2.5 gals. of nitrogen or 12-15 lbs. ammonium sulfate per 100 gals. of spray solution to improve weed control (but may increase crop injury). Use Basagran at 6-16 fl. oz. per acre or Rezult at 12-24 fl. oz. per acre to minimize crop injury. In all cases, Raptor is most effective on weeds less than 3 inches tall, and the 3 fl. oz. rate is weak on grasses. Using Raptor on fields treated with trifluralin may increase the risk of injury. Do not exceed 1 application per year. REI: 4-hour. PHI: 30-day when tank mixed with Basagran or Rezult. WSSA 2.

**Rezult (5L) (bentazon, sethoxydim)**

Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas

3.2 pts. per acre. Apply when weeds are small and after peas have 3 pairs of leaves or first trifoliate leaf of beans is fully expanded. An additional application of Basagran is allowed not to exceed 2 pts. per acre, and an additional application of Poast is allowed at 2.9 pts. per acre. REI: 48-hour. PHI: 30-day. WSSA 6, WSSA 1.

**Eptam 7E (EPTC)**

Beans (Dry), Beans (Fresh), Peas (Fresh) | 1.3 pts. per acre. For fresh beans: apply 0.4-0.67 pt. per acre. For fresh peas: apply 1.3 pts. per acre. Broadcast before planting, or after planting before crop emerges. Not effective on muck soil. REI: 12-hour. PHI: 45-day for succulent beans. WSSA 13.

**Dual Magnum (7.62EC) (s-metolachlor)**

Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1-2 pts. per acre. For fresh and dry peas: apply after seeding before crop emerges. Do not incorporate. For fresh and dry beans, and southern peas/cowpeas, and lima beans: apply and incorporate before planting, or apply after seeding but before crop emerges. Can be tank-mixed preplant incorporated with Eptam or trifluralin. Do not use on muck soils. In all cases, use lower rates on coarse soils. Do not use on muck soils. Dual II Magnum contains a safener and may used instead of Dual Magnum to limit crop injury under cool soil conditions. REI: 24-hour. WSSA 15.

**Lorox DF (50) (linuron)**

Peas (Dry) | 1-2 lbs. per acre. For dry peas and dry southern peas/cowpeas: apply after seeding but before crop emerges. Do not apply to sand or loamy sand. Do not use on soils with less than 1% organic matter. REI: 24-hour to 8-day. WSSA 7.

**Outlook (6) (dimethenamid-p)**

Beans (Dry) | 10-21 fl. oz. per acre. Use lower rate on coarse soils low in organic matter. Apply before planting and incorporate, apply after planting before emergence, or apply after planting when beans have 1-3 trifoliate leaves. Do not exceed 12 fl. oz. on coarse soils prior to emergence. REI: 12-hour. PHI: 70-day. WSSA 15.

**pendimethalin products (pendimethalin)**

Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 3.3EC formulations at 1.2-3.6 pts. per acre. Use 3.8ME formulations at 1.5-3 pts. per acre. Use low rates on coarse soils. Broadcast and incorporate before planting. Not effective on soils with high organic matter. REI: 24-hour. WSSA 3.
**Legumes - Weeds**

**Pursuit (2) (imazethapyr)** Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Southern Peas/Cowpeas | For fresh beans in Illinois, Indiana, Iowa, Michigan, and Minnesota only: apply and 1.5 fl. oz. per acre and incorporate within 1 week of planting, or apply within 1 day after planting. In Missouri only, a postemergence application can be mixed with Basagran after crop has at least one true leaf. Apply before July 31. For dry beans and peas, Lima beans, and Southern peas/cowpeas: apply 3 fl. oz. per acre and incorporate within 1 week of planting, or apply within 3 days after planting before crop emerges, or apply after crop has 1 fully expanded trifoliate leaf if peas or cowpeas are at least three inches tall. Early postemergence application not allowed on lima beans. Use 8 oz. of NIS per 25 gals. of spray solution if emerged weeds are present. If using COC or N fertilizer on dry beans to improve weed control, add Basagran at 6-16 fl. oz. per acre or Rezult at 12-24 fl. oz. per acre to minimize crop injury. In all cases, do not apply to fields treated with trifluralin or injury may occur. In Minnesota north of Highway 210 and in Michigan on sandy or sandy loam soils do not apply more than 2 fl. oz. per acre. REI: 4-hour. PHI: 30-day for succulent legumes, 60-day for dry legumes. WSSA 2.

**Sonalan HFP (35.4) (ethalfluralin)** Beans (Dry) | 1.5-4.5 pts. per acre. Apply and incorporate before planting. Use higher rates to suppress eastern black nightshade. Not for muck soils. REI: 24-hour. WSSA 3.

**Spartan Advance (glyphosate, sulfentrazone)** Beans (Dry), Lima Beans, Peas (Dry), Southern Peas/Cowpeas | 16-57 fl. oz. per acre. Spring-apply early-preplant, preplant-incorporated, or preemergent. Rate depends on soil texture, organic matter, and pH. Do not use on sand soils with less than 1% organic matter or apply after crop emerges. Michigan, Minnesota, and Wisconsin only: a fall application is allowed for control of weeds ahead of winter. REI: 12-hour. PHI: 90-day. WSSA 9, WSSA 14.

**trifluralin products (trifluralin)** Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 0.5-1 lb. a.i. per acre. Use 4E formulations at 1-1.5 pts. per acre for snap beans, lima beans, and peas, or up to 2 pts. per acre for dry beans. Use 10G formulations at 5-7.5 lbs. per acre for snap beans, lima beans, and peas, or up to 10 lbs. per acre for dry beans. Broadcast and incorporate 1-2 inches before seeding. Use lower rate on coarse soils with less than 2% organic matter. Not effective on muck or high organic matter soils REI: 12-hour. WSSA 3.

**Broadleaf Weeds Only - Postemergence**

**Pesticide**

**Aim EC (2) (carfentrazone)** Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 0.5-2 fl. oz. per acre. Apply prior to or within 24 hours after seeding, or apply between crop rows with hooded sprayer. Do not allow spray to contact crop. Use COC or NIS. Weeds must be actively growing and less than 4 inches tall. Do not exceed 6.1 fl. oz. per acre per season. REI: 12-hour. WSSA 14.

**Basagran (4) (bentazon)** Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use Basagran 4L at 1.5 to 2.0 pts. per acre, or Basagran 5L at 1.2-1.6 pts. per acre. Apply when weeds are small and after peas have 3 pairs of leaves or first trifoliate leaf of beans is fully expanded. Do not add COC for peas. REI: 48-hour. PHI: 30-day. WSSA 6.

**Optill (WG) (imazethapyr, saflufenacil)** Peas (Dry), Peas (Fresh) | For dry and fresh peas: apply 1.0-1.5 oz per acre preplant, preplant incorporated or preemergence (up to 3 days after planting before cracking). In Michigan: do not apply more than 1 oz. per acre on sand or loamy sand soils preplant burndown or preemergence. In Minnesota: do not apply north of Highway 210. For fresh peas in Illinois, Iowa, and Minnesota: a sequential application of Sharpen may be made with a minimum of 30 days between applications. In all cases, some varieties may be injured; check with seed supplier. Plant at least 1/2 inch deep to avoid injury. Do not use on any Phaseolus bean species. Do not apply group 14 herbicides within 30 days of planting. REI: 12-hour. WSSA 2, WSSA 14.

**Sandea (75) (halosulfuron)** Beans (Dry), Beans (Fresh), Lima Beans, Southern Peas/Cowpeas | 0.5-1 oz. per acre. For Southern peas/cowpeas: apply 0.5 oz. per acre after planting but prior to soil cracking. Or use up to 1.0 oz. per acre as a directed postemergence application to the row middles when plants have 2-4 trifoliate leaves but before flowering. For Lima beans and fresh beans: apply 0.5-1.0 oz. per acre after planting but prior to soil cracking. Or, use 0.5-0.67 oz. per acre for postemergence applications over crop and weeds when plants have 2-4 trifoliate leaves but before flowering, or use up to 1 oz. per acre as a directed postemergence application to row middles with no crop contact. For dry beans: apply up to 0.67 oz. per acre after planting but prior to soil cracking. Or, use or as a postemergence application over crop and weeds when plants have 1-3 trifoliate leaves but before flowering, or use up to 1 oz. per acre as a directed postemergence application to row middles with no crop contact. Use 0.5-1 pt. of NIS per 25 gals. of spray solution if emerged weeds are present at time of preemergence application. Use lower rates on coarse soils with low organic matter. Not recommended when temperatures are cool due to potential for crop injury. Do not exceed 1 oz. per acre per crop cycle or 2 oz. per acre per 12-month period. REI: 12-hour. PHI: 30-day. WSSA 2.

**Sharpen (2.85SC) (saflufenacil)** Peas (Dry), Peas (Fresh) | For fresh peas in Illinois, Iowa, Michigan, and Minnesota: apply 0.75 fl. oz. per acre preplant incorporated or preemergence up to 3 days after planting before cracking. For lentils in Minnesota: use up to 2.0 fl. oz. per acre as described for fresh peas. For dry pea and chickpeas: apply 1-2 fl. oz. per acre to the surface as a burndown early preplant through preemergence up to 3 days before cracking. Add MSO at 1 pt. per acre when used as a preplant burndown. Suppresses black nightshade, lambsquarters, pigweed, and velvetleaf. Higher rates in lentils and chickpeas will provide more, but still limited, residual weed control. Plant legumes at least 1/2-inch deep to avoid injury. Do not apply group 14 herbicides within 30 days of planting. REI: 12-hour. WSSA 14.
Spartan Charge (SE) (carfentrazone, sulfentrazone) Peas (Dry) | 3.0-10.2 fl. oz. per acre. For dry peas and chickpeas: apply preplant-burndown, early-preplant, or preemergence. Do not use on coarse soils with less than 1% soil organic matter. Rate depends on soil texture, organic matter, and pH. Do not apply after crop emerges. REI: 12-hour. WSSA 14.

Thistrol (2L) (MCPB) Peas (Dry), Peas (Fresh) | 1-2 qts. per acre. Controls Canada thistle. Apply when peas have 6-12 nodes. Do not apply later than 3 nodes before pea flowering or after pea flower buds appear. Do not apply when peas are stressed or when temperature exceeds 90 F. REI: 24-hour. WSSA 4.

**Broadleaf Weeds Only - Preemergence**

**Pesticide**

Optill (WG) (imazethapyr, saflufenacil) Peas (Dry), Peas (Fresh) | For dry and fresh peas: apply 1.0-1.5 oz per acre preplant, preplant incorporated or preemergence (up to 3 days after planting before cracking). In Michigan: do not apply more than 1 oz. per acre on sand or loamy sand soils preplant, preemergence or preemergence burndown or preemergence. In Minnesota: do not apply north of Highway 210. For fresh peas in Illinois, Iowa, and Minnesota: a sequential application of Sharpen may be made with a minimum of 30 days between applications. In all cases, some varieties may be injured; check with seed supplier. Plant at least 1/2 inch deep to avoid injury. Do not use on any Phaseolus bean species. Do not apply group 14 herbicides within 30 days of planting. REI: 12-hour. WSSA 2, WSSA 14.

Reflex (2L) (fomesafen) Beans (Dry), Beans (Fresh), Peas (Fresh) | For fresh and dry beans: Reflex is labeled in all states participating in this publication except in Kansas west of Highway 281 and in Minnesota north of Highway 2. It can be used in extreme southeast Missouri (Region 1) at 1.5 pts. per acre year; Indiana, Illinois, and Ohio south of I-70 (Region 2) at 1.5 pts. per acre in alternate years; Indiana, Illinois, and Ohio north of I-70 (Region 3), and the rest of Missouri at 1.25 pts. per acre in alternate years; Kansas east of Highway 281 and Michigan and Minnesota south of I-94 (Region 4) at 1 pt. per acre in alternate years; and in Minnesota south of Highway 2 and north of I-94 (Region 5) at 0.75 pt. per acre in alternate years. Preplant and preemergence applications are labeled for Regions 1, 2, 3, and 4. Postemergence applications are labeled for Regions 1, 2, 3, 4, and 5. Apply postemergence when dry beans or succulent beans have at least one fully expanded trifoliate leaf, and use NIS, COC, or other additives following label instructions. Do not use liquid nitrogen or ammonium sulfate as an additive. For overhead irrigated dry beans in Kansas (KS 24c exp. 12/31/2022): 1 pt. per acre can be applied after the first fully expanded trifoliate in any county. For fresh peas in Michigan (MI 24c exp. 12/31/23) and Minnesota (MN 24c exp. 12/31/20) only: apply 1 pt. per acre in a tank-mix with other herbicides after seeding peas and before emergence. Use only once in 2 years on same soil. 18-month waiting period before planting most other crops. REI: 24-hour. PHI: 30-day for succulent beans; 45-day for dry beans and succulent peas. WSSA 14.

Sandea (75) (halosulfuron) Beans (Dry), Beans (Fresh), Lima Beans, Southern Peas/Cowpeas | 0.5-1 oz. per acre. For Southern peas/cowpeas: apply 0.5 oz. per acre after planting but prior to soil cracking. Or use up to 1.0 oz. per acre as a directed postemergence application to the row middles when plants have 2-4 trifoliate leaves but before flowering. For Lima beans and fresh beans: apply 0.5-1.0 oz. per acre after planting but prior to soil cracking. Or, use 0.5-0.67 oz. per acre for postemergence applications over crop and weeds when plants have 2-4 trifoliate leaves but before flowering, or use up to 1 oz. per acre as a directed postemergence application to row middles with no crop contact. For dry beans: apply up to 0.67 oz. per acre after planting but prior to soil cracking. Or, use or as a postemergence application over crop and weeds when plants have 1-3 trifoliate leaves but before flowering, or use up to 1 oz. per acre as a directed postemergence application to row middles with no crop contact. Use 0.5-1 pt. of NIS per 25 gals. of spray solution if used in extreme southeast Missouri (Region 1) at 1.5 pts. per acre in alternate years; Indiana, Illinois, and Ohio south of I-70 (Region 2) at 1.5 pts. per acre in alternate years; Kansas east of Highway 281 and Michigan and Minnesota south of I-94 (Region 4) at 1 pt. per acre in alternate years; and in Minnesota south of Highway 2 and north of I-94 (Region 5) at 0.75 pt. per acre in alternate years. Preplant and preemergence applications are labeled for Regions 1, 2, 3, and 4. Postemergence applications are labeled for Regions 1, 2, 3, 4, and 5. Apply postemergence when dry beans or succulent beans have at least one fully expanded trifoliate leaf, and use NIS, COC, or other additives following label instructions. Do not use liquid nitrogen or ammonium sulfate as an additive. For overhead irrigated dry beans in Kansas (KS 24c exp. 12/31/2022): 1 pt. per acre can be applied after the first fully expanded trifoliate in any county. For fresh peas in Michigan (MI 24c exp. 12/31/23) and Minnesota (MN 24c exp. 12/31/20) only: apply 1 pt. per acre in a tank-mix with other herbicides after seeding peas and before emergence. Use only once in 2 years on same soil. 18-month waiting period before planting most other crops. REI: 24-hour. PHI: 30-day for succulent beans; 45-day for dry beans and succulent peas. WSSA 14.

Sharpener (2.85SC) (saflufenacil) Peas (Dry), Peas (Fresh) | For fresh peas in Illinois, Iowa, Michigan, and Minnesota: apply up to 0.75 oz. per acre preplant incorporated or preemergence up to 3 days after planting before cracking. For lentils in Minnesota: use up to 2.0 oz. per acre as described for fresh peas. For dry pea and chickpeas: apply up to 1-2 fl. oz. per acre to the surface as a burndown early preplant through preemergence up to 3 days before cracking. Add MSO at 1 pt. per acre when used as a preplant burndown. Suppresses black nightshade, lambsquarters, pigweed, and velvetleaf. Higher rates in lentils and chickpeas will provide more, but still limited, residual weed control. Plant legumes at least 1/2-inch deep to avoid injury. Do not apply group 14 herbicides within 30 days of planting. REI: 12-hour. PHI: 30-day. WSSA 2.

Spartan 4F (sulfentrazone) Peas (Dry) | 2.25-8.0 fl. oz. per acre. Spring-apply early-preplant, preplant-incorporated, or preemergence up to 3 days after planting before cracking. Rate depends on soil texture, organic matter, and pH. Do not use on sand soils with less than 1% organic matter or apply after crop emerges. Michigan, Minnesota, and Wisconsin only: a full application before soil freezes is allowed. REI: 12-hour. WSSA 14.

Spartan Charge (SE) (carfentrazone, sulfentrazone) Peas (Dry) | 3.0-10.2 fl. oz. per acre. For dry peas and chickpeas: apply preplant-burndown, early-preplant, or preemergence. Do not use on coarse soils with less than 1% soil organic matter. Rate depends on soil texture, organic matter, and pH. Do not apply after crop emerges. REI: 12-hour. WSSA 14.
Grass Weeds Only - Postemergence

Pesticide

Assure II (10.3EC) (quizalofop) Beans (Dry), Beans (Fresh), Peas (Dry), Peas (Fresh) | 5-12 fl. oz. per acre. Use 1 qt. of COC per acre. Apply to actively growing grass. Do not exceed 14 fl. oz. per acre. REI: 12-hour. PHI: 15-day for succulent beans; 30-day for dry beans and succulent peas; 60-day for dry peas. WSSA 1.

clethodim products (clethodim) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | Use 2EC formulations at 6-16 fl. oz. per acre with 1 qt. of COC per 25 gals. of spray solution (1% v/v). Use Select Max at 9-32 fl. oz. per acre with 8 fl. oz. of NIS per 25 gals. of spray solution (0.25% v/v). Use low rates for annual grasses, the high rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. Do not exceed 32 fl. oz. of 2EC formulations per acre per season. Do not exceed 64 fl. oz. of Select Max per acre per season. REI: 24-hour. PHI: 21-day for succulent legumes, 30-day for dry legumes. WSSA 1.

Fusilade DX (2EC) (fluazifop-P) Beans (Dry) | 8-12 fl. oz. per acre. Include 1-2 pts. of COC or 0.5-1 pt. of NIS per 25 gals. of spray solution. Spray on actively growing grass. Wait at least 14 days between applications. Do not exceed 48 fl. oz. per acre per season. REI: 12-hour. PHI: 60-day. WSSA 1.

Poast (1.5EC) (sethoxydim) Beans (Dry), Beans (Fresh), Lima Beans, Peas (Dry), Peas (Fresh), Southern Peas/Cowpeas | 1-2.5 pts. per acre. Use 1 qt. of COC per acre. Spray on actively growing grass. Use high rate on quackgrass. Do not exceed 4 pts. per acre per season. REI: 12-hour. PHI: 15-day for succulent legumes, 30-day for dry legumes. WSSA 1.

Mint - Horticulture

Reviewed by Ben Phillips, Liz Maynard – Oct 2020

Crop Description

Mints are a group of perennial herbs that are commercially important as sources of essential oils obtained by distillation of their hay. The discussion in this section refers to production for essential oils. They are also commonly grown as a leaf herb; see the leafy vegetable section for common production practices for that product. The most common cultivated types are peppermint and spearmint.

Peppermint (Mentha x piperita): All peppermints are a hybrid of two other species, watermint (M. aquatica) and native spearmint (M. spicata). The varieties include Black Mitcham, Murray Mitcham, Robert’s Mitcham, and Todd’s Mitcham. The latter three varieties are more resistant to verticillium wilt.

Spearmint: Scotch Spearmint (M. cardiaca) and Native Spearmint (M. spicata). These two species of spearmints have distinctly different oils.

Because verticillium wilt disease is an important problem (even with the more resistant varieties), growers should always use disease-free planting stock. Certified and disease-free stocks are available.

Planting and Spacing

Mints are grown from 3- to 4-inch long dormant runners dug from existing fields in the late fall or spring. They spend their first year as a row crop before spreading through runners. The following years are spent as a solid stand or meadow crop. Careful fall plowing of established stands is important for both winter protection and for reducing the incidence of mint rust and other foliar diseases. “Squirrelly” mint, which occurs primarily on peppermint, is caused by the mind bud mite, Tarsonemus pipermenthae. Although mints are perennials, older stands may show serious build-ups of disease, insect, and weed problems and should be rotated out every 3 to 4 years.

Fertilizing

pH: Maintain a soil pH of 5.5 to 6.5.

New plantings: Before planting new stolons, apply 40 pounds N per acre, 0 to 100 pounds P2O5 per acre, and 0 to 400 pounds K2O per acre based on soil test results and recommendations from your state. Broadcast the fertilizer and plow it under when preparing the land for the planting furrows.

Established plantings: Each year before emergence, broadcast or drill in 40 to 60 pounds N per acre, 0 to 50 pounds P2O5 per acre and 0 to 150 pounds K2O per acre if a soil test recommends it.

Topdress with 60 to 90 pounds N per acre after canopy closure. The total amount of N from fertilizer should be 120 to 150 pounds N per acre.

Irrigation significantly increases oil yields both on muck and mineral soils, even in seasons with normal rainfall.

Harvesting

For oil production, maximum yield and quality is reached when 10% of peppermint is in full bloom, or 100% of spearmint is in full bloom. Cut, windrow, and allow to partially dry for 24 to 36 hours before collecting for distillation. The machines for this are similar to hay, but the collection into distillation tubs requires a specialized procedure and equipment.
**Mint - Diseases**
Reviewed by Dan Egel – Nov 2020

**Recommended Controls**

**Leaf Spot of Mint - Septoria Fungus**

**Pesticide**

chlorothalonil products (chlorothalonil) | **Indiana only.** Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See product labels. REI: 12-hour. PHI: 80-day. FRAC M5.

**Rust of Multiple Crops - Puccinia Fungus**

**Pesticide**

azoxystrobin products (azoxystrobin) | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day for fresh; 7-day for processed. FRAC 11.

chlorothalonil products (chlorothalonil) | **Indiana only.** Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See product labels. REI: 12-hour. PHI: 80-day. FRAC M5.

**Headline (SC) (2.08) (pyraclostrobin)** | 9-12 fl. oz. per acre. Additional formulations of Headline may be labeled. REI: 12-hour. PHI: 14-day. FRAC 11.

**propiconazole products (propiconazole)** | 4 fl. oz. per acre. Propimax EC and Tilt are labeled. REI: 12-hour. PHI: 90-day. FRAC 3.

**Rally 40WSP (myclobutanil)** | 4-5 fl. oz. per acre. REI: 24-hour. PHI: 30-day. FRAC 3.

**Wilt of Multiple Crops - Verticillium Fungus**

**Non-Pesticide**

Rotate plantings after no more than 3 or 4 years. Use wilt resistant varieties of peppermint. Native spearmint is resistant.

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**Mint - Insects**
Reviewed by Laura Ingwell, Elizabeth Long – Nov 2020

**Recommended Controls**

**Caterpillars**

The primary caterpillar pests of mint are loopers, cutworms, and the mint root borer.

**Non-Pesticide**

The soil-dwelling mint root borer caterpillar can be treated with the commercially-available parasitic nematode, *Steinernema carpocapsae*. Mix the nematodes with water and apply at a rate that deposits 1 - 1.5 billion nematodes per acre.

**Pesticide**

Avaunt (30WDG) (indoxacarb) | 3.5 oz. per acre. For cutworms, and loopers. Do not exceed 14 oz. per acre per season or 4 applications per crop. REI: 12-hour. PHI: 7-day. IRAC 22.

*Bacillus thuringiensis products for caterpillars (Bacillus thuringiensis aizawai strain ABTS-1857, Bacillus thuringiensis aizawai strain GC-91, Bacillus thuringiensis kurstaki strain ABTS-351, Bacillus thuringiensis kurstaki strain EVB-113-19, Bacillus thuringiensis kurstaki strain SA-11)* | For armyworms, cutworms, and loopers. Various Bt products are available for control of young caterpillars (Agree, Biobit, Dipel, Javelin, etc.) Different Bt subspecies have different control properties. Check labels for pest insects controlled before use. Follow label directions for rates, timing of application and required safety equipment. REI: 4-hour. PHI: 0-day. IRAC 11A.

Coragen (1.67SC) (chlorantraniliprole) | 3.5-7.0 fl. oz. per acre. For armyworms, cutworms, loopers, and mint root borers. Do not exceed 15.4 fl. oz. per acre season or 4 applications per crop. Allow 14 days between applications. REI: 4-hour. PHI: 7-day. IRAC 28.

Entrust SC (2) (spinosad) | For armyworms, cutworms, and loopers. Use 2SC formulations at 4.0-10.0 fl. oz. per acre. Do not exceed 29 fl. oz. per acre per season or 3 applications per crop. Use 80WP formulations at 1.25-3.0 oz. per acre. Do not exceed 9 oz. per acre per season or 3 applications per crop. Allow 4 days between applications. REI: 4-hour. PHI: 7-day. IRAC 5. OMRI-listed.

Intrepid 2F (methoxyfenozide) | 10-16 fl. oz. per acre. For armyworms, cutworms, and loopers. Do not exceed 16 fl. oz. per acre per application or 64 fl. oz. per acre per year. REI: 4-hour. PHI: 14-day. IRAC 18.

Lannate LV (2.4L) (methomyl) | 3 pts. per acre. For cutworms, and loopers. Do not exceed 6 pts. per acre per crop or 4 applications per crop. REI: 48-hour. PHI: 14-day. IRAC 1A. RUP.
Mint - Weeds

Lorsban 4E (chlorpyrifos) | For cutworms and mint root borers. Use 4E formulations at 2-4 pts. per acre. Do not exceed 1 application per growing season with maximum rate of 4 pts. per acre. Use 75WG formulations at 1.33-2.67 lbs. per acre. Do not exceed 1 application per growing season with maximum rate of 2.67 lbs. per acre. Use lower rates when cutworm larvae are less than 0.75 inch long. REI: 24-hour to 3-day. PHI: 90-day. IRAC 1B. RUP.

Orthene 97 (S) (acephate) | 1 lb. per acre. For cutworms, and loopers. Do not exceed 2 1/8 lbs. per acre per season or 2 applications per season. Allow 7 days between applications. REI: 24-hour. PHI: 14-day. IRAC 1B.

Radiant 1SC (spinetoram) | 4-12 fl. oz. per acre. For armyworms, cutworms, and loopers. Do not exceed 39 fl. oz. per acre per season or 4 applications per season. Allow 4 days between treatments. REI: 4-hour. PHI: 7-day. IRAC 5.

Flea Beetles

Pesticide

Actara (25WDG) (thiamethoxam) | 1.5-3.0 oz. per acre. Do not exceed 12 oz. per acre per season. Allow 14 days between applications. See pollinator precautions. REI: 12-hour. PHI: 7-day. IRAC 4A.

Lannate LV (2.4L) (methomyl) | 2.25-3 pts. per acre. For best results, apply immediately after harvest on stubble. Do not exceed 6 pts. per acre per crop or 4 applications per crop. REI: 48-hour. PHI: 14-day. IRAC 1A. RUP.

Malathion 5EC (malathion) | Use 5EC formulations at 1.5 pts. per acre. Use 57EC formulations at 1.0-1.5 pts. per acre. Do not exceed 3 application per year. Allow 7 days between applications. For best results, apply immediately after harvest on stubble. REI: 12 to 24-hour. PHI: 7-day. IRAC 1B.

Mites

Squirrelly mint, which occurs primarily on peppermint, is caused by the mint bud mite, Tarsonemus pipermenthae.

Pesticide

Acramite 50WS (bifenazate) | 0.75-1.5 lbs. per acre. Do not exceed 1 application per season. REI: 12-hour. PHI: 7-day. IRAC UN.

Agri-Mek SC (0.7) (abamectin) | 8-12 fl. oz. per acre. Use 0.7EC formulations at 1.75-2.5 fl. oz. per acre. Do not exceed 7.75 fl. oz. per acre per season or 3 applications per season. Allow 7 days between applications. Use 0.15EC formulations at 8-12 fl. oz. per acre. Do not exceed 36 fl. oz. per acre per season or 3 applications per season. Allow 7 days between applications. REI: 12-hour. PHI: 28-day. IRAC 6. RUP.

Dicofol 4E (dicofol) | 1.75-2.5 pts. per acre. Do not exceed 1 application per season. REI: 32-day. PHI: 30-day. IRAC UN.

Portal (0.4EC) (fenpyroximate) | 1-2 pts. per acre. Do not exceed 4 pts. per acre per season or 2 applications per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 21A.

Zeal (72WP) (etoxazole) | 2-4 oz. per acre. Do not exceed 4 oz. per acre per season or 1 application per season. REI: 12-hour. PHI: 7-day. IRAC 10B.

Mint - Weeds

Reviewed by Stephen Meyers, Ben Phillips – Nov 2020

Recommended Controls

All Weeds

Before establishing a mint planting, reduce perennial weeds in the area to be planted with systemic broad-spectrum herbicides.

The herbicides listed below may also be used. Most herbicides that control broadleaves must be applied while mint is dormant. Others require application with shielded equipment between the row, as stated on the label. Grass herbicides, and some broadleaf herbicides may be applied over the top of mint plants.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

Non-Pesticide

Good weed control in the planting year is especially important. Multivators, tines, rolling cultivators, flame weeders work well before emergence of mint, but it is important to avoid damaging crowns when cultivating. Row-middle cultivate and hand hoe after emergence. After established, and before spring growth, harrow bed thoroughly but carefully to avoid injuring the crowns. During the growing season, cultivate row-middles and hand hoe to keep the planting clean. Following the first light freeze in fall, mulch with 3-4 inches of straw around plants, but not on crowns. If additional mulch is needed in the spring, apply before hot, dry weather. Add more mulch during summer (if needed) to control weeds and retain moisture.

Broadleaf and Grass Weeds - Postemergence

Pesticide

Chateau SW (51WDG) (flumioxazin) | 2-4 oz. per acre. Apply to established, dormant mint from November 25 to March 1. Do not apply to frozen or snow covered ground. Do not exceed 4 oz. per acre in a single application or more than 8 oz. per acre in a single growing season. Do not make a sequential application of Chateau within 60 days of first application. Applying to
nondormant mint may result in unacceptable injury. For improved postemergence control, tank-mix with paraquat and add NIS at 0.5 pt. per 25 gal. of solution (0.25% v/v). Adding a nitrogen source will increase activity. REI: 12-hour. PHI: 80-day. WSSA 14.

glyphosate products (glyphosate) | Apply as a spot treatment in a 1-2% solution to actively growing weeds. The sprayed mint crop will be killed. Not all glyphosate formulations are labeled for mint. Apply as a spot treatment to no more than 10% of any acreage but can reapply to the same area at 30-day intervals. Avoid any drift to nontarget crops. REI: 4 to 12-hour. PHI: 7-day. WSSA 9.

paraquat products (paraquat) | 1.3-2 pt. per acre of 3 lb. per gal. formulation or 2-3 pt per acre of 2 lb. per gal. formulation. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS (0.25% v/v) per 25 gal. Apply to dormant mint when weeds are less than 6 in. tall. Do not make more than 2 applications per year or apply more than 2 pt. per dormant season. Certified applicators must successfully complete an EPA-approved training program before mixing, loading, and/or applying paraquat. REI: 12 to 24-hour. PHI: 80-day. WSSA 22. RUP.

**Broadleaf and Grass Weeds - Preemergence**

**Pesticide**

Chateau SW (51WDG) (flumioxazin) | 2-4 oz. per acre. Apply to established, dormant mint from November 25 to March 1. Do not apply to frozen or snow covered ground. Do not exceed 4 oz. per acre in a single application or more than 8 oz. per acre in a single growing season. Do not make a sequential application of Chateau within 60 days of first application. Applying to nondormant mint may result in unacceptable injury. For improved postemergence control, tank-mix with paraquat and add NIS at 0.5 pt. per 25 gal. of solution (0.25% v/v). Adding a nitrogen source will increase activity. REI: 12-hour. PHI: 80-day. WSSA 14.

Command 3ME (clomazone) | 1.3 pts. per acre. Apply in spring before mint starts to grow. Do not apply to emerged mint. Do not exceed 1 application per season. Some whitening of tissue may occur as mint emerges. REI: 12-hour. PHI: 84-day. WSSA 13.

Devrinol DF-XT (50) (napropamide) | 8 lb. per acre. New plantings: Apply soon after planting. Established plantings: Must be established for at least one growing season. REI: 24-hour. WSSA 15.

pendimethalin products (pendimethalin) | 1.5-4.0 pts. per acre. Established mint only. Apply 3.8 formulations to dormant mint before mint and weeds start to grow. Use low rate on coarse soils. REI: 24-hour. PHI: 90-day. WSSA 3.

trifluralin products (trifluralin) | Apply 1.0-1.5 pt. per acre of 4 lb. per gal. trifluralin to established, dormant or semi-dormant mint, late winter to spring or in the fall after harvest prior to emergence of targeted weed species. Must be incorporated mechanically or by 0.5 in. rainfall or irrigation within 3 days of application. REI: 12-hour. WSSA 3.

**Broadleaf Weeds Only - Postemergence**

**Pesticide**

Aim EC (2) (carfentrazone) | 0.5 to 1.92 fl. oz. per acre Apply before crop emergence to emerged weeds less up to 4 in. tall. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gal. of spray solution (0.25% v/v). REI: 12-hour. PHI: 5-day WSSA 14.

Basagran (4) (bentazon) | Use 4L formulations at 1-2 pts. per acre and 5L formulations at 1.2-1.6 pt per acre. Apply after mint and weeds have emerged. To control yellow nutsedge and Canada thistle, repeat application 7-10 days later. Crop oil will enhance activity. Do not exceed 4 pts. per acre per season. REI: 48-hour. PHI: 20-day. WSSA 6.

Goal Tender (4) (oxyfluorfen) | Indiana and Michigan only - applicators must have supplemental label. 2-3 pt. per acre Goal 2XL or 1 pt. per acre Goal TendeR. Use 20-40 gals. of water per acre. Add 0.5 pt. NIS per 25 gal. of solution if emerged weeds are present. Apply to dormant spearmint and peppermint on muck soil (greater than 20% organic matter) before weeds are 4 in. tall. Application to emerged mint will result in severe injury. Not for use on mineral or black sand soils. REI: 24 to 48-hour. WSSA 14.

Moxxy 2E (bromoxynil) | 1.0-1.5 pts. per acre. Apply in at least 10 gals. water per acre. Apply before weeds have more than 4 leaves, and only on established mint that has been harvested at least one year prior to application. Do not apply to mint growing under stressful conditions, or when air temperatures are, or are expected to be, more than 70 F within 5 days of application. REI: 24-hour. PHI: 70-day. WSSA 6.

Sinbar WDG (80) (terbacil) | As a preemergence application for weeds, apply 1-2 lb. per acre in the spring just after the last cultivation and before mint starts growing. As a postemergence application for weeds, apply 1.0-1.5 lb. per acre in the spring to broadleaf weeds less than 2 inches tall or grasses less than 1 inch tall and before mint starts growing. For postemergence application, add 1 qt. COC (1% v/v) or 0.5 pt. NIS (0.25% v/v) to 25 gal. of solution. Do not apply more than 2 lb. per acre per season. Discontinue use 1 year before rotating to other crops. REI: 12-hour. PHI: 60-day. WSSA 5.

Stinger (3) (clopyralid) | 0.33-1.0 pt. per acre. Use 4 fl. oz. of NIS per 25 gals. of spray solution. Apply up to 0.5 pt. in spring or up to 1 pt. in fall. Controls mainly composites and nightshade. To control Canada thistle in spring, apply before bud stage. Do not use mint straw, hay, or spent hay for compost or mulch and do not dispose of on land to be rotated to broadleaf crops due to herbicide remaining in mint hay or straw that will injure broadleaf plants. Do not exceed 1 pt. per acre per growing season. REI: 12-hour. PHI: 45-day. WSSA 4.

Thistrol (2L) (MCPB) | 1-2 pts. per acre. Apply in spring after mint emerges to suppress broadleaf weeds, or apply in fall to
control winter annuals. May injure mint. Oil yields may be reduced if mint is more than 6 inches tall at the time of application. Bindweed suppression is best with spring application when weeds are 6-8 inches long. REI: 24-hour. PHI: 40-day. WSSA 4.

**Broadleaf Weeds Only - Preemergence**

**Pesticide**

**GoalTender (4) (oxyfluorfen)** | Indiana and Michigan only - applicators must have supplemental label. 2-3 qt. per acre **Goal 2XL** or 1 pt. per acre **GoalTender**. Use 20-40 gals. of water per acre. Add 0.5 pt. NIS per 25 gal. of solution if emerged weeds are present. Apply to dormant spearmint and peppermint on muck soil (greater than 20% organic matter) before weeds are 4 in. tall. Application to emerged mint will result in severe injury. Not for use on mineral or black sand soils. REI: 24 to 48-hour. PHI: 60-day. WSSA 14.

**Sinbar WDG (80) (terbacil)** | As a preemergence application for weeds, apply 1-2 lb. per acre in the spring just after the last cultivation and before mint starts growing. As a postemergence application for weeds, apply 1.0-1.5 lb. per acre in the spring to broadleaf weeds less than 2 inches tall or grasses less than 1 inch tall and before mint starts growing. For postemergence application, add 1 qt. COC (1% v/v) or 0.5 pt. NIS (0.25% v/v) to 25 gal. of solution. Do not apply more than 2 lb. per acre per season. Discontinue use 1 year before rotating to other crops. REI: 12-hour. PHI: 60-day. WSSA 5.

**Spartan 4F (sulfentrazone)** | New plantings: 3.3-9.0 fl. oz. per acre. Established plantings: 4.5-12.0 fl. oz. per acre. New plantings: Apply after planting before weeds and mint emerge. Established plantings: Apply to established mint when it is dormant, in the fall after postharvest cultivation, and/or in the spring after cultivation. Renovation applications: Up to 8 fl. oz. per acre can be applied at dormancy followed by up to 4 fl. oz. per acre 1-3 days after the first harvest. Dormant and postharvest applications must be at least 100 days apart. Use lower rates on coarse soils with low organic matter. Rainfall or irrigation is required to move herbicide into the soil. Application may injure crop as mint emerges. Application to emerged mint will result in severe injury. Do not exceed 12 fl. oz. per 12-month period. Do not apply to mint grown on sands with less than 1% organic matter. REI: 12-hour. PHI: 92-day for dormant and new planting applications, 55-day for renovation applications. WSSA 14.

**Grass Weeds Only - Postemergence**

**Pesticide**

**Assure II (10.3EC) (quizalofop)** | 8-12 oz. per acre. Add 1 qt. COC or 0.5 pt. NIS per 25 gal. of spray solution. Apply to actively growing grass. Do not exceed 2 applications or 24 fl. oz. per acre per season. Applications must be greater than 7 days apart. REI: 12-hour. PHI: 30-day. WSSA 1.

**clethodim products (clethodim)** | Use 2EC formulations at 6-16 fl. oz. per acre with 1 qt. COC per 25 gals. of spray solution (1% v/v). Do not exceed 32 fl. oz. per acre per season. Use Select Max at 9-16 fl. oz. per acre to control annual grasses and 12-32 fl. oz. per acre to control perennial grasses. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gals. of spray solution (0.25% v/v). Do not exceed 64 fl. oz. per acre per season. Spray on actively growing grass. Wait at least 14 days between applications. REI: 24-hour. PHI: 21-day. WSSA 1.

**Poast (1.5EC) (sethoxydim)** | 1.0-2.5 pts. per acre. Add 1 qt. COC per 25 gal. of spray solution (1% v/v). Spray on actively growing grass. Do not exceed 5 pt. per acre per season. REI: 12-hour. PHI: 20-day. WSSA 1.

**Okra - Horticulture**

Reviewed by Ben Phillips, Liz Maynard – Oct 2020

**Crop Description**

Okra (**Abelmoschus esculentus**) is a subtropical plant related to hibiscus that is grown for its young green fruit. Okra requires warm weather for best growth. Some varieties have many small spines, similar to vine crops, which can irritate the skin when harvesting. There are also spineless varieties and red-fruiting varieties. Though okra is often listed on pesticide labels along with eggplants, peppers, and tomatoes, they are not a related species and share few pests.

**Planting and Spacing**

Seed 12 to 18 inches apart in rows 36 inches apart. Seed only after the soil has warmed to 65° F to 70° F for several days. Black plastic mulch with drip irrigation will increase yields. Transplants can be used for early production.

**Fertilizing**

**pH:** Maintain a soil pH of 6.0 to 6.5. Okra is very sensitive to low pH soils.

Before planting, apply 40 pounds N per acre, 0 to 200 pounds P2O5 per acre, and 0 to 300 pounds K2O per acre based on soil test results and recommendations from your state.

Sidedress with 40 pounds N per acre after the first harvest.

**Harvesting**

Okra should be harvested every 2 to 3 days to maintain optimal market size (2- to 4-inch long pods). Frequent harvesting increases overall yield since the plant will reset pods faster. Okra will yield 8,000 to 10,000 pounds per acre. Time from transplanting to harvest ranges between 50 to 65 days.
Okra - Diseases
Reviewed by Dan Egel – Nov 2020

Recommended Controls
Wilt of Multiple Crops - Fusarium Fungus

Non-Pesticide
Use disease-free seed and transplants. Avoid fields with a history of the disease. Rotate to non-Solanaceous, non-Cucurbit crops for >6 years. Use raised beds and mulch to improve drainage and reduce splashing. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Okra - Insects
Reviewed by Laura Ingwell, Celeste Welty – Nov 2020

Recommended Controls
Aphids
Pesticide
Admire Pro (4.6SC) (imidacloprid) | 1.3-2.2 fl. oz. per acre foliar application, 7-14 fl. oz. per acre soil application. Do not exceed 6.7 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day for foliar applications, 21-day for soil applications. IRAC 4A.

Assail 30SG (acetamiprid) | 2.0-4.0 oz. per acre. Do not exceed 16 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

Beleaf (50SG) (flonicamid) | 2.8-4.28 oz. per acre. REI: 12-hour. PHI: 0-day. IRAC 4A.

Caterpillars
Pesticide
Bacillus thuringiensis products for caterpillars (Bacillus thuringiensis aizawai strain ABTS-1857, Bacillus thuringiensis aizawai strain GC-91, Bacillus thuringiensis kurstaki strain ABTS-351, Bacillus thuringiensis kurstaki strain EVB-113-19, Bacillus thuringiensis kurstaki strain SA-11) | For armyworms, fruitworms, and loopers. Various Bt products are available for control of young caterpillars (Agree, Biobit, Dipel, Javelin, etc.) Different Bt subspecies have different control properties. Check labels for rates, timing of application and required safety equipment. REI: 4-hour. PHI: See label. IRAC 11A.

Brigade 2EC (bifenthrin) | For armyworms, fruitworms, and loopers. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season. Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for okra. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Coragen (1.67SC) (chlorantraniliprole) | 3.5-7.5 fl. oz. per acre. For armyworms, fruitworms, and loopers. Can be applied as either a foliar application or via drip chemigation. Chemigation will provide up to 30 days of control. Do not exceed 15.4 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28. OMRI-listed.

Entrust SC (2) (spinosad) | For armyworms, fruitworms, and loopers. Use 2SC formulations at 3.0-8.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 1.0-2.5 oz. per acre and do not exceed 9 oz. per acre per season. Allow 4 days between applications. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

Exirel (0.83SE) (cyantraniliprole) | 7-13.5 fl. oz. per acre. For armyworms, fruitworms, and loopers. Do not exceed 61.7 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 28.

Harvanta (0.42SL) (cyclaniliprole) | 10.9-16.4 fl. oz. per acre. For armyworms, fruitworms, and loopers. Use with adjuvant. Do not exceed 49.2 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

Mustang Maxx (0.8) (zeta-cypermethrin) | 2.24-4.0 fl. oz. per acre. For armyworms, fruitworms, and loopers. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.
Okra - Weeds

Proclaim (5SG) (emamectin benzoate) | 2.4-4.8 oz. per acre. For armyworms, fruitworms, and loopers. REI: 12-hour. PHI: 1-day. IRAC 6. RUP.

Radiant 1SC (spinetoram) | 5-10 fl. oz. per acre. For armyworms, fruitworms, and loopers. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 5.

Rimon 0.83EC (novaluron) | 9-12 fl. oz. per acre. For armyworms, fruitworms, and loopers. REI: 12-hour. PHI: 1-day. IRAC 15.

Sevin XLR Plus (4SC) (carbaryl) | 1.0-1.5 qts. per acre. For fruitworms. Do not exceed 6 qts. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 1A.

Japanese Beetle

Pesticide

Brigade 2EC (bifenthrin) | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season. Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for okra. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

EverGreen Pro 60-6 (L) (piperonyl butoxide, pyrethrins) | 2-12.6 fl. oz. per acre. REI: 12-hour. PHI: 0-day. IRAC UN, IRAC 3A.

Malathion 5EC (malathion) | Use 5EC and 57EC formulations at 1.5-1.9 pts. per acre. Do not exceed 5 applications per season. Allow 7 days between applications. REI: 12 to 24-hour. PHI: 1-day. IRAC 1B.

Mites

Pesticide

Acramite 50WS (bifenazate) | 0.75-1.0 lb. per acre. Do not exceed 1 application per season. REI: 12-hour. PHI: 3-day. IRAC UN.

Agri-Mek SC (0.7) (abamectin) | 1.75-3.5 fl. oz. per acre. REI: 12-hour. PHI: 7-day. IRAC 6. RUP.

Magister SC (1.7) (fenazaquin) | 24-36 fl. oz. per acre. REI: 12-hour. PHI: 3-day. IRAC 21A, FRAC 39.

Onager Optek (1EC) (hexythiazox) | 12-24 fl. oz. per acre. REI: 12-hour. PHI: 1-day IRAC 21A.

Portal (0.4EC) (fenpyroximate) | 2 pints per acre. REI: 12-hour. PHI: 1-day. IRAC 21A.

Zeal (72WP) (etoxazole) | 2-3 oz. per acre. Do not exceed 1 application per season. REI: 12-hour. PHI: 7-day. IRAC 10B.

Stink Bugs

Pesticide

Brigade 2EC (bifenthrin) | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season. Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for okra. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) | 2.24-4.0 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Sevin XLR Plus (4SC) (carbaryl) | 1.0-1.5 qts. per acre. Do not exceed 6 qts. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 1A.

Okra - Weeds

Reviewed by Stephen Meyers, Ben Phillips – Nov 2020

Recommended Controls

All Weeds

Okra is a warm-season crop that is nearly always started with transplants. There are several herbicides labeled for the control of weeds preemergence, applied before crops are transplanted, or directed between the rows only after transplanting.

Herbicide choices are limited, and the products that can be broadcast do not control many broadleaf weeds, so it is important to include mechanical control in the weed management plan.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

Non-Pesticide

Because these are warm-season, transplanted crops, there should be enough time in the spring to prepare a stale seedbed before planting, which should reduce weed pressure in the crop. These crops can also benefit from the soil warming properties of plastic mulch in addition to the in-row weed control. Mulches provide good weed control when planted into, when used for between row spaces, or in combination in-row and between-row.

Materials include landscape cloth, plastic, biodegradable plastic. Straw mulch can delay growth by suppressing soil temperatures. Weeds between beds and along the edges of beds can be controlled with a combination of cultivation, mowing, or hand hoeing/pulling. Weeds along the edge of the mulches can be a particular challenge to avoid ripping the mulch. Some fresh market plantings are often small enough to accommodate some hand hoeing or pulling. For larger plantings it may make more sense to mechanically cultivate with tow-able tools between plastic rows or between bare-soil rows.
**Broadleaf and Grass Weeds - Postemergence**

**Pesticide**

Caparol 4L (prometryn) | 1.5 pts. per acre. Apply as a post-directed spray when okra has 7-9 leaves and weeds are less than 2 inches tall. Do not exceed 3 pts. per acre per year. REI: 12-hour. PHI: 14-day. WSSA 5.

Glyphosate products (glyphosate) | 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations containing 3 lbs. ae per gal. (4 lbs. isopropylamine salt per gal.) at 1-5 qts. per acre, or formulations containing 4.5 lbs. ae per gal. (5 lbs. potassium salt per gal) at 0.66-3.3 qts. per acre. Broadcast at least 3 days before transplanting, or apply between crop rows with hooded or shielded sprayers. Use low rate for annuals and higher rates for perennials. See label for suggested application volume and adjuvants. Remove herbicide residue from plastic mulch prior to transplanting. REI: 4 to 12-hour. PHI: 14-day. WSSA 9.

**Broadleaf and Grass Weeds - Preemergence**

**Pesticide**

Caparol 4L (prometryn) | 1.5 pts. per acre. Apply as a post-directed spray when okra has 7-9 leaves and weeds are less than 2 inches tall. Do not exceed 3 pts. per acre per year. REI: 12-hour. PHI: 14-day. WSSA 5.

Dual Magnum (7.62EC) (s-metolachlor) | 1-2 pts. per acre. Indiana, Michigan, and Ohio only. MI 24c exp. 12/31/21. OH 24c exp. 12/31/22. Apply to okra at least 4 inches tall before weeds emerge. Direct the spray to minimize contact with crop foliage, or apply only between crop rows. Do not incorporate. Do not exceed 2 pts. per acre or 1 application per crop per season. REI: 24-hour. PHI: 60-day. WSSA 15.

Trifluralin products (trifluralin) | 0.5-1.0 lb. a.i. per acre. Use 4EC formulations at 1-2 pts. per acre. Use 10G formulations at 5-10 lbs. per acre. Use low rate on soils with less than 2% organic matter. Broadcast and incorporate before transplanting. Not effective on muck or high organic matter soils. REI: 12-hour. WSSA 3.

**Broadleaf Weeds Only - Postemergence**

**Pesticide**

Aim EC (2) (carfentrazone) | 0.5-2.0 fl. oz. per acre. Apply prior to transplanting or apply between crop rows with hooded sprayer. Do not allow spray to contact crop. Use COC or NIS. Weeds must be actively growing and less than 4 inches tall. Do not exceed 6.1 fl. oz. per acre per season. REI: 12-hour. WSSA 14.

Callisto (40SC) (mesotrione) | 6 fl. oz. per acre. Band to row middles prior to weed emergence. Leave 1 foot over row or 6 inches on each side of row un sprayed. Do not apply directly over the planted okra row or severe injury may occur. Injury risk is greatest on coarse-textured soils (sand, sandy loam, or loamy sands). A postemergence hooded application can be made at 3 oz. per acre when okra is at least 3 inches tall at time of application. Add 0.25% NIS v/v to spray solution. Avoid any contact with okra plant foliage. Do not exceed 1 application and 6 oz. per acre per year. REI: 12-hour. PHI: 28-day. WSSA 27.

Sandea (75) (halosulfuron) | 0.5-1.0 oz. per acre. Apply between rows of transplanted crop. Use lower rates on coarse soils with low organic matter. Add 0.5-1.0 pt. of NIS per 25 gals. of spray solution if emerged weeds are present. Avoid contact of the herbicide with the crop. Avoid contact with surface of plastic mulch if present. Effective against nutsedge. Do not exceed 2 oz. per acre per 12-month period. REI: 12-hour. PHI: 30-day. WSSA 2.

**Grass Weeds Only - Postemergence**

**Pesticide**

Poast (1.5EC) (sethoxydim) | 1.0-1.5 pts. per acre. Use 1.0 qt. of COC per acre. Spray on actively growing grass. Use high rate on quackgrass. Do not exceed 5.5 pts. per acre per season. REI: 12-hour. PHI: 14-day. WSSA 1.
Onions and Related Crops - Horticulture

Reviewed by Ben Phillips, Liz Maynard – Oct 2020

Crop Description

Garlic (Allium sativum): There are two main types of garlic: softneck and hardneck. Hardneck types overwinter better in the Midwest, have a stronger flavor, and are easier to peel. Softneck types have a longer shelf life, milder flavor, and smaller cloves. Elephant or great headed garlic (A. ampeloprasum) is grown like other garlic, but has a milder flavor.

Leek (Allium porrum): Leeks do not bulb, but form a straight shank of layered leaves that stay white when buried with soil. They can be planted deeply and hilled to increase the length of the shank. There are nonhardy summer-harvested varieties and frost-tolerant fall-harvest varieties.

Onion (A. cepa var. cepa): Bulb onions include yellow, red, and white-skinned types, and within each of the colors, there are sweet varieties and pungent storage varieties. Bulb onions are categorized as long-day, intermediate-day, or short-day based on the day-length that stimulates bulbing. Long-day varieties grow best in the Midwest. Some intermediate-day onions can also do well in the Midwest. Sweet onions contain more sugar, and do not keep as well as pungent storage onions. Any onion variety can also be used as a green onion, but A. fistulosum is a species that is commonly used for bunching that does not make a large bulb.

Shallot (A. cepa var. aggregatum or A. ascalonicum): Shallots form clusters of bulbs and are very winter hardy, like garlic. The torpedo-shaped bulbs are smaller than onions and have a milder flavor.

Planting and Spacing

Garlic: Plant in fall 6 to 8 weeks before ground freezes in rows 12 to 36 inches apart with cloves 3 to 6 inches apart in the row. Plant bulbs 3 to 4 inches deep, with top of clove twice the depth of the clove height. Garlic benefits from 2 to 4 inches of straw mulch applied over winter, which can be left on the rows until harvest. For mechanical cultivation, plant flat side of clove perpendicular to the length of the row; for hand cultivation in dense plantings, plant angled side of clove parallel to the length of the row. Remove flower stalks for maximum yield.

Leek: Seed or transplant outdoors about a month before the frost-free date in rows 14 to 18 inches apart with plants 3 to 4 inches apart in the row. Transplants can be started 10 to 15 weeks before planting. Place transplants 4 to 8 inches deep and backfill soil, or hill throughout the season to maintain a long white shank.

Onion: Seed or transplant outdoors about a month before the frost-free date, or as early as soil can be worked on raised beds with two double rows or wide rows spaced 14 inches apart on top of the bed with 12 seeds per foot, or 3 to 4 transplants per foot. A popular transplanting method on farms that are hand-weeded is to plant onions in groups of four that grow up and out as a clover shape. Transplants may also be planted into plastic-much covered beds. When seedling, use 4 pounds per acre of onion seed and consider broadcasting 1 bushel of oats or barley per acre overtop as a nurse crop that can protect young onions from sandblasting and hard frosts. Kill the barley or oats when they are 5 to 6 inches tall with a graminicide. Young onions can withstand several overnight lows in the 23° to 32° F range, but survivability is less if it is also windy.

Shallots: Seed in the spring like onions with similar row spacing, or transplant bulbs in the fall like garlic with similar row spacings. However, if fall planted, remove mulch in the spring before emergence. Shallot leaves are hollow and are easy to bend and crimp by the movement of straw mulch once they emerge. Transplanting young plants from a greenhouse in the early spring will yield bulbs along the same timeline as garlic.

Fertilizing

pH: Maintain a soil pH of 6.0 to 6.8 on mineral soils, and above 5.2 on muck soils.

Garlic, Shallot–fall-planted: Before planting, apply 25 pounds N per acre, up to 150 pounds P2O5 per acre, and up to 100 pounds K2O per acre based on soil test results and recommendations from your state. Sidedress in 20- to 40-pound increments of N per acre in 3-week intervals, ending 4 to 6 weeks before harvest. The total amount of N from fertilizer (including starter) and other credits should be 70 to 125 pounds N per acre.

Onion, Leek, Shallot–spring-planted: Before planting, apply 70 pounds N per acre, 0 to 250 pounds P2O5 per acre, and 0 to 250 pounds K2O per acre based on soil test results and recommendations from your state. Or, broadcast half the N and most of the K2O before planting, and at planting time band the remaining N, all of the P2O5, and up to 20 pounds of K2O at least 2 inches below and 2 inches to the side of the row. If indicated by soil test, include manganese, copper and zinc in band, or broadcast.

If planting on organic (muck) soils with a pH over 6.0, include 1 pound manganese sulfate per acre, and/or apply 1 to 2 pounds manganese sulfate per acre as a foliar spray 2 to 3 times starting 3 weeks after emergence.

Sidedress bulb onions with 90 to 100 pounds N per acre in mid-June or split that amount between early and late June. Sidedress green onions and leeks with 40 to 50 pounds of N per acre when the plants have four true leaves. Reduce the amount of fertilizer N applied by the value of N credits from green manures, legume crops grown in the previous year, compost and animal manures, and soils with more than 3 percent organic matter. The total amount of N from fertilizer (including starter) and other credits should be 190, 150, or 130 pounds N per acre for bulb onions.
leeks, or green onions, respectively, on mineral soils, and 50 pounds less on muck soils.

Harvesting

Garlic and Shallot: Harvest when tops have fallen over and partially dried. Lift from soil and dry protected from sun and rain. After drying, trim roots and remove tops, or leave softneck garlic tops on for braiding. Time from planting to harvest ranges from 90 to 100 days.

Onion, bulb: Harvest pungent storage-type bulb onions after tops have naturally fallen over, and tops are dried. To prevent sprouting of bulb onions in storage, use maleic hydrazide (Royal MH-30 or Sprout-Stop) according to label directions, when bulbs are fully mature and 50% of tops have fallen over but all tops are still green. Rolling leaves and undercutting several days before harvest can hasten dormancy and improve keeping quality of storage onions. Dig from soil and dry in field or indoors at 75°F to 80°F and 70 percent to 80 percent relative humidity. Cut tops about 1 inch from bulb at harvest or after drying, or braid tops and hang onions to dry. Clean dry onions by gently brushing. Time from seeding to harvest ranges from 100 to 125 days for pungent storage types.

Harvest sweet onions at the desired size any time before tops dry down, as they do become pungent as they go into dormancy, but do not store as well as true pungent storage-types. Time from transplanting to harvest ranges from 60 to 80 days for cipollini or pearl-sized onions, or 90 to 115 days for larger sizes.

Onion, green: Harvest by pulling from soil after bulb base is thicker than a pencil but before bulbing. Optional undercutting can be used to make pulling easier. Remove dirty outer layer from bulb area. Trim roots. Trim tops as needed if allowed by state regulations. Green onions are usually sold in bunches. Harvest small “knob” onions by pulling from soil when bulb has reached desired stage of development, following the same practices as for green onions. Time from seeding to harvest ranges from 60 to 70 days.

Leek: Harvest when stalk is 1 inch or more in diameter. Undercut plants, pull from soil, trim, and bunch. The wide range of maturity times is variety-dependent. Some can withstand heavy freezes and mature late into the fall, while others are not as frost-hardy and mature earlier for summer harvests. Time from seeding to harvest ranges from 70 to 120 days.

Onions and Related Crops - Diseases

Reviewed by Dan Egel, Mary Hausbeck – Nov 2020

Recommended Controls

Basal Rot of Alliums - Fusarium Fungus

Non-Pesticide

Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Avoid fields with a history of the disease and excess water. Rotate to non-host crops for 4 years. Resistant varieties are available. Managing soil insect pests, like Onion Maggot, may reduce disease incidence.

Bulb Rot of Alliums - Pseudomonas Bacteria

Pesticide

ManKocide (DF) (copper hydroxide, mancozeb) Garlic, Onion (Dry), Shallot | 1.5-2.25 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC M1, FRAC M3.

Damping-Off Seed and Seedling Rots of Multiple Crops - Multiple Pathogens

Non-Pesticide

Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Use disease-free seeds and sets. Practice good greenhouse sanitation of equipment, tools propagation trays/pots, and surfaces. Avoid excess moisture to the transplants in the greenhouse by monitoring irrigation frequency. Plant in warm field soils. The fungi responsible for damping-off in field soils cause more loss when the seeding is slow to emerge.

Pesticide

azoxystrobin products (azoxystrobin) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Use 2 lb. a.i. per gallon formulations (Quadriz) at 0.4-0.8 fl. oz. per 1,000 row feet. Use 3.3 lb. per gallon formulations (Azteroid) at 0.24-0.48 fl. oz. per 1,000 row feet. Use 0.83 lb. per gallon formulations (Dynasty) for treating seed at 0.10-0.38 fl. oz. per 100 lbs. of seed. REI: 4-hour. PHI: 0-day. FRAC 11.

Ridomil Gold SL (4SC) (mefenoxam) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 0.5-1.0 pts. per acre. REI: 48-hour. PHI: 0-day. FRAC 4.

Uniform (L) (mefenoxam, azoxystrobin) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 0.34 fl. oz. per 1,000 ft. Make one application per crop season. REI: 0-hour. PHI: 0-day. FRAC 4, FRAC 11.
Onions and Related Crops - Diseases

Downy Mildew of Multiple Crops - Peronospora Oomycete

Cool, wet conditions favor the development of this disease. Can be seedborne or setborne.

Non-Pesticide

Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Use disease-free seed and sets. Plant in areas with adequate drainage and air movement to reduce leaf wetness and humidity. Rotate to non-host crop for 3 years. Some resistant varieties of onion are available. Avoid late-season fertilizer applications or overhead irrigation. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up. Destroy onion cull piles and debris.

Pesticide

Ariston (L) (chlorothalonil, cymoxanil) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 1.6-2.4 pts. per acre. Use lower rates for dry bulb onions and garlic. REI: 12-hour. PHI: 7-day for dry bulb onions, and garlic; 14-day for green bunching onions, shallots, leeks. FRAC M5, FRAC 27.

Catamaran (potassium phosphite, chlorothalonil) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 4-7 pts. per acre. REI: 12-hour. PHI: 7-day for dry bulb onion, shallot and garlic; 14-day for green bunching onion and leek. FRAC P7, FRAC M5.

Dexter Max (DG) (mancozeb, azoxystrobin) Garlic, Onion (Dry), Shallot | 3.2 lb. per acre. REI: 24-hour. PHI: 7-day. FRAC M3, FRAC 11.

Dexter Xcel (mancozeb, azoxystrobin, tebuconazole) Onion (Dry) | 56-72 fl. oz. per acre. REI: See label. PHI: 7-day. FRAC M3, FRAC 11, FRAC 3.

Forum (4.17SC) (dimethomorph) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 6 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC M3, FRAC 11, FRAC 3.

Gavel 75DF (zoxamide, mancozeb) Garlic, Onion (Dry), Shallot | 1.5-2 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC M3, FRAC 22, FRAC M3.

Zampro (SC) (ametoctradin, dimethomorph) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 14 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 45, FRAC 40.

Viathon (potassium phosphite, tebuconazole) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 14 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 45, FRAC 40.

Leaf Blight and Center Rot of Alliums - Pantoea Bacteria

Applying fixed copper products may reduce the spread of these bacterial diseases. For emerged annuals, apply before planting or crop emergence.

Pesticide

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Several formulations of copper (Badge, Champ, Kocide) are labelled for use and may slow the spread of bacterial blights. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.
### Leaf Blight and Stalk Rot of Onions - Stemphylium Fungus

Stemphylium causes leaf blight and stalk rot but rarely affects the bulb. Long warm periods with leaf wetness favor disease development.

#### Pesticide

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<tr>
<th>Product</th>
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<td>Cabrio EG (20) (pyraclostrobin)</td>
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<td>Fontelis (1.67SC) (penthiopyrad)</td>
<td>Garlic, Leek, Onions (Dry), Onions (Green), Shallot</td>
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<tr>
<td>Inspire Super (EW) (difenoconazole, cyprodinil)</td>
<td>Garlic, Leek, Onions (Dry), Onions (Green), Shallot</td>
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<tr>
<td>Luna Experience (fluopyram, tebuconazole)</td>
<td>Garlic, Leek, Onions (Dry), Onions (Green), Shallot</td>
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<tr>
<td>Merivon (fluxapyroxad, pyraclostrobin)</td>
<td>Garlic, Leek, Onions (Dry), Onions (Green), Shallot</td>
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<tr>
<td>Pristine 38WG (boscalid, pyraclostrobin)</td>
<td>Garlic, Leek, Onions (Dry), Onions (Green), Shallot</td>
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<tr>
<td>Quadris Opti (SC) (azoxystrobin, chlorothalonil)</td>
<td>Garlic, Leek, Onions (Dry), Onions (Green), Shallot</td>
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<tr>
<td>Switch 62.5WG (cyprodinil, fludioxonil)</td>
<td>Garlic, Leek, Onions (Dry), Onions (Green), Shallot</td>
</tr>
</tbody>
</table>

### Leaf Blight of Alliums - Botrytis Fungus

Non-Pesticide

Garlic, Leek, Onions (Dry), Onions (Green), Shallot | Use disease-free seeds and sets. Rotate to non-host crops for 3-4 years. Monitor thrips populations. Prompt destruction of the finished crop and cull piles with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

#### Pesticide

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<tr>
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<td>azoxystrobin products (azoxystrobin)</td>
<td>Garlic, Leek, Onions (Dry), Onions (Green), Shallot</td>
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<td>chlorothalonil products (chlorothalonil)</td>
<td>Garlic, Leek, Onions (Dry), Onions (Green), Shallot</td>
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<tr>
<td>Custodia (SC) (azoxystrobin, tebuconazole)</td>
<td>Garlic, Leek, Onions (Dry), Onions (Green), Shallot</td>
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<tr>
<td>Dexter Max (DG) (mancozeb, azoxystrobin)</td>
<td>Garlic, Onion (Dry), Shallot</td>
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<td>Dexter Xcel (mancozeb, azoxystrobin, tebuconazole)</td>
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<td>Endura (WG) (boscalid)</td>
<td>Garlic, Leek, Onions (Dry), Onions (Green), Shallot</td>
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<td>Fontelis (1.67SC) (penthiopyrad)</td>
<td>Garlic, Leek, Onions (Dry), Onions (Green), Shallot</td>
</tr>
<tr>
<td>Inspire Super (EW) (difenoconazole, cyprodinil)</td>
<td>Garlic, Leek, Onions (Dry), Onions (Green), Shallot</td>
</tr>
</tbody>
</table>

### Non-Pesticide

Garlic, Leek, Onions (Dry), Onions (Green), Shallot | Use disease-free seeds and sets. Rotate to non-host crops for 3-4 years. Monitor thrips populations. Prompt destruction of the finished crop and cull piles with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.
Luna Experience (fluopyram, tebuconazole) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 8-12.8 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 3.

Luna Tranquility (SC) (fluopyram, pyrimethanil) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 16-27 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 9.

Mancozeb products (mancozeb) Garlic, Onion (Dry), Shallot | Several formulations of mancozeb (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 7-day. FRAC M3.

Merivon (fluxapyroxad, pyraclostrobin) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 8-11 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 11.

Omega 500F (4.17) (fluazinam) Garlic, Onion (Dry), Shallot | 1 pt. per acre. REI: 12-hour. PHI: 7-day. FRAC 29.

Pristine 38WG (boscalid, pyraclostrobin) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 14.5-18.5 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 11.

Propiconazole products (propiconazole) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 2-8 fl. oz. per acre. PropiMax EC and Tilt are labeled. Use 2-4 fl. oz. per acre rate when tank mixing with another effective fungicide. REI: 12-hour. PHI: 14-day for dry bulb onions, shallots, and garlic; 0-day for green bunching onion and leek. FRAC 3.

Quadris Opti (SC) (azoxystrobin, chlorothalonil) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 1.6-3.2 pts. per acre. REI: 12-hour. PHI: 7-day for dry bulb onion, shallots, and garlic; 14-day for green bunching onions and leeks. FRAC 11, FRAC M5.

Quilt (SE) (azoxystrobin, propiconazole) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 14-27.5 fl. oz. per acre. REI: 12-hour. PHI: 14-day for dry bulb onions, shallots, and garlic; 0-day for green bunching onions and leeks. FRAC 11, FRAC M5.

Scala (SC) (pyrimethanil) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 18 fl. oz. per acre. Use 9-18 fl. oz. per acre rate when tank mixing with another effective fungicide. REI: 12-hour. PHI: 7-day. FRAC 9.

Switch 62.5WG (cyprodinil, fludioxonil) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 11-14 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 9, FRAC 12.

Vanguard WG (75) (cyprodinil) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 10 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 9.

Leaf Blight of Alliums - Xanthomonas Bacteria

Applying fixed copper products may reduce the spread of these bacterial diseases. For emerged annuals, apply before planting or crop emergence.

Pesticide
copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Several formulations of copper (Badge, Champ, Kocide) are labelled for use and may slow the spread of bacterial blights. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

ManKocide (DF) (copper hydroxide, mancozeb) Garlic, Onion (Dry), Shallot | 1.5-2.25 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC M1, FRAC M3.

Leaf Streak of Alliums - Pseudomonas Bacteria

Applying fixed copper products may reduce the spread of these bacterial diseases. For emerged annuals, apply before planting or crop emergence.

Pesticide
copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Several formulations of copper (Badge, Champ, Kocide) are labelled for use and may slow the spread of bacterial blights. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

ManKocide (DF) (copper hydroxide, mancozeb) Garlic, Onion (Dry), Shallot | 1.5-2.25 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC M1, FRAC M3.

Neck Rot of Alliums - Botrytis Fungus

Treatments for Botrytis leaf blight may retard or prevent symptomless spread of Botrytis neck rot in the field prior to harvest.

Non-Pesticide
Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Rotate to non-host crop for 3 years. Avoid late-season fertilizer applications or overhead irrigation. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up. For dry-bulb crops: windrow plants until neck tissues are dry before topping and storage. Cure rapidly and properly. Artificial drying may be necessary (forced heated air at 93-95 degrees F for 5 days).
Pink Root of Alliums - Phoma Fungus
Plants infected with pink root may appear to be nutrient deficient or drought-stressed and stunted. Affected plants have fewer leaves and begin to form bulbs early. The pathogen can survive in soil as deep as 17.7 inches. Temperatures at 75-82 degrees F favor disease development. The pathogen can spread by onion sets and in infested soil carried by machinery, dust storms, and surface run-off.

Non-Pesticide
Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Use disease-free seeds and sets. Rotate to non-host crops for 3-4 years. Monitor thrips populations. Prompt destruction of the finished crop and cull piles with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide
Aprovia Top (difenoconazole, benzovindiflupyr) Garlic, Leek, Onion (Dry), Onion (Green) | 10.5 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 3, FRAC 7.

Arison (L) (chlorothalonil, cymoxanil) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 1.6-2.4 pts. per acre. Use lower rates for dry bulb onions and garlic. REI: 12-hour. PHI: 7-day for dry bulb onions, and garlic; 14-day for green bunching onions, shallots, leeks. FRAC M5, FRAC 27.

azoxystrobin products (azoxystrobin) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-12.0 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-7.8 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.15 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

Onions and Related Crops - Diseases

Switch 62.5WG (cyprodinil, fludioxonil) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 11-14 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 9, FRAC 12.

Vangard WG (75) (cyprodinil) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 10 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 9.

Purple Blotch of Alliums - Alternaria Fungus

Non-Pesticide
Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Use disease-free seeds and sets. Rotate to non-host crops for 3-4 years. Monitor thrips populations. Prompt destruction of the finished crop and cull piles with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide
Aprovia Top (difenoconazole, benzovindiflupyr) Onion (Dry), Onion (Green) | 10.5 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 3, FRAC 7.

Arison (L) (chlorothalonil, cymoxanil) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 1.6-2.4 pts. per acre. Use lower rates for dry bulb onions and garlic. REI: 12-hour. PHI: 7-day for dry bulb onions, and garlic; 14-day for green bunching onions, shallots, leeks. FRAC M5, FRAC 27.

azoxystrobin products (azoxystrobin) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-12.0 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-7.8 fl. oz. per acre. Use 0.5 lb. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.15 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.
Onions and Related Crops - Diseases

**Cabrio EG (20) (pyraclostrobin)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 8-12 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11.

**Catamaran (potassium phosphite, chlorothalonil)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 4-7 pts. per acre. REI: 12-hour. PHI: 7-day for dry bulb onion, shallot and garlic; 14-day for green bunching onion and leek. FRAC P7, FRAC M5.

**chlorothalonil products (chlorothalonil)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 7-day for dry bulb onion, shallot, and garlic; 14-day for green bunching onion and leek. FRAC M5.

**Custodia (SC) (azoxystrobin, tebuconazole)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 8.6-12.9 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC 3.

**Dexter Max (DG) (mancozeb, azoxystrobin)** Garlic, Onion (Dry), Shallot | 3.2 lb. per acre. REI: 24-hour. PHI: 7-day. FRAC M3, FRAC 11.

**Dexter Xcel (mancozeb, azoxystrobin, tebuconazole)** Onion (Dry) | 48-72 fl. oz. per acre. REI: See label. PHI: 7-day. FRAC M3, FRAC 11, FRAC 3.

**Endura (WG) (boscalid)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 6.8 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7.

**Fontelis (1.67SC) (penthiopyrad)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 16-24 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC 3.

**Inspire Super (EW) (difenoconazole, cyprodinil)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day for dry bulb onions, shallots, and garlic; 14-day for green bunching onion and leek. FRAC 3, FRAC 9.

**iprodione products (iprodione)** Onion (Dry) | Formulations of iprodione include Nevado and Rovral. REI: 24-hour. PHI: 14-day. FRAC 2.

**Luna Experience (fluopyram, tebuconazole)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 8-12.8 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 3.

**Luna Tranquility (SC) (fluopyram, pyrimethanil)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 16-27 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 9.

**mancozeb products (mancozeb)** Garlic, Onion (Dry), Shallot | Several formulations of mancozeb (Dithane, Manzate, Penningo) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 7-day. FRAC M3.

**Merivon (fluxapyroxad, pyraclostrobin)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 5.5-11 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 11.

**Muscle ADV (chlorothalonil, tebuconazole)** Garlic, Onion (Dry), Shallot | 1.1-1.6 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC M5, FRAC 3.

**Omega 500F (4.17) (fluazinam)** Garlic, Leek, Onion (Dry), Shallot | 1 pt. per acre. REI: 12-hour. PHI: 7-day. FRAC 29.

**Pristine 38WG (boscalid, pyraclostrobin)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 10.5-18.5 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 11.

**propiconazole products (propiconazole)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 2-8 fl. oz. per acre. PropiMax EC and Tilt are labeled. Use 2-4 fl. oz. per acre rate when tank mixing with another effective fungicide. REI: 12-hour. PHI: 14-day for dry bulb onions, shallots, and garlic; 0-day for green bunching onion and leek. FRAC 3.

**Quadris Opti (SC) (azoxystrobin, chlorothalonil)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 1.6-3.2 pts. per acre. REI: 12-hour. PHI: 7-day for dry bulb onion, shallot, and garlic; 14-day for green bunching onions and leeks. FRAC 11, FRAC M5.

**Quilt (SE) (azoxystrobin, propiconazole)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 14-27.5 fl. oz. per acre. REI: 12-hour. PHI: 14-day for dry bulb onions, shallots, and garlic; 0-day for green bunching onions and leeks FRAC 11, FRAC 3.

**Scala (SC) (5) (pyrimethanil)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 18 fl. oz. per acre. Use 9-18 fl. oz. per acre rate when tank mixing with another effective fungicide. REI: 12-hour. PHI: 7-day. FRAC 9.

**Switch 62.5WG (cyprodinil, fludioxonil)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 2-8 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 9, FRAC 12.

**Tanos (DF) (famoxadone, cyoxanil)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 4-6 fl. oz. per acre. There are many brand names (Monsoon, Onset, Vibe) with 3.6 lbs. a.i. per gallon that use the same rate. REI: 12-hour to 18-day. PHI: 7-day FRAC 3.

**Vangard WG (75) (cyprodinil)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 10 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 9.

**tebuconazole products (tebuconazole)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 4-6 fl. oz. per acre. There are many brand names (Monsoon, Onset, Vibe) with 3.6 lbs. a.i. per gallon that use the same rate. REI: 12-hour to 18-day. PHI: 7-day FRAC 3.

**Viathon (potassium phosphite, tebuconazole)** Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 2-3 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC P7, FRAC 3.
Slippery Skin and Sour Rot of Alliums - Burkholderia Bacteria

Applying fixed copper products may reduce the spread of these bacterial diseases. For emerged annuals, apply before planting or crop emergence.

Pesticide

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Several formulations of copper (Badge, Champ, Kocide) are labelled for use and may slow the spread of bacterial blights. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

ManKocide (DF) (copper hydroxide, mancozeb) Garlic, Onion (Dry), Shallot | 1.5-2.25 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC M1, FRAC M3.

Smut of Onion - Urocystis Fungus

Non-Pesticide

Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Use disease-free seed and sets. Plant in areas with adequate drainage and air movement to reduce leaf wetness and humidity. Rotate to non-host crop for 3 years. Avoid late-season fertilizer applications or overhead irrigation.

Pesticide

Elixir (mancozeb, chlorothalonil) Garlic, Onion (Dry), Shallot | 3-3.6 lbs. per acre. REI: 24-hour. PHI: 7-day. FRAC M3, FRAC M5.

mancozeb products (mancozeb) Garlic, Onion (Dry), Shallot | Apply as an in-furrow drench at time of seedling. Several formulations of mancozeb (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 7-day. FRAC M3.

White Rot of Alliums - Sclerotium Fungus

This highly destructive soil pathogen is is related to White Mold (Sclerotinia), but only infects onions and related species. There are quarantines in effect to slow its spread from region to region.

The fungus infects roots, and then moves to the surface of the bulbs. Inspection of the bulbs will reveal small black pellets that are the overwintering body of the pathogen.

Non-Pesticide

Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Wash equipment and footwear between fields to avoid transferring fungal propagules from infested fields.

Pesticide

Custodia (SC) (azoxystrobin, tebuconazole) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Apply foliar spray at 8.6-12.9 fl. oz. per acre. For dry bulb onion and garlic, one application is also allowed at planting with 32 fl. oz. per acre via in-furrow or chemigation. REI: 12-hour. PHI: 14-day for dry bulb onions, shallots, and garlic; 7-day for green bunching onions and leeks, FRAC 11, FRAC 3.

Fontelis (1.67SC) (penthiopyrad) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Apply 1.2-1.6 fl. oz. per 1,000 ft. of row as pre-plant, at-plant in-furrow incorporated, transplant drench or drip irrigation application. Or, use 16-24 fl. oz. as foliar applications REI: 12-hour. PHI: 3-day. FRAC 7.

iprodione products (iprodione) Garlic | 4 pts. per acre. Formulations of iprodione include Neurova and Rovral. Use as in-furrow spray preplant. REI: 24-hour. PHI: 7-day. FRAC 2.

ManKocide (DF) (mancozeb) Garlic, Onion (Dry), Shallot | 1-1.6 fl. oz. per 1,000 ft. of row. REI: 24-hour. PHI: 7-day. FRAC 7, FRAC 3.

Luna Experience (fluopyram, tebuconazole) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 12.8 fl. oz. per acre. Suppression only. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 3.

Luna Tranquility (SC) (fluopyram, pyrimethanil) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 27 fl. oz. per acre. Suppression only. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 9.

Quadris Opti (SC) (azoxystrobin, chlorothalonil) Garlic, Onion (Dry) | 1.6-3.2 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC M5.

Quilt (SE) (azoxystrobin, propiconazole) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 14-27.5 fl. oz. per acre. REI: 12-hour. PHI: 14-day for dry bulb onions, shallots, and garlic; 0-day for green bunching onions and leeks FRAC 11, FRAC 3.

Switch 62.5WG (cyprodinil, fludioxonil) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 11-14 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 9, FRAC 12.

Topsin 4.5FL (thiophanate-methyl) Garlic, Onion (Dry) | Use 4FL formulation or Cercobin at 40 fl. oz. per acre, or 70WSB formulation at 2 lb. per acre. REI: 24-hour to 3-day. PHI: 3-day. FRAC 1.
Onions and Related Crops - Insects

Recommended Controls

Seed and Root Maggots

Non-Pesticide

Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Plant after the peak flight and egg-laying window of the first generation of flies looking to lay eggs around 700 GDD base 40. Handle seeds carefully to prevent cracking. Plow winter vegetation under early in the spring and thoroughly cover to limit attractiveness of rotting vegetation to the first generation of flies to lay eggs on.

Pesticide

Diazinon AG500 (4ES) (diazinon) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 2-4 qts. per acre. Use 50W formulations at 4-8 lbs. per acre as a pre-plant incorporation and do not exceed 8 lbs. per acre per season. Use AG500 formulations at 64-128 fl. oz. per acre as a pre-plant incorporation and do not exceed 128 fl. oz. per acre per season. Use AG600 formulations at 51-102 fl. oz. per acre as a pre-plant incorporation and do not exceed 102 fl. oz. per acre per season. Onion maggot exhibit resistance to diazinon. REI: 2 to 4-day. IRAC 1B. RUP.

Lorsban 4E (chlorpyrifos) Onion (Dry) | Use 4E formulations at 1.1 fl. oz. per 1,000 foot of row as an in-furrow drench at planting, or 1 qt. per acre as a postplant drench directed at base of plants during peak egg laying using 100 gallons per acre of water and do not exceed 2 applications per season (at-plant and post-plant). Use 15G formulations at 3.7 oz. per 1,000 foot of row. Use 73WG formulations at 1.33 lbs. per acre using 40 gallons per acre of water and do not exceed 2.67 lbs. per acre per season. REI: 24-hour to 3-day. PHI: 60-day as a post-plant soil drench. IRAC 1B. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 2.24-4.0 fl. oz. per acre. For adult control only. Do not exceed 20 fl. oz. per acre per season. Allow 7 days between applications. Add COC at 16 fl. oz. per acre. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Perm-Up 25DF (permethrin) Garlic, Onion (Dry) | For adult control only. Use 25W, 25WP, and 25DF formulations at 9.6-19.2 oz. per acre for dry onion or 9.6-12.8 oz. per acre for garlic, and not exceed 64 oz. per acre per season for dry onion or 51.2 oz. per acre per season for garlic. Use 3.2EC formulations at 4-12 fl. oz. per acre for dry onion and 4-8 fl. oz. per acre for garlic, and do not exceed 40 fl. oz. per acre per season on dry onion or 32 fl. oz. per acre per season on garlic. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Warrior II (2.08CS) (lambda-cyhalothrin) Garlic, Onion (Dry) | 0.96-1.6 fl. oz. per acre. For adult control only. Do not exceed 15.36 fl. oz. per acre per season. REI: 24-hour. PHI: 14-day. IRAC 3A. RUP.

Thrips

Threshold for making an insecticide application is 1 thrips per leaf for Agri-Mek, Exirel, Minecto Pro, Movento, Lannate LV and 3 thrips per leaf for Radiant.

A suggested treatment schedule starts with two applications of Movento for the first two weekly applications when the thrips population reaches the treatment threshold of 1 thrips per leaf for the first time of the season. Then, rotate products with two sequential weekly applications for each, reserving Radiant for high 3 thrips per leaf thresholds in peak season.

Pesticide

Agri-Mek SC (0.7) (abamectin) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 1.75-3.5 fl. oz. per acre. Supplemental label available for green onions and leeks. Use at 1 thrips per leaf threshold. Make 2 consecutive applications 7-days apart, then rotate to an insecticide with a different mode of action. Do not use before or after Minecto Pro since it contains the same active ingredient. Do not exceed 14 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 6. RUP.

Assail 30SG (acetamiprid) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Use 30SG formulations at 5.0-8.0 oz. per acre and do not exceed 32 oz. per acre per season. Use 70WP formulations at 2.1-3.4 oz. per acre and do not exceed 13.7 oz. per acre per season. Allow 7 days between applications. Many onion thrips populations have developed resistance to this insecticide, so efficacy will vary. REI: 12-hour. PHI: 7-day. IRAC 4A.

Entrust SC (2) (spinosad) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | For armyworms, fruitworms, and loopers. For armyworms, cutworms, and loopers. Use 2SC formulations at 4.0-8.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 1.25-2.5 oz. per acre and do not exceed 9 oz. per acre per season. Observe resistance management restrictions. Allow 4 days between applications. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

Exirel (0.83SE) (cytantraniliprole) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 13.5-20.5 oz. per acre. Use at 1 thrips per leaf threshold. For suppression only. For best results, use highest rate listed. If thrips populations are high, use Radiant...
before using Exirel. Tank mix with nonionic surfactant (0.25%-0.5% v/v) for best efficacy. Allow 5 days between applications. Do not make more than 2 consecutive applications before switching to another mode of action. Therefore, do not use in sequence before or after Minecto Pro since it contains the same active ingredient. REI: 12-hour. PHI: 1-day. IRAC 28.

Lannate LV (2.4L) (methomyl) Onion (Dry), Onion (Green) | 3 pts. per acre. Do not exceed 18 pts. per acre per season on green bunching onions, or 12 pts. per acre per season on dry bulb onions. REI: 48-hour. PHI: 7-day. IRAC 1A. RUP.

Minecto Pro (1.13SC) (cyantraniliprole, abamectin) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 7.0-10 oz. per acre. Use at 1 thrips per leaf threshold. For suppression only. For best results, use highest rate listed. Not for rescue treatments. Tank mix with nonionic surfactant (0.25%-0.5% v/v) for best efficacy. Allow 5 days between applications. Do not make more than 2 consecutive applications before switching to another mode of action. Do not use before or after Exirel or Agri-Mek since these contain the same active ingredients. REI: 12-hour. PHI: 30-day for dry onion, shallots, and garlic.; 7-day for green bunching onion, shallots, and leek IRAC 28, IRAC 6. RUP.

Mocento (2SC) (spirotetramat) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 5 oz. per acre. Use in June or July when populations reach the 1 thrips per leaf threshold for the first time of the season. Tank mix with nonionic surfactant (0.25%-0.5% v/v) for best efficacy. Allow 7 days between applications. Do not make more than 2 consecutive applications before switching to another mode of action. REI: 24-hour. PHI: 3-day for dry onion, shallots, and garlic.; 7-day for green bunching onion, shallots, and leek IRAC 23.

Perm-Up 25DF (permethrin) Garlic, Onion (Dry) | Use 25W, 25WP, and 25DF formulations at 9.6-19.2 oz. per acre for dry onion or 9.6-12.8 oz. per acre for garlic, and not exceed 64 oz. per acre per season for dry onion or 51.2 oz. per acre per season for garlic. Use 3.2EC formulations at 6-12 fl. oz. per acre for dry onion and 6-8 fl. oz. per acre for garlic, and do not exceed 40 fl. oz. per acre per season on dry onion or 32 fl. oz. per acre per season on garlic. Many onion thrips populations have developed resistance to this insecticide, so efficacy may vary. Do not exceed 15.36 fl. oz. per acre per season. REI: 24-hour. PHI: 14-day. IRAC 3A. RUP.

Radiant 1SC (spinetoram) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 6-10 fl. oz. per acre. Use at 3 thrips per leaf threshold. Do not exceed 30 fl. oz. per acre per season or 5 applications. Do not make more than 2 consecutive applications before switching to another mode of action. REI: 4-hour. PHI: 1-day. IRAC 5.

Torac (1.29SC) (tolifenpyrad) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 24 fl. oz. per acre. Do not exceed 72 fl. oz. per acre per year. REI: 12-hour. PHI: 7-day. IRAC 21A, FRAC 39.

Warrior II (2.08CS) (lambda-cyhalothrin) Garlic, Onion (Dry) | 1.28-1.92 fl. oz. per acre. Many onion thrips populations have developed resistance to this insecticide so efficacy may vary. Do not exceed 15.36 fl. oz. per acre per season. REI: 24-hour. PHI: 14-day. IRAC 3A. RUP.

Onions and Related Crops - Weeds

Recommended Controls

All Weeds

Onions and related crops pose challenges for weed control because the narrow leaves and short height of the crop provide little shade to suppress weed growth, and, except for green onions, the crops grow for several months.

Prepare a stale seedbed several weeks in advance of planting, allow weeds to emerge, and kill weeds without bringing new weed seeds to the surface with a burndown herbicide. It may be possible to plant without killing the weeds, and then kill them just before the crop emerges. When herbicides are used, multiple applications are often made before and after crop emergence.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

Non-Pesticide

Garlic, Leek, Onion (Dry), Onion (Green), Shallot | Weed control in onions often relies heavily on cultivation and hand weeding for full season weed control. These operations are most efficient when planting arrangement is designed with weed control in mind and is designed to work with available weed control equipment. Specialized weeding equipment for onions includes basket weeders, narrow-bladed hoes, finger weeders, and others. Prepare a stale seedbed with flaming or very shallow cultivation, instead of herbicides. Some growers also use flaming successfully over the top of young onions or garlic, or directed toward the bases of larger plants, even though some crop injury is likely with postemergent flaming. For transplanted sweet onions, plastic mulched beds are commonly used to manage weeds in the row with two or three rows of onions per bed. Black plastic can damage maturing onions in high-light conditions and so many growers prefer white-on-black plastic with the white side up.
Onions and Related Crops - Weeds

Broadleaf and Grass Weeds - Postemergence

Pesticide

glyphosate products (glyphosate) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations containing 3 lbs. ae per gal. (4 lbs. isopropylamine salt per gal.) at 1-5 qts. per acre, or formulations containing 4.5 lbs. ae per gal. (5 lbs. potassium salt per gal.) at 0.66-3.3 qts. per acre. Broadcast before planting, after planting but before crop emergence, or apply between crop rows with hooded or shielded sprayers. Use low rate for annuals and higher rates for perennials. See label for suggested application volume and adjuvants. REI: 12-hour. PHI: 60-day. WSSA 3.

Nortron SC (4) (ethofumesate) Onion (Dry), Shallot | 16-32 fl. oz. per acre. Apply preemergence or soon after seeding before weeds germinate. May also be used postemergence. Do not exceed 4 applications or 48 fl. oz. per acre per season on coarse soils and 96 fl. oz. per acre per season on medium and fine soils. May cause temporary leaf fusion. May injure stressed plants. Use on mineral soils only. REI: 12-hour. PHI: 30-day. WSSA 15.

paraquat products (paraquat) Garlic, Onion (Dry) | 2-4 pt. per acre of 2 lb. per gal. formulation. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS (0.25% v/v) per 25 gal. of solution and apply to emerged weeds less than 6” tall prior to transplanting or after direct-planting. REI: 24-hour. PHI: 45-day. WSSA 9.

Broadleaf and Grass Weeds - Preemergence

Pesticide

Dacthal W-75 (DCPA) Leek, Onion (Dry), Onion (Green), Shallot | Dacthal W-75 at 6-14 lbs. per acre, or Dacthal Flowable at 6-14 pts. per acre. Apply at seeding, transplanting, and/or layby. Preplant incorporation not recommended. May be sprayed over transplants. REI: 12-hour. PHI: 60-day. WSSA 22. RUP.

Nortron SC (4) (ethofumesate) Onion (Dry), Shallot | 16-32 fl. oz. per acre. Apply preemergence or soon after seeding before weeds germinate. May also be used postemergence. Do not exceed 4 applications or 48 fl. oz. per acre per season on coarse soils and 96 fl. oz. per acre per season on medium and fine soils. May cause temporary leaf fusion. May injure stressed plants. Use on mineral soils only. REI: 12-hour. PHI: 30-day. WSSA 8.

Outlook (6) (dimethenamid-p) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 12-21 fl. oz. per acre. Apply after crop plants have 2 true leaves. For transplants, apply after transplanting when soil has settled around plants. See label for tank-mix recommendations. REI: 12-hour. PHI: 30-day. WSSA 15.

pendimethalin products (pendimethalin) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | For garlic: use 3.8 formulations at 1.5-3.2 pts. per acre or 3.3 formulations at 1.8-3.6 pts. per acre after planting but before crop and weeds emerge, or when garlic has 1-5 true leaves. For dry bulb onion, and dry shallot: use 3.8 formulations at 1.5-3.2 pts. per acre (up to 4 pts. on muck) or 3.3 formulations at 1.8-3.6 pts. per acre (up to 4.8 pts. on muck) after planting but before crop and weeds emerge, or when onions have 2-9 true leaves. In Michigan only: for mineral soils with more than 10% organic matter, use similar rates as muck soil applications. For green onion, leek, and green shallot: use 3.8 formulations at 2 pts. per acre after seeding but before crop emerges, or when crop has 2-3 true leaves. The 3.3 formulations are not labeled for green onions or leeks. If both pre and post applications are used, wait 30 days after pre application before making a post application. Only apply pre to muck soils (organic matter greater than 20%) or mineral soils with greater than 3% organic matter. Do not exceed 4 pts. per acre per year. For green onion, leek, and green shallot in Michigan only. MI 24c exp. 04/16/24. For mineral soils with more than 5% organic matter, use 3.8 formulations up to 4 pts. per acre or 3.3. formulations up to 4.8 pts. per acre. Use low rates on course soils. Heavy rain or excessive irrigation soon after application may cause crop injury. Will not control emerged weeds. REI: 24-hour. PHI: 45-day for dry bulb onion, garlic and dry shallot; 30-day for green onion, leek, and green shallot. WSSA 3.

Prefar 4E (bensulide) Garlic, Onion (Dry), Shallot | 5-6 qts. per acre. Use low rate on soils with less than 1% organic matter. Apply and incorporate before planting. Or apply after seeding, before crop emerges and irrigate within 24 hours to incorporate. Mineral soils only. REI: 12-hour. PHI: 60-day. WSSA 8.

trifluralin products (trifluralin) Onion (Dry) | Use 10G formulations at 3.75-6.26 lbs. per acre and do not exceed 20 lbs. per acre per season on fine soils. Use 4EC formulations at 0.75-1.25 pts. per acre and do not exceed 4 pts. per acre per season on fine soils. Apply at layby as a directed spray between onion rows and incorporate 1-2 inches. Mineral soils only (less than 3.5% organic matter). REI: 12-hour. PHI: 60-day. WSSA 3.
Broadleaf Weeds Only - Postemergence

Pesticide

Aim EC (2) (carfentrazone) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 0.5-2 fl oz. per acre. Apply a minimum of 30 days prior to direct-seeding or with a hooded sprayer as a directed application between crop rows. Add 1 pt. COC (1% v/v) or 0.5 pt. NIS per 25 gal. of spray solution (0.25% v/v). Weeds must be actively growing and less than 4 inches tall. Do not exceed 6.1 fl oz. per acre per season. Do not allow spray to contact crop. REI: 12-hour. WSSA 14.

GoalTender (4) (oxyfluorfen) Garlic, Onion (Dry) | Seeded crops: Broadcast 0.25 pt. per acre GoalTender or 0.5 pt. per acre Goal 2XL after crop has 2 true leaves. Transplanted crops: Broadcast 0.5-1 pt. per acre GoalTender or 1-2 pts. per acre Goal 2XL prior to transplanting (onion only), or within 2 days of transplanting. Greenhouse-grown transplants may be sensitive to GoalTender at transplanting. May cause foliar injury during cool weather. Use lower rate on coarse soils. Do not exceed 1 pt. per acre per season GoalTender or 2 pts. per acre per season Goal 2XL. REI: 24 to 48-hour. PHI: 42-day for onion, 60-day for garlic. WSSA 14.

Moxy 2E (bromoxynil) Garlic, Onion (Dry) | 1-1.5 pt. per acre for onion or 1.5-2 pt. per acre for garlic. Apply to weeds up to 2 in. tall and 1 in. wide with less than 4 leaves. For onions: apply 1.0-1.5 pts. per acre when onions have 2-5 true leaves, using 50-70 gal. of water per acre, or on muck soils east of the Mississippi River only, apply 3-4 days before onions emerge. To minimize onion injury apply after 2 days of sunny weather when onion leaves are dry and temperatures are 70-80 F. For garlic: apply 1.5-2.0 pts. per acre after garlic emerges and before it is 12 in. tall, using at least 20 gal. water per acre. REI: 24-hour. PHI: 45-day for onion, 112-day for garlic. WSSA 6.

Starane Ultra (2.8) (fluoroxypr) Onion (Dry) | 5.6 fl. oz. per acre. Michigan only. Mi 24c exp. 07/17/23. Apply to onions with 2-6 true leaves. Do not exceed 2 applications per season. Controls volunteer potato, chickweed, composites, nightshades, and mustards. REI: 24-hour. PHI: 42-day. WSSA 4.

GoalTender (4) (oxyfluorfen) Garlic, Onion (Dry) | Seeded crops: Broadcast 0.25 pt. per acre GoalTender or 0.5 pt. per acre Goal 2XL after crop has 2 true leaves. Transplanted crops: Broadcast 0.5-1 pt. per acre GoalTender or 1-2 pts. per acre Goal 2XL prior to transplanting (onion only), or within 2 days of transplanting. Greenhouse-grown transplants may be sensitive to GoalTender at transplanting. May cause foliar injury during cool weather. Use lower rate on coarse soils. Do not exceed 1 pt. per acre per season GoalTender or 2 pts. per acre per season Goal 2XL. REI: 24 to 48-hour. PHI: 45-day for onion, 60-day for garlic. WSSA 14.

Grass Weeds Only - Postemergence

Pesticide
clethodim products (clethodim) Garlic, Onion (Dry) | Use 2EC formulations at 6-16 fl oz. per acre with 1 qt. COC per 25 gals. of spray solution (1% v/v). Do not exceed 32 fl oz. per acre per season. Use Select Max at 9-16 fl oz. per acre to control annual grasses and 12-32 fl oz. per acre to control perennial grasses. Add 0.5 pt. NIS per 25 gals. of spray solution (0.25% v/v). Do not exceed 64 fl oz. per acre per season. Spray on actively growing grass. Wait at least 14 days between applications. REI: 24-hour. PHI: 45-day. WSSA 1.

Fusilade DX (2EC) (fluazifop-P) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 10-12 fl oz. per acre. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gal. of spray solution (0.25% v/v). Apply to small actively growing grass. Do not exceed 48 fl oz. per acre per year. REI: 12-hour. PHI: 45-day for garlic and dry bulb onion (dry), 14-day for green onion and leek. WSSA 1.

Poast (1.5EC) (sethoxydim) Garlic, Leek, Onion (Dry), Onion (Green), Shallot | 1-1.5 pt. per acre. Add 0.5 pt. NIS per 25 gals. of spray solution (1% v/v). Spray on actively growing grass. Use high rate on quackgrass. Do not exceed 4.5 pts. per acre per growing season. REI: 12-hour. PHI: 30-day. WSSA 1.

Potato - Horticulture

Reviewed by Ben Phillips, Liz Maynard – Oct 2020

Crop Description

Potatoes (Solanum tuberosum) are staple food grown from small tubers of a mother plant that is grown by specialized seed-potato producers. The Midwest produces potatoes primarily for table stock and processing into potato chips. Varieties used for chipping are usually brown skinned, white-fleshed, and globe-shaped to facilitate slicing from any direction. Table stock potatoes include ‘starchy’ (high dry matter) baking varieties and ‘waxy’ (low dry matter) boiling varieties in numerous skin and flesh color combinations with widely variable sizes and shapes. Starchy varieties include the Russets. Waxy varieties include Norland Reds. Some varieties are intermediate between those two types, like Yukon Gold.

An important disease that affects the marketability of table stock potatoes is scab. One way to manage scab is to maintain a soil
pH of 5.0 to 5.2. However, low soil pH reduces phosphorus availability, and most rotational crops will not perform well at the low pH. In fields with a history of scab, using scab-resistant varieties is the best option to avoid having to adjust pH to the detriment of rotational crops.

**Planting and Spacing**

**Tuber production:** Rows 34 to 36 inches apart. Seed pieces 9 to 11 inches apart in row, depending on variety and intended use. Seed 16 to 18 100-pound bags per acre. Seed piece should be 1-1/2 to 2 ounces. Using B-size certified seed will save cutting labor and reduce tuber-borne diseases.

**Seed stock production:** Select seed stock from high-yielding hills that are smooth, well-shaped, and free of diseases and insect injury. When possible, obtain certified G1 or G2 (generation) seed stock. Store seed stock in new crates to avoid disease contamination. Seed potatoes should be at least 1-1/2 to 2 ounces in weight. If cutting larger seed potatoes, warm to 45 F before cutting, then sort to remove blind, slab, sliver, ripped, and undersized pieces after cutting. Cure cut stock at 38 to 40 F, with circulation for 6 to 10 days. To supply one acre of seed potatoes, you need roughly 14,000 to 26,000 seed pieces.

**Fertilizing**

**pH:** Maintain a soil pH of 5.5 to 6.5.

Before planting, do not fertilize with N or P, but apply 50 to 400 pounds K2O per acre based on soil test results and recommendations from your state. The most efficient way to spread the remaining fertilizer is with a banded application at planting at least 2 inches below and 2 inches to both sides of the tuber. As a banded starter fertilizer, apply 0 to 30 pounds N per acre, 0 to 150 pounds P2O5 per acre, and 0 to 200 pounds K2O per acre. The rate of K2O should not exceed 200 pounds per acre when banded.

Manganese may be needed when the soil pH is above 6.5 on mineral soils and above 5.8 on organic soils. Use a soil test to determine the amount of manganese needed. Include the required amount of manganese in the starter fertilizer, or spray the foliage with 1 to 2 pounds of manganese per acre at least twice during active growth. On sandy soils, broadcast 30 pounds or band 15 pounds sulfur per acre.

Sidedress once at emergence and once at hilling or tuber initiation with 50-75 pounds N per acre each time. The second application can be adjusted according to rainfall and a petiole nitrate-N analysis. Use lower end of range for early-maturing varieties. Reduce the amount of fertilizer N applied by the value of N credits from green manures, legume crops grown in the previous year, compost and animal manures, and soils with more than 3 percent organic matter. The total amount of N from fertilizer and other credits should be 100 to 150 pounds per acre.

**Harvesting**

“New” potatoes can be dug by hand from the sides of hills for continual harvest for fresh market sale, but they do not keep as well as a mature tuber. New potatoes can also be once-over harvested in sections at a time, but the chain conveyors can blemish the soft skins of these immature tubers.

Storage potato market life can be lengthened by preventing sprouting of potatoes in storage, use maleic hydrazide (Royal MH-30 or Sprout-Stop) according to label directions one week after blossoms fall. For varieties and conditions where flowering does not occur, apply four to six weeks before potatoes are mature and ready for harvest. Make only one application. Apply when no rain is expected for 24 hours. Potatoes treated with maleic hydrazide cannot be used for seed because sprouting will be inhibited. Follow label directions.

Storage potatoes benefit from uniform maturation for mechanical harvest. This can be accomplished by killing the vines with a labeled herbicide. Once vines are down and dried, mechanical harvest can begin with chain-conveyor diggers. The labeled vine-killing herbicides are listed below, along with instructions.

**Vine Kill Herbicides**

**Defol 750 (7.5L) (sodium chlorate)** 3.2 qts. per acre of 750 formulations, and 4.8 qts. per acre of the 5 formulations with 10-20 gals. per acre water by ground or 5-10 gals. per acre water by air. Apply 10 days before harvest. Do not apply in extreme heat during the middle of the day. REI: 12-hour. WSSA NC.

**paraquat formulations (paraquat)** 0.8-1.5 pts. per acre of 2.5L or 0.6-1.0 pt. per acre of 3L in 50-100 gals. of water plus 1 gal. COC or 1-2 pts. nonionic surfactant per 100 gals. spray solution. **Not for potatoes to be stored or used for seed.** Begin applications when leaves begin to turn yellow. Immature potato foliage and drought-stressed potato foliage are tolerant to this product. Maximum 3 pts. of 2.5L or 2 pts. of 3L per acre per season. For split applications, use lower rate and wait 5 days between applications. Read label for complete instructions. 3L formulation not for use in Iowa or Missouri. REI: 24-hour. PHI: 3-day. WSSA 22. RUP.

**Reglone (2L) (diquat)** 1-2 pts. in 20-100 gals. water plus 8-64 fl. oz. nonionic surfactant. A second application can be made if necessary. Allow at least 5 days between applications. REI: 24-hour. PHI: 7-day. WSSA 22.

**Rely 280 (2.34L) (glufosinate)** 21 fl. oz. per acre. **Not for potatoes to be used for seed.** Do not make more than 1 application. REI: 12-hour. PHI: 9-day. WSSA 10.
Potato - Diseases
Reviewed by Dan Egel, Jaime Wilbur – Nov 2020

Recommended Controls

Aster Yellows (Purple-Top Wilt) of Multiple Crops - Phytoplasma Mollicutes

This pathogen is transmitted by leafhoppers. Infection rates can jump when adjacent crops are harvested mid-season, such as alfalfa or wheat.

Non-Pesticide

Plant only certified seed tubers. Practice clean cultivation. Rogue first infected plants, including tubers.

Pesticide

Insecticides | Use an insecticide to control leafhoppers that transmit the disease. Leafhoppers must be controlled before they feed. See Insect section.

Black Dot of Potatoes - Colletotrichum Fungus

Pesticide

azoxystrobin products (azoxystrobin) | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-20.0 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-12.8 fl. oz. per acre. REI: 4-hour. PHI: 14-day. FRAC 11.

chlorothalonil products (chlorothalonil) | Michigan only -- Bravo Weather Stik (exp. 12/31/2024), Bravo ZN (exp. 12/31/2020), Echo 720 (exp. 12/31/2024), and Echo 90DF (exp. 12/31/2024) can apply up to 16 lbs. a.i. per acre per year. All other states do not exceed 11.25 lbs. a.i. per acre per year. Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See product labels. REI: 7-day. FRAC M5.

Headline (SC) (2.08) (pyraclostrobin) | 6-9 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 11.

Luna Tranquility (SC) (fluopyram, pyrimethanil) | 8-11.2 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 9.

Miravis Prime (SC) (pydiflumetofen, fludioxonil) | 9.2-11.4 fl. oz. per acre. Black dot suppression only. Use high rate for potato. REI: 12-hour. PHI: 14-day. FRAC 7, FRAC 12.

Revus Top (SC) (mandipropamid, difenoconazole) | 5.5-7.0 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 40, FRAC 3.

Tanos (DF) (famoxadone, cymoxanil) | 6-8 oz. per acre. Disease suppression only. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC 27.

Zing! (zoxamide, chlorothalonil) | 24-34 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 22, FRAC M5.

Black Leg of Potatoes - Pectobacterium or Dickeya Bacteria

Non-Pesticide

Use seed pieces certified to be free of disease. Plant in well-drained soil and avoid over-irrigation. Sanitize equipment at planting and at harvest to limit spread.

Pesticide

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) | Several formulations of copper (Badge, Champ, Kocide) products are labelled for use and may slow the spread of bacterial blight. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

Double Nickel 55 (25WDG) (Bacillus amyloliquefaciens strain D-747) | 0.125-1 lbs. per acre as a soil drench or 0.25-3 lbs. per acre as a foliar application, according to disease management considerations. REI: 4-hour. PHI: 0-day. FRAC 44. OMRI-listed.

streptomycin products (Streptomycin sulfate) | Use 17% products at 8 oz. per 100 gals of water, or 50% products at 2.7 oz. per 100 gals. of water to maintain a concentration of 100 ppm. Soak seed pieces in solution for several minutes. REI: 12-hour. FRAC 25.

Black Scurf of Potatoes - Rhizoctonia Fungus

Use a fungicide when appropriate.

Non-Pesticide

Plant seed pieces certified to be free of disease. Harvest potatoes as soon after maturity as possible. Rotation to a non-host crop 2-3 years.

Pesticide

azoxystrobin products (azoxystrobin) | Use 2 lb. a.i. per gallon formulations (Quadris) at 0.4-0.8 fl. oz. per 1,000 row feet. Use 3.3 lb. per gallon formulations (Azteroid) at 0.24-0.48 fl. oz. per 1,000 row feet. Use 0.83 lb. per gallon formulations (Dynasty) for treating seed at 0.10-3.75 fl. oz. per 100 lbs. of seed. REI: 4-hour. FRAC 11.

Moncut (3.8) (flutolanil) | 0.7-1.1 lbs. per acre of the DF formulation or 16-25 fl. oz. per acre of the SC formulation. REI: 12-hour. FRAC 7.
Potato - Diseases

Dry Rot of Potatoes - Fusarium Fungus
Avoid bruising at harvest. Cure potatoes in storage at 60 degrees F before lowering temperature. Provide adequate ventilation.

Non-Pesticide
Avoid bruising at harvest. Cure potatoes in storage at 60 degrees F before lowering temperature. Provide adequate ventilation.

Pesticide
mancozeb products (mancozeb) | Seed piece treatment; dip whole or cut potatoes in solution. Several formulations of mancozeb (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 14-day. FRAC M3.

Maxim 4FS (fludioxonil) | 0.08 fl. oz. per 100 lbs. of seed. Seed piece treatment. Use specific application equipment according to label. REI: 12-hour. FRAC 12.

Maxim MZ (mancozeb, fludioxonil) | 0.5 lbs. per 100 lbs. of seed. Seed piece treatment. REI: 24-hour. FRAC M3, FRAC 12.

Mertect 340-F (SC) (thiabendazole) | 0.42 oz. per 2,000 lbs. of tubers. 0.42 fl. oz. per 2,000 lbs. of tubers. Do not treat seed potatoes after cutting. Fungicide resistance known REI: 12-hour. FRAC 1.

Seed treatments (thiamethoxam, mfenoxam, fludioxonil, azoxystrobin, thiabendazole, spinosad, abamectin) | Rates vary by product. Select seed treatments Cruiser Maxx Vibrance Potato (thiamethoxam, difenoconazole, sedaxane, fludioxonil); Cruiser Maxx Potato Extreme (thiamethoxam, difenoconazole, fludioxonil); Ernesto Silver (penflufen, prothioconazole). IRAC 4A, FRAC 4, FRAC 12, FRAC 11, FRAC 1, IRAC 5, IRAC 6.

Stadium (FSC) (azoxystrobin, difenoconazole, fludioxonil) | 1 fl. oz. per 2,000 lbs. of tubers. Postharvest application only; no more than one application to tubers. FRAC 11, FRAC 3, FRAC 12.

Early Blight of Potatoes - Alternaria Fungus
This disease initially causes lesions on lower leaves of the potato plant. After field planting, begin protective fungicide applications on a 7-14 day schedule.

Group 11 Resistance: Strains of the fungus that causes early blight that are resistant to group 11 fungicides have been observed in Indiana and Ohio. Group 11 products labeled for potato and early blight include Cabrio and Quadris. Tank-mix group 11 fungicides with products that have a different mode of action, or alternate group 11 fungicides with fungicides that have a different group number.

Non-Pesticide
Avoid fields with a history of nematodes, Fusarium or Verticillium wilts, droughty, wet, or compacted soils, and other conditions (such as insufficient nitrogen) that might add undue stress to the crop and increase susceptibility to early blight. Varieties with partial resistance are available. Rotate to non-host crops for 2-3 years.

Pesticide
azoxystrobin products (azoxystrobin) | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-20.0 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-12.8 fl. oz. per acre. REI: 4-hour. PHI: 14-day. FRAC 11.

chlorothalonil products (chlorothalonil) | Michigan only -- Bravo Weather Stik (exp. 12/31/2024), Bravo ZN (exp. 12/31/2020), Echo 720 (exp. 12/31/2024), and Echo 90DF (exp. 12/31/2024) can apply up to 16 lbs. a.i. per acre per year. All other states do not exceed 11.25 lbs. a.i. per acre per year. Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See product labels. REI: 12-hour. PHI: 7-day. FRAC M5.

Endura (WG) (boscalid) | 3.5-4.5 oz. per acre. REI: 12-hour. PHI: 10-day. FRAC 7.

Gavel 75DF (zoxamide, mancozeb) | 1.5-2 lbs. per acre. REI: 48-hour. PHI: 3-day in Michigan and Ohio; 14-day in all other states. FRAC 22, FRAC M3.

Headline (SC) (2.08) (pyraclostrobin) | 6-9 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 11.

iprodione products (iprodione) | 1-2 pts. per acre. Formulations of iprodione include Nevado and Rovral. REI: 24-hour. PHI: 14-day. FRAC 2.

Luna Tranquility (SC) (fluopyram, pyrimethanil) | 8-11.2 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 9.

mancozeb products (mancozeb) | Several formulations of mancozeb (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 14-day. FRAC M3.

Miravis Prime (SC) (pydiflumetofen, fludioxonil) | 9.2-11.4 fl. oz. per acre. Black dot suppression only. Use high rate for potato. REI: 12-hour. PHI: 14-day. FRAC 7, FRAC 12.

Quadris Opti (SC) (azoxystrobin, chlorothalonil) | 1.6 pts. per acre. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC M5.

Revus Top (SC) (mandipropamid, difenoconazole) | 5.5-7.0 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 40, FRAC 3.

Scala (SC) (5) (pyrimethanil) | 7 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 9.

Tanos (DF) (famoxadone, cymoxanil) | 6 oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC 27.
Velum Prime (4.16SC) (fluopyram) | 6.5-6.84 fl. oz. per acre. Apply through overhead chemigation. Do not exceed 13.7 fl. oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 7-day. FRAC 7.

Zing! (zoxamide, chlorothalonil) | 24-34 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 22, FRAC M5.

Late Blight of Potatoes/Tomatoes - Phytophthora Oomycete
This destructive pathogen causes quick plant death and can be identified by large spreading brown stem lesions, velvety white growth on plant surfaces, and large brown leathery spots on green fruits. It is favored by prolonged cool and damp conditions.

The pathogen overwinters on plant residue, including volunteer potatoes and potato cull piles. When it is reported in your region, begin weekly preventive sprays with chlorothalonil and mancozeb for as long as favorable conditions persist. Pay attention to which pathogen strain is identified. If infections start in a field, the strain US-23 is sensitive to mefenoxam (Ridomil).

Non-Pesticide
The first step to manage this disease is monitoring and destroying cull and volunteer potato emergence in the spring.

Pesticide
chlorothalonil products (chlorothalonil) | Michigan only -- Bravo Weather Stik (exp. 12/31/2024), Bravo ZN (exp. 12/31/2020), Echo 720 (exp. 12/31/2024), and Echo 90DF (exp. 12/31/2024) can apply up to 16 lbs. a.i. per acre per year. All other states do not exceed 11.25 lbs. a.i. per acre per year. Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See product labels. REI: 12-hour. PHI: 7-day. FRAC M5.

Curzate 60DF (cymoxanil) | 3.2 oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 27.

Gavel 75DF (zoxamide, mancozeb) | 1.5-2 lbs. per acre. REI: 48-hour. PHI: 3-day in Michigan and Ohio; 14-day in all other states. FRAC 22, FRAC M3.

mancozeb products (mancozeb) | Several formulations of mancozeb (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 14-day. FRAC M3.

Omega 500F (4.17) (fluazinam) | 5.5 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 29.

Orodis Ultra Premix (SC) (oxathiapiprolin, mandipropamid) | 5.5-8 fl. oz. per acre. REI: 4-hour. PHI: 14-day. FRAC 49, FRAC 40.

Previcur Flex (6) (propamocarb) | 0.7-1.2 pts. per acre. REI: 12-hour. PHI: 14-day. FRAC 28.

Ranman 400SC (34.5) (cyazofoamid) | 1.4-2.75 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 21.

Revus Top (SC) (mandipropamid, difenoconazole) | 5.5-7.0 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 40, FRAC 3.

Tanos (DF) (famoxadone, cymoxanil) | 6-8 oz. per acre. Disease suppression only. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC 27.

Zampro (SC) (ametoctradin, dimethomorph) | 11-14 fl. oz. per acre. REI: 12-hour. PHI: 4-day. FRAC 45, FRAC 40.

Zing! (zoxamide, chlorothalonil) | 30-34 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 22, FRAC M5.

Nematodes
Potato cyst nematodes are serious pathogens that reduce stands, yield and tuber quality. As sedentary endoparasites, the female body hardens into a cyst that protects its eggs for a decade or so in absence of a host.

Root lesion nematodes form a destructive disease complex with Verticillium, called Potato Early-Die. Both root lesion nematodes and Verticillium can be supported by multiple crops, which makes it difficult to control through rotation.

Non-Pesticide
Collect soil samples for nematodes in the fall and avoid fields with high numbers. Rotate to a non-broadleaf crop, such as grass grains or sweet corn for >3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue and displace nematodes is an important method to prevent nematode build-up. Anaerobic soil disinfestation (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain nematodes.

Pesticide
Nimitz (4EC) (fluensulfone) | 3.5-7.0 pts. per acre. May be broadcast, banded, or drip-applied in the spring up to 7 days before planting at a depth of 8 inches. Effectiveness is reduced on muck and clay soils REI: 12-hour. IRAC UN.

Sectagon K42 (4.2L) (metam sodium) | 30-75 gals. per acre (or 37.5-75 gals. per acre for Vapam HL) according to label instructions. Use high rates on muck and lower rates on sands. In the fall, when soil temperatures are above 50 F and soil is moist, place product about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, apply through drip irrigation under unperforated plastic beds.
**Ring Rot of Potatoes - Clavibacter Bacteria**

The ring rot bacterium is easily spread. Although this bacterium will not survive more than 1 year in the soil (and thus can be controlled by crop rotation), a farm with ring rot must conduct a thorough clean-up before bringing in seed for the next crop. The organism can easily survive the winter in crop debris or soil on storage walls; seed cutters, bin pilers, graders, and other handling equipment; tractors, fork lifts and other vehicles; and on burlap sacks, wooden boxes, or other containers. If clean seed potatoes contact any of these contamination sources, the problem can recur.

**Non-Pesticide**

Use certified disease-free seed. When cutting seed stock, the cutter should be periodically cleaned and disinfected, especially when changing seed lots. The first step is to clean all contaminated surfaces with hot soapy water under pressure or steam to remove all soil and debris. Then apply a disinfectant sanitizer. For more information about sanitation, see *Commercial Greenhouse and Nursery Production: Sanitation for Disease and Pest Management* (Purdue Extension publication HO-250-W), available from the Education Store, www.edustore.purdue.edu.

**Scab of Potatoes - Streptomyces Bacteria**

Scab is more common on potatoes grown in soils with pH over 5.2.

**Non-Pesticide**

Avoid fields with a history of nematodes, Fusarium or Verticillium wilts, droughty, wet, or compacted soils, and other conditions (such as insufficient nitrogen) that might add undue stress to the crop and increase susceptibility scab. Acidify soil to a pH between 5.0 and 5.2 with elemental sulfur in the fall prior to planting.

**Silver Scurf of Potatoes - Helminthosporium Fungus**

Use a fungicide when appropriate.

**Non-Pesticide**

Plant seed pieces certified to be free of disease. Harvest potatoes as soon after maturity as possible. Rotation to a non-host crop 2-3 years.

**Pesticide**

**azoxy-strobin products (azoxy-strobin)** | Use 2 lb. a.i. per gallon formulations (Quadris) at 0.4-0.8 fl. oz. per 1,000 row feet. Use 3.3 lb. per gallon formulations (Azertoid) at 0.24-0.48 fl. oz. per 1,000 row feet. Use 0.83 lb. per gallon formulations (Dynasty) for treating seed at 0.10-3.75 fl. oz. per 100 lbs. of seed. REI: 4-hour. FRAC 11.

**White Mold (Timber Rot, Drop, Stem Rot) of Multiple Crops - Sclerotinia Fungus**

This soil pathogen is long-lived in the soil, and has a wide host range on broadleaved crops and weeds, including beans, vine crops, lettuce, tomatoes, peppers, and cole crops. It goes by other
names in other crops, such as Drop, White Mold, Stem Rot, and Timber Rot. It is more commonly where humidity and temperatures are high. The fungus often infects flowers, which then drop off and infect the stems that they land on. But, the pathogen can also infect stem tissue around the root crown. The stems take on a woody appearance and can split open, revealing small black pellets that are the overwintering body of the pathogen.

**Non-Pesticide**

Avoid fields with a history of the problem. Rotate to a non-broadleaf crop, such as grass grains or sweet corn for >6 years. Avoid excess nitrogen. Reduce overhead irrigation if disease is present. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

*Contans WG (5) (Coniothyrium minitans strain CON/M/91-08)* | 1-6 lbs. per acre. Apply immediately after harvest or 3-4 months before planting. REI: 4-hour. FRAC NC. OMRI-listed.

*Endura (WG) (boscalid)* | 5.5-10 oz. per acre. REI: 12-hour. PHI: 10-day. FRAC 7.

*iprodione products (iprodione)* | 2 pts. per acre. Formulations of iprodione include Nevado and Rovral. REI: 24-hour. PHI: 14-day. FRAC 2.

*Luna Tranquility (SC) (fluopyram, pyrimethanil)* | 11.2 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 9.

*Miravis Prime (SC) (pydiflumetofen, fludioxonil)* | 9.2-11.4 fl. oz. per acre. Black dot suppression only. Use high rate for potato. REI: 12-hour. PHI: 14-day. FRAC 7, FRAC 12.

*Omega 500F (4.17) (fluazinam)* | 5.5-8 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 29.

*Topsin M WSB (70) (thiophanate-methyl)* | 20-30 fl. oz. per acre. 20-30 fl. oz. per acre for Topsin 4.5FL, 21.8-32.7 fl. oz. per acre for Cercobin, or 1-1.5 lbs. per acre for Topsin M WSB. REI: 24-hour to 3-day. PHI: 21-day PHI. FRAC 1.

*Velum Prime (4.16SC) (fluopyram)* | 6.5-6.84 fl. oz. per acre. Apply through overhead chemigation. Do not exceed 13.7 fl. oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 7-day. FRAC 7.

**Wilt of Multiple Crops - Verticillium Fungus**

This pathogen can interact with root lesion nematodes to create a destructive condition known as Potato Early-Die.

**Non-Pesticide**

Choose potato varieties that have partial resistance to Verticillium wilt. Good weed control also is important in reducing pathogen populations. Employ at least a 2-year rotation with small grains to manage fungus populations in the soil.

**Potato - Insects**

Reviewed by Laura Ingwell, Donald Lewis – Nov 2020

**Recommended Controls**

**Aphids**

**Pesticide**

*Actara (25WDG) (thiamethoxam)* | 3.0 oz. per acre. Apply as a foliar spray. Do not exceed 6 oz. per acre per season. Allow 7 days between applications. See pollinator precautions. REI: 12-hour. PHI: 14-day. IRAC 4A.

*Admire Pro (4.6SC) (imidacloprid)* | *Seed piece treatment*: 0.17-0.35 fl. oz. per 100 lbs of seed applied directly to seed pieces. *Soil application*: 5.7-8.7 fl. oz. per acre applied in-furrow, side-dressed, or below seed piece at planting. Do not exceed 8.7 fl. oz. per acre per season from seed or soil applications. *Foliar application*: 1.3 fl. oz. per acre applied to foliage. Do not exceed 5.6 fl. oz. per acre per season from foliar applications. See pollinator precautions. REI: 12-hour. PHI: 7-day for foliar applications. IRAC 4A.

*Asana XL (0.66EC) (esfenvalerate)* | 5.8-9.6 fl. oz. per acre. Do not exceed 42 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 3A, IRAC 6. RUP.

*Assail 30SG (acetamiprid)* | Use 30SG formulations at 2.5-4.0 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 1.0-1.7 oz. per acre and do not exceed 7.0 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

*Athena (0.76EC) (bifenthrin, abamectin)* | 7-17 fl. oz. per acre. Do not exceed 42 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 3A, IRAC 6. RUP.

*Belay (2.13SC) (clothianidin)* | *Seed piece treatment*: 0.4-0.6 fl. oz. per 100 lbs of seed applied directly to seed pieces. *Soil application*: 9-12 fl. oz. per acre applied in-furrow, side-dressed, or below seed piece at planting. Do not exceed 12 fl. oz. per acre per season from seed or soil applications. *Foliar application*: 2-3 fl. oz. per acre applied to foliage. Do not exceed 12 fl. oz. per acre per season from foliar applications. Allow 7 days between
Potato - Insects

applications. See pollinator precautions. REI: 12-hour. PHI: 14-day. IRAC 4A.

**Beleaf (50SG) (flonicamid)** | 2.0-2.8 oz. per acre. Do not exceed 8.4 oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 29.

**Dimethoate 4EC (dimethoate)** | Use 2.67EC formulations at 0.75-1.5 pt. per acre and do not exceed 3.0 pts. per acre per season. Use 4EC, LV-4, and 400 formulations at 0.5-1 pt. per acre and do not exceed 2 pt. per acre per season. Allow 7 days between applications. REI: 48-hour. PHI: 0-day. IRAC 1B.

**Fulfill (50WDG) (pyrethrozine)** | 2.75-5.5 oz. per acre. Do not exceed 11 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 14-day. IRAC 9B.

**Lannate LV (2.4L) (methomyl)** | 1.5-3.0 pts. per acre. Do not exceed 15 pts. per acre per season. REI: 48-hour. PHI: 6-day. IRAC 1A. RUP.

**M-Pede (3.8) (potassium salts of fatty acids)** | 1-2% by volume. Must contact aphids to be effective. Combine with another labeled product for best results. REI: 12-hour. PHI: 0-day. IRAC UN, FRAC NC. OMRI-listed.

**Movento (2SC) (spiroetramat)** | 4-5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. Allow 7 days between applications. REI: 24-hour. PHI: 7-day. IRAC 23.

**Mustang Maxx (0.8) (zeta-cypermethrin)** | 3.2-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. Allow 4 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Perm-Up 25DF (permethrin)** | Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2oz. per acre per season. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Allow 10 days between applications REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

**Platinum 2SC (thiamethoxam)** | Use 2SC formulations at 5-8 fl. oz. per acre and do not exceed 8 fl. oz. per acre per season. Use 75SG formulations at 1.66-2.67 oz. per acre and do not exceed 2.67 oz. per acre per season. Seed piece only, apply as in-furrow spray during planting. REI: 12-hour. PHI: 14-day. IRAC 4A.

**Scorpion 35SL (3.24) (dinitofuran)** | **Soil application**: Use Scorpion 35SL at 11.5-13.25 fl. oz. per acre, or Venom 70SG at 6.5-7.5 fl. oz. per acre applied in-furrow at planting, or side-dressed to both sides of the row at ground crack. **Foliar application**: Use Scorpion 35SL at 2.0-2.75 fl. oz. per acre, or Venom 70SG at 1.0-1.5 fl. oz. per acre applied to foliage. Allow 14 days between applications. See pollinator precautions. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Seed treatments (thiamethoxam, mfenoxam, fludioxonil, azoxyhydroxynil, thiamethoxam, thiabendazole, spinosad, abamectin)** | See label. Rates vary by product. Choose seed treatments that include thiamethoxam insecticide (Cruiser 5FS, Cruiser Maxx, and Cruiser Maxx Potato). For best results, plant potatoes immediately after treatment. PHI: See label. IRAC 4A, FRAC 4, FRAC 12, FRAC 11, FRAC 1, IRAC 5, IRAC 6.

**Sivanto 200 (1.67SL) (flupyradifurone)** | 7.0-10.5 fl. oz. per acre. Do not exceed 28.0 fl. oz. per acre per season. Allow 7 days between applications. REI: 4-hour. PHI: 7-day. IRAC 4D.

**Thimet 20G (phorate)** | Light or sandy soils: 8.5-11.3 oz. per 1,000 ft. of row for any row spacing larger than 32-inches. Use at planting or post-emergence. Heavy or clay soils: 13.0-17.3 oz. per 1,000 ft. of row. Do not use post emergence. Apply as a band application on each side of row and beneath soil surfaces, or in the seed furrow. REI: 48-hour. PHI: 90-day. IRAC 1B. RUP.

**Torac (1.29SC) (tolifenpyrad)** | 17-21 fl. oz. per acre. Do not exceed 42 fl. oz. per acre per season for 2 applications. Allow 14 days between applications. See pollination precautions. REI: 12-hour. PHI: 14-day. IRAC 21A, FRAC 39.

**Transform WG (50) (sulfoxaflor)** | 0.75-1.5 oz. per acre. Do not exceed 8.5 oz. per acre per season. Allow 14 days between applications. REI: 24-hour. PHI: 7-day. IRAC 4C.

**Volum Flexi (WDG) (thiamethoxam, chlorantraniliprole)** | 4 oz. per acre. Do not exceed 8 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 14-day. IRAC 4A, IRAC 28.

**Vydate C-LV (3.77WSL) (oxamyl)** | 17-34 fl. oz. per acre. Do not exceed 8 applications or 306 fl. oz. per acre per season. In Kansas, allow 14 days between applications. Do not exceed 4 applications or 204 fl. oz. per acre per season. REI: 48-hour. PHI: 7-day. IRAC 1A. RUP.

**Warrior II (2.08CS) (lambda-cyhalothrin)** | 1.28-1.92 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 3A. RUP.

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**Caterpillars**

**Pesticide**

**Asana XL (0.66EC) (esfenvalerate)** | 5.8-9.6 fl. oz. per acre. For corn borers and cutworms. Do not exceed 67.2 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

**Assail 30SG (acetamiprid)** | For corn borers as an ovicide. Use 30SG formulations at 2.5-4.0 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 1.1-1.7 oz. per acre and do not exceed 7.0 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Athena (0.76EC) (bifenthrin, abamectin)** | 7-17 fl. oz. per acre. For corn borers, and cutworms. Do not exceed 42 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 3A, IRAC 6. RUP.

**Avanta (30WDG) (indoxacarb)** | 3.5-6.0 oz. per acre. For corn borers. Do not exceed 24 oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 22.
Baythroid XL (1EC) (beta-cyfluthrin) | 0.8-2.8 fl. oz. per acre. For corn borers, and cutworms. Do not exceed 16.8 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

Blackhawk (36G) (spinosad) | 1.7-3.3 oz. per acre. Do not exceed 14.4 oz. per acre per season. REI: 4-hour. PHI: 7-day. IRAC 5.

Coragen (1.67SC) (chlorantraniliprole) | 3.5-7.5 fl. oz. per acre. For corn borers. Do not exceed 15.4 fl. oz. per acre per season. Allow 5 days between applications. REI: 4-hour. PHI: 7-day. IRAC 5.

Diazinon AG500 (4ES) (diazinon) | 3-4 qts. per acre. For cutworms in Ohio only. (OH 24c exp. 12/31/25). Use as a pre-plant incorporation and do not exceed 1 application per season. REI: 2 to 4-day. IRAC 1B. RUP.

Endigo ZC (thiamethoxam, lambda-cyhalothrin) | 3.5-4.5 fl. oz. per acre. For corn borers, and cutworms. Do not exceed 10 fl. oz. per acre per season. Allow 7 days between applications. REI: 24-hour. PHI: 14-day. IRAC 4A, IRAC 3A. RUP.

Entrust SC (2) (spinosad) | For corn borers. Use 2SC formulations at 3.0-10.0 fl. oz. per acre and do not exceed 21 fl. oz. per acre per season. Use 80WP formulations at 1.0-3.0 oz. per acre and do not exceed 9 oz. per acre per season. Allow 7 days between applications. REI: 4-hour. PHI: 7-day. IRAC 5. OMRI-listed.

Lannate LV (2.4L) (methomyl) | 1.5 pts. per acre. For cutworms. Do not exceed 15 pts. per acre per season. REI: 48-hour. PHI: 6-day. IRAC 1A. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) | 1.28-4.0 fl. oz per acre. For corn borers, and cutworms. Do not exceed 24 fl. oz. per acre per season. Allow 4 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Perm-Up 25DF (permethrin) | For corn borers, and cutworms. Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2oz. per acre per season. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Allow 10 days between applications REI: 12-hour. PHI: 14-day. IRAC 3A. RUP.

Radiant 1SC (spinetoram) | 6-8 fl. oz. per acre. For corn borers. Do not exceed 32 fl. oz. per acre. Allow 7 days between applications. REI: 4-hour. PHI: 7-day. IRAC 5.

Rimon 0.83EC (novaluron) | 6-12 fl. oz. per acre. For corn borers. Do not exceed 24 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 14-day. IRAC 15.

Sevin XLR Plus (4SC) (carbaryl) | 1-2 qts. per acre. For corn borers, and cutworms. Do not exceed 6 qts. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 1A.

Voliam Flexi (WDG) (thiamethoxam, chlorantraniliprole) | 4 oz. per acre. For corn borers. Do not exceed 8 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 14-day. IRAC 4A, IRAC 28.

Warrior II (2.08CS) (lambda-cyhalothrin) | 0.96-1.92 For corn borers, and cutworms. Do not exceed 7.68 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 3A. RUP.

**Colorado Potato Beetle**

**Pesticide**

Actara (25WDG) (thiamethoxam) | 3.0 oz. per acre. Apply as a foliar spray. Do not exceed 6 oz. per acre per season. Allow 7 days between applications. See pollinator precautions. REI: 12-hour. PHI: 14-day. IRAC 4A.

Admire Pro (4.6SC) (imidacloprid) | Seed piece treatment: 0.17-0.35 fl. oz. per 100 lbs of seed applied directly to seed pieces. Soil application: 5.7-8.7 fl. oz. per acre applied in-furrow, side-dressed, or below seed piece at planting. Do not exceed 8.7 fl. oz. per acre per season from seed or soil applications. Foliar application: 1.3 fl. oz. per acre applied to foliage. Do not exceed 5.6 fl. oz. per acre per season from foliar applications. See pollinator precautions. REI: 12-hour. PHI: 7-day for foliar applications. IRAC 4A.

Agri-Mek SC (0.7) (abamectin) | 1.7-3.5 fl. oz. per acre. Do not exceed 10.25 fl. oz. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 6. RUP.

Asana XL (0.66EC) (esfenvalerate) | 5.8-9.6 fl. oz. per acre. Do not exceed 67.2 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Assail 30SG (acetamiprid) | Use 30SG formulations at 1.5-4.0 fl. oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 0.6-1.7 oz. per acre and do not exceed 7.0 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

Athena (0.76EC) (bifenthrin, abamectin) | 7-17 fl. oz. per acre. Do not exceed 42 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 3A, IRAC 6. RUP.

Avant (30WDG) (indoxacarb) | 3.5-6.0 oz. per acre. Do not exceed 24 oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 22.

Baythroid XL (1EC) (beta-cyfluthrin) | 1.6-2.8 fl. oz. per acre. Do not exceed 16.8 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

Belay (2.13SC) (clothianidin) | Seed piece treatment: 0.4-0.6 fl. oz. per 100 lbs of seed applied directly to seed pieces. Soil application: 9-12 fl. oz. per acre applied in-furrow, side-dressed, or below seed piece at planting. Do not exceed 12 fl. oz. per acre per season from seed or soil applications. Foliar application: 2-3 fl. oz. per acre applied to foliage. Do not exceed 12 fl. oz. per
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acre per season from foliar applications. Allow 7 days between applications. See pollinator precautions. REI: 12-hour. PHI: 7-day. IRAC 4A.

Blackhawk (36G) (spinosad) | 1.7-3.3 oz. per acre. Do not exceed 14.4 oz. per acre per season. REI: 4-hour. PHI: 7-day. IRAC 4A.

Coragen (1.67SC) (chlorantraniliprole) | 3.5-7.5 fl. oz. per acre. Do not exceed 15.4 fl. oz. per acre per season. Allow 5 days between applications. REI: 4-hour. PHI: 14-day. IRAC 28.

Endigo ZC (thiamethoxam, lambda-cyhalothrin) | 3.5-4.5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. Allow 7 days between applications. REI: 24-hour. PHI: 14-day. IRAC 4A. RUP.

Exirel (0.83SE) (cytanrlaniprole) | 5.0-13.5 fl. oz. per acre. Do not apply more than twicer per generation. Allow 5 days between applications. REI: 12-hour. PHI: 7-day. IRAC 28.

Mustang Maxx (0.8) (zeta-cypermethrin) | 3.2-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. Allow 4 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Neemix (0.39) (azadirachtin) | 4-16 fl. oz. per acre. Use on larvae. REI: 4-hour. PHI: 0-day. IRAC UN. OMRI-listed.

Novodor FC (10) (Bacillus thuringiensis tenebrionis strain NB-176) | 1-3 qts. per acre. Effective on small (up to 1/4 inch) larvae only. Use higher rate for mixed sizes or heavier infestations. REI: 4-hour. PHI: 0-day. IRAC 11A.

Perm-Up 25DF (permethrin) | Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2 oz. per acre per season. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Allow 10 days between applications. REI: 12-hour. PHI: 14-day. IRAC 3A. RUP.

Platinum 2SC (thiamethoxam) | Use 2SC formulations at 5-8 fl. oz. per acre and do not exceed 8 fl. oz. per acre per season. Use 75SG formulations at 1.66-2.67 oz. per acre and do not exceed 2.67 oz. per acre per season. Seed piece only, apply as in-furrow spray during planting. REI: 12-hour. IRAC 4A.

Radiant 1SC (spinetoramin) | 4.5-8 fl. oz. per acre. Do not exceed 32 fl. oz. per acre. Allow 7 days between applications. REI: 4-hour. PHI: 7-day. IRAC 5.

Rimon 0.83EC (novaluron) | 6-12 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 14-day. IRAC 15.

Scorpion 35SL (3.24) (dinotefuran) | Soil application: Use Scorpion 35SL at 11.5-13.25 fl. oz. per acre, or Venom 70SG at 6.5-7.5 fl. oz. per acre applied in-furrow at planting, or side-dressed to both sides of the row at ground crack. Foliar application: Use Scorpion 35SL at 2.0-2.75 fl. oz. per acre, or Venom 70SG at 1.0-1.5 fl. oz. per acre applied to foliage. Allow 14 days between applications. See pollinator precautions. REI: 12-hour. PHI: 7-day. IRAC 4A.

Seed treatments (thiamethoxam, mefenoxam, fludioxonil, azoxystrobin, thiabendazole, spinosad, abamectin) | See label. Rates vary by product. Choose seed treatments that include thiamethoxam insecticide (Cruiser 5FS, Cruiser Maxx, and Cruiser Maxx Potato). For best results, plant potatoes immediately after treatment. PHI: See label. IRAC 4A, FRAC 4, FRAC 12, FRAC 11, FRAC 1, IRAC 5, IRAC 6.

Sivanto 200 (1.67SL) (flupyradifurone) | 10.5-14.0 fl. oz. per acre. Do not exceed 28.0 fl. oz. per acre per season. Allow 7 days between applications. REI: 4-hour. PHI: 7-day. IRAC 4D.

Thimet 20G (phorate) | Light or sandy soils: 8.5-11.3 oz. per 1,000 ft. of row for any row spacing larger than 32-inches. Use at planting or postemergence. Heavy or clay soils: 13.0-17.3 oz. per 1,000 ft. of row. Do not use post emergence. Apply as a band application on each side of row and beneath soil surfaces, or in the seed furrow. REI: 48-hour. PHI: 90-day. IRAC 1B. RUP.

Torac (1.29SC) (tolifenpyrad) | 14-21 fl. oz. per acre. Do not exceed 42 fl. oz. per acre per season, or 2 applications. Allow 14 days between applications. See pollination precautions. REI: 12-hour. PHI: 14-day. IRAC 21A, FRAC 39.

Trident (14.32) (Bacillus thuringiensis tenebrionis strain SA-10) | 3-6 qts. per acre. Effective on small (up to 1/4 inch) larvae only. Use higher rate for mixed sizes or heavier infestations. REI: 4-hour. PHI: 0-day. IRAC 11A. OMRI-listed.

Trigard (75WP) (cyromazine) | 2.66-5.32 oz. per acre. Do not exceed 1 lb. per acre per season. Allow 14 days between applications. REI: 12-hour. PHI: 17-day. IRAC 17.

Vilam Flexi (WDG) (thiamethoxam, chlorantraniliprole) | 4 oz. per acre. Do not exceed 8 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 14-day. IRAC 4A, IRAC 28.

Warrior II (2.08CS) (lambda-cyhalothrin) | 1.28-1.92 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 3A. RUP.
Flea Beetles

Pesticide

Actara (25WDG) (thiamethoxam) | 3.0 oz. per acre. Apply as a foliar spray. Do not exceed 6 oz. per acre per season. Allow 7 days between applications. See pollinator precautions. REI: 12-hour. PHI: 14-day. IRAC 4A.

Admire Pro (4.6SC) (imidacloprid) | Seed piece treatment: 0.17-0.35 fl. oz. per 100 lbs of seed applied directly to seed pieces. Soil application: 5.7-8.7 fl. oz. per acre applied in-furrow, side-dressed, or below seed piece at planting. Do not exceed 8.7 fl. oz. per acre per season from seed or soil applications. Foliar application: 1.3 fl. oz. per acre applied to foliage. Do not exceed 5.6 fl. oz. per acre per season from foliar applications. See pollinator precautions. REI: 12-hour. PHI: 7-day for foliar applications. IRAC 4A.

Asana XL (0.66EC) (esfenvalerate) | 5.8-9.6 fl. oz. per acre. Do not exceed 67.2 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Assail 30SG (acetamiprid) | Use 30SG formulations at 1.5-2.5 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 0.6-1.1 oz. per acre and do not exceed 7.0 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

Athena (0.76EC) (bifenthrin, abamectin) | 7-17 fl. oz. per acre. Do not exceed 42 fl. oz. per acre per season. REI: 21-day. IRAC 3A, IRAC 6. RUP.

Baythroid XL (1EC) (beta-cyfluthrin) | 1.6-2.8 fl. oz. per acre. Do not exceed 16.8 fl. oz. per acre per season. PHI: 0-day. IRAC 3A. RUP.

Belay (2.13SC) (clothianidin) | Seed piece treatment: 0.4-0.6 fl. oz. per 100 lbs of seed applied directly to seed pieces. Soil application: 9-12 fl. oz. per acre applied in-furrow, side-dressed, or below seed piece at planting. Do not exceed 12 fl. oz. per acre per season from seed or soil applications. Foliar application: 2-3 fl. oz. per acre applied to foliage. Do not exceed 12 fl. oz. per acre per season from foliar applications. Allow 7 days between applications. See pollinator precautions. REI: 12-hour. PHI: 14-day. IRAC 4A.

Endigo ZC (thiamethoxam, lambda-cyhalothrin) | 3.5-4.5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. Allow 7 days between applications. REI: 24-hour. PHI: 14-day. IRAC 4A, IRAC 3A. RUP.

Lannate LV (2.4L) (methomyl) | 1.5 pts. per acre. Do not exceed 15 pts. per acre per season. REI: 48-hour. PHI: 6-day. IRAC 1A. RUP.

Perm-Up 25DF (permethrin) | Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2oz. per acre per season. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Allow 10 days between applications. REI: 12-hour. PHI: 14-day. IRAC 3A. RUP.

Platinum 2SC (thiamethoxam) | Use 2SC formulations at 5-8 fl. oz. per acre and do not exceed 8 fl. oz. per acre per season. Use 75SG formulations at 1.66-2.67 oz. per acre and do not exceed 2.67 oz. per acre per season. Seed piece only, apply as in-furrow spray during planting. REI: 12-hour. IRAC 4A.

Scorpion 35SL (3.24) (dinitofuran) | Soil application: Use Scorpion 35SL at 11.5-13.25 fl. oz. per acre, or Venom 70SG at 6.5-7.5 fl. oz. per acre applied in-furrow at planting, or side-dressed to both sides of the row at ground crack. Foliar application: Use Scorpion 35SL at 2.0-2.75 fl. oz. per acre, or Venom 70SG at 1.0-1.5 fl. oz. per acre applied to foliage. Allow 14 days between applications. See pollinator precautions. REI: 12-hour. PHI: 7-day. IRAC 4A.

Seed treatments (thiamethoxam, mefenoxam, fludioxonil, azoxystrobin, thiabendazole, spinosad, abamectin) | See label. Rates vary by product. Choose seed treatments that include thiamethoxam insecticide (Cruiser 5FS, Cruiser Maxx, and Cruiser Maxx Potato). For best results, plant potatoes immediately after treatment. PHI: See label. IRAC 4A, FRAC 4, FRAC 12, FRAC 11, FRAC 1, IRAC 5, IRAC 6.

Sevin XLR Plus (4SC) (carbaryl) | 0.5-1.0 qts. per acre. Do not exceed 6 qts. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 1A.

Thimet 20G (phorate) | Light or sandy soils: 8.5-11.3 oz. per 1,000 ft. of row for any row spacing larger than 32-inches. Use at planting or postemergence. Heavy or clay soils: 13.0-17.3 oz. per 1,000 ft. of row. Do not use post emergence. Apply as a band application on each side of row and beneath soil surfaces, or in the seed furrow. PHI: 48-hour. PHI: 90-day. IRAC 1B. RUP.

Voliam Flexi (WDG) (thiamethoxam, chlorantraniliprole) | 4 oz. per acre. Do not exceed 8 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 14-day. IRAC 4A, IRAC 28.

Warrior II (2.08CS) (lambda-cyhalothrin) | 1.28-1.92 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 3A. RUP.

Leafhoppers

Pesticide

Actara (25WDG) (thiamethoxam) | 3.0 oz. per acre. Apply as a foliar spray. Do not exceed 6 oz. per acre per season. Allow 7 days between applications. See pollinator precautions. REI: 12-hour. PHI: 14-day. IRAC 4A.

Admire Pro (4.6SC) (imidacloprid) | Seed piece treatment: 0.17-0.35 fl. oz. per 100 lbs of seed applied directly to seed pieces. Soil application: 5.7-8.7 fl. oz. per acre applied in-furrow, side-dressed, or below seed piece at planting. Do not exceed 8 fl. oz. per acre per season from seed or soil applications. See pollinator precautions. REI: 12-hour. PHI: 7-day. IRAC 4A.

Assail 30SG (acetamiprid) | Use 30SG formulations at 1.5-2.5 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 0.6-1.1 oz. per acre and do not exceed 7.0 oz. per acre per season. Allow 7 days between applications. PHI: 7-day. IRAC 4A.

Athena (0.76EC) (bifenthrin, abamectin) | 7-17 fl. oz. per acre. Do not exceed 42 fl. oz. per acre per season. REI: 21-day. IRAC 3A, IRAC 6. RUP.

Baythroid XL (1EC) (beta-cyfluthrin) | 1.6-2.8 fl. oz. per acre. Do not exceed 16.8 fl. oz. per acre per season. PHI: 0-day. IRAC 3A. RUP.

Belay (2.13SC) (clothianidin) | Seed piece treatment: 0.4-0.6 fl. oz. per 100 lbs of seed applied directly to seed pieces. Soil application: 9-12 fl. oz. per acre applied in-furrow, side-dressed, or below seed piece at planting. Do not exceed 12 fl. oz. per acre per season from seed or soil applications. Foliar application: 2-3 fl. oz. per acre applied to foliage. Do not exceed 12 fl. oz. per acre per season from foliar applications. Allow 7 days between applications. See pollinator precautions. REI: 12-hour. PHI: 14-day. IRAC 4A.

Endigo ZC (thiamethoxam, lambda-cyhalothrin) | 3.5-4.5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. Allow 7 days between applications. REI: 24-hour. PHI: 14-day. IRAC 4A, IRAC 3A. RUP.

Lannate LV (2.4L) (methomyl) | 1.5 pts. per acre. Do not exceed 15 pts. per acre per season. REI: 48-hour. PHI: 6-day. IRAC 1A. RUP.

Perm-Up 25DF (permethrin) | Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2oz. per acre per season. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Allow 10 days between applications. REI: 12-hour. PHI: 14-day. IRAC 3A. RUP.
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Asana XL (0.66EC) (esfenvalerate) | 5.8-9.6 fl. oz. per acre. Do not exceed 67.2 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 4A.

Assail 30SG (acetamiprid) | Use 30SG formulations at 1.5-4.0 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 0.6-1.7 oz. per acre and do not exceed 7.0 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

Athena (0.76EC) (bifenthrin, abamectin) | 7-17 fl. oz. per acre. Do not exceed 42 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 3A, IRAC 6. RUP.

Baythroid XL (1EC) (beta-cyfluthrin) | 0.8-1.6 fl. oz. per acre. Do not exceed 16.8 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A.

Belay (2.13SC) (clothianidin) | Seed piece treatment: 0.4-0.6 fl. oz. per 100 lbs of seed applied directly to seed pieces. Soil application: 9-12 fl. oz. per acre applied in-furrow, side-dressed, or below seed piece at planting. Do not exceed 12 fl. oz. per acre per season from seed or soil applications. Foliar application: 2-3 fl. oz. per acre applied to foliage. Do not exceed 12 fl. oz. per acre per season from foliar applications. Allow 7 days between applications. See pollinator precautions. REI: 12-hour. PHI: 0-day. IRAC 4A.

Dimethoate 4EC (dimethoate) | Use 2.67EC formulations at 0.75-1.5 pt. per acre and do not exceed 3.0 pts. per acre per season. Use 4EC, LV-4, and 400 formulations at 0.5-1 pt. per acre and do not exceed 2 pts. per acre per season. Allow 7 days between applications. REI: 48-hour. PHI: 0-day. IRAC 1B.

Endigo ZC (thiamethoxam, lambda-cyhalothrin) | 3.5-4.5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. Allow 7 days between applications. REI: 24-hour. PHI: 14-day. IRAC 4A, IRAC 3A. RUP.

Lannate LV (2.4L) (methomyl) | 1.5-3.0 pts. per acre. Do not exceed 15 pts. per acre per season. REI: 48-hour. PHI: 6-day. IRAC 1A. RUP.

Malathion 5EC (malathion) | Use 5EC formulations at 2.0 pts. per acre. Use 57EC formulations at 1.0-1.5 pts. per acre. Do not exceed 2 applications per season. Allow 7 days between applications. REI: 12 to 24-hour. PHI: 0-day. IRAC 1B.

Mustang Maxx (0.8) (zeta-cypermethrin) | 3.2-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. Allow 4 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Perm-Up 25DF (permethrin) | Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2 oz. per acre per season. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Allow 10 days between applications. REI: 12-hour. PHI: 14-day. IRAC 4A. RUP.

Platinum 2SC (thiamethoxam) | Use 2SC formulations at 5-8 fl. oz. per acre and do not exceed 8 fl. oz. per acre per season. Use 75SG formulations at 1.66-2.67 oz. per acre and do not exceed 2.67 oz. per acre per season. Seed piece only, apply as in-furrow spray during planting. REI: 12-hour. IRAC 4A.

Scorpion 35SL (3.24) (dinitofuran) | Soil application: Use Scorpion 35SL at 11.5-13.25 fl. oz. per acre, or Venom 70SG at 6.5-7.5 fl. oz. per acre applied in-furrow at planting, or side-dressed to both sides of the row at ground crack. Foliar application: Use Scorpion 35SL at 2.0-2.75 fl. oz. per acre, or Venom 70SG at 1.0-1.5 fl. oz. per acre applied to foliage. Allow 14 days between applications. See pollinator precautions. REI: 12-hour. PHI: 7-day. IRAC 4A.

Seed treatments (thiamethoxam, mefenoxam, fludioxonil, azoxystrobins, thiabendazole, spinosad, abamectin) | See label. Rates vary by product. Choose seed treatments that include thiamethoxam insecticide (Cruiser 5FS, Cruiser Maxx, and Cruiser Maxx Potato). For best results, plant potatoes immediately after treatment. PHI: See label. IRAC 4A, FRAC 4, FRAC 12, FRAC 11, FRAC 1, IRAC 5, IRAC 6.

Sevin XLR Plus (4SC) (carbaryl) | 0.5-1.0 qts. per acre. Do not exceed 6 qts. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

Sivanto 200 (1.67SL) (flupyradifurone) | 7.0-10.5 fl. oz. per acre. Do not exceed 28.0 fl. oz. per acre per season. Allow 7 days between applications. REI: 4-hour. PHI: 7-day. IRAC 4D.

Thimet 20G (phorate) | Light or sandy soils: 8.5-11.3 oz. per 1,000 ft. of row for any row spacing larger than 32-inches. Use at planting or postemergence. Heavy or clay soils: 13.0-17.3 oz. per 1,000 ft. of row. Do not use post emergence. Apply as a band application on each side of row and beneath soil surfaces, or in the seed furrow. REI: 48-hour. PHI: 90-day. IRAC 1B. RUP.

Torac (1.29SC) (tolfenpyrad) | 14-21 fl. oz. per acre. Do not exceed 42 fl. oz. per acre per season, or 2 applications. Allow 14 days between applications. See pollinator precautions. REI: 12-hour. PHI: 14-day. IRAC 21A, FRAC 39.

Transform WG (50) (sulfoxaflor) | 1.5-2.25 oz. per acre. Do not exceed 8.5 oz. per acre per season. Allow 14 days between applications. REI: 24-hour. PHI: 7-day. IRAC 4C.

Voliam Flexi (WDG) (thiamethoxam, chlorantraniliprole) | 4 oz. per acre. Do not exceed 8 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 14-day. IRAC 4A, IRAC 28.

Vydate C-LV (3.77WSL) (oxamyl) | 17-34 fl. oz. per acre. Do not exceed 8 applications or 306 fl. oz. per acre per season. In Kansas, allow 14 days between applications. Do not exceed 4
applications or 204 fl. oz. per acre per season. REI: 48-hour. PHI: 7-day. IRAC 1A. RUP.

**Warrior II (2.08CS) (lambda-cyhalothrin)** | 0.96-1.60 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 3A. RUP.

### Wireworms

**Pesticide**

**Admire Pro (4.6SC) (imidacloprid)** | 0.17-0.35 fl. oz. per 100 lbs of seed. Apply directly to seed pieces. Do not exceed 8.7 fl. oz. per acre per season. See pollinator precautions. REI: 12-hour. IRAC 4A.

**Brigade 2EC (bifenthrin)** | 9.6-19.2 fl. oz. per acre. Use 2EC formulations at 9.6-19.2 fl. oz. per acre as preplant broadcast and incorporate, at planting as a banded spray into furrow, or at lay-by as a soil-directed and incorporated spray through cultivation. Do not exceed 32 fl. oz. per acre per season. Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for potatoes. Allow 21 days between applications. REI: 12-hour. PHI: 21-day. IRAC 3A. RUP.

**Capture LFR (1.5) (bifenthrin)** | 12.75-25.5 fl. oz. per acre. Apply as preplant broadcast and incorporate, at planting as a banded spray into furrow, or at lay-by as a soil-directed and incorporated spray through cultivation. REI: 12-hour. PHI: 21-day. IRAC 3A. RUP.

**Platinum 2SC (thiamethoxam)** | Use 2SC formulations at 5-8 fl. oz. per acre and do not exceed 8 fl. oz. per acre per season. Use 75SG formulations at 1.66-2.67 oz. per acre and do not exceed 2.67 oz. per acre per season. Seed piece only, apply as in-furrow spray during planting. REI: 12-hour. IRAC 4A.

**Regent 4SC (fipronil)** | 0.184-0.220 fl. oz. per 1,000 ft. of row. Do not apply in row spacing less than 30 inches. On any row spacing greater than 36 inches, apply no more than 0.220 fl. oz. REI: 0-hour. PHI: 90-day. IRAC 2B. RUP.

**Seed treatments (thiamethoxam, mefenoxam, fludioxonil, azoxystrobin, thiabendazole, spinosad, abamectin)** | See label. Rates vary by product. Choose seed treatments that include thiamethoxam insecticide (Cruiser 5FS, Cruiser Maxx, and Cruiser Maxx Potato). For best results, plant potatoes immediately after treatment. PHI: See label. IRAC 4A, FRAC 4, FRAC 12, FRAC 11, FRAC 1, IRAC 5, IRAC 6.

**Thimet 20G (phorate)** | *Light or sandy soils*: 8.5-11.3 oz. per 1,000 ft. of row for any row spacing larger than 32-inches. Use at planting or postemergence. *Heavy or clay soils*: 13.0-17.3 oz. per 1,000 ft. of row. Do not use post emergence. Apply as a band application on each side of row and beneath soil surfaces, or in the seed furrow. REI: 48-hour. PHI: 90-day. IRAC 1B. RUP.

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### Potato - Weeds

**Recommended Controls**

#### All Weeds

A relatively large number of herbicides are labeled for use on potatoes, and there are many opportunities to apply them because the hillling process recreates a preemergent crop situation by burying crop leaves and protecting them from soil surface sprays. For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table. Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

#### Non-Pesticide

Potato cultural practices offer several good opportunities to control weeds, beginning with the period between planting and emergence (when early-emerging weeds can be killed by flaming), and continuing through the hillling process (when weeds can be buried or cultivated out). Some organic farmers also use flaming after potatoes emerge because some injury to the potato foliage early in the season can be tolerated. Rolling cultivators on wide tool-bars offer effective high-speed cultivation between rows and can also hill.

#### Broadleaf and Grass Weeds - Postemergence

**Pesticide**

**glyphosate products (glyphosate)** | 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations containing 3 lbs. ae per gal. (4 lbs. isopropylamine salt per gal.) at 1-5 qts. per acre, or formulations containing 4.5 lbs. ae per gal. (5 lbs. potassium salt per gal.) at 0.66-3.3 qts. per acre. Broadcast before planting, after planting before ground cracks, or apply between crop rows with wipers or hooded or shielded sprayers. Use low rate for annuals and higher rates for perennials. See label for suggested application volume and adjuvants. REI: 4 to 12-hour. PHI: 14-day. WSSA 9.

**Lorox DF (50) (linuron)** | Use 50DF formulations at 1.5-3 lbs. per acre. Use 4L formulations at 1.5-4 pts. per acre. Also controls small, emerged weeds. Apply after planting but before crop emergence, when weeds are less than 2 inches tall. Seed pieces must be planted at least 2 inches deep. Do not use on sand, loamy sand, or soils with less than 1 percent organic matter. REI: 24-hour to 8-day. WSSA 7.

**Matrix SG (25WSG) (rimsulfuron)** | 1-1.5 oz. per acre. Typically combined with full-labeled rates of metribuzin to improve spectrum of broadleaf control. Use 0.5 pt. of NIS per 25 gals. of spray solution if emerged weeds are present. Apply after planting before crop emerges, at hilling, drag-off, or reservoir...
Potato - Weeds
tillage, to a clean, newly prepared seedbed. Apply post when
weeds are less than 1 inch tall. Avoid using adjuvants when
potatoes are under heat stress. Do not exceed 2.5 oz. per acre per
year. REI: 4-hour. PHI: 30-day. WSSA 2.

**paraquat products (paraquat)** | 1-2 pts. per acre. Use 1 qt. of
COC, or 4-8 fl. oz. of NIS per 25 gals. of spray solution. Apply
before planting, or after planting but before ground cracks. REI:
12 to 24-hour. PHI: 0-day. WSSA 22. RUP.

**Broadleaf and Grass Weeds -
Preemergence**

**Pesticide**

**Dual Magnum (7.62EC) (s-metolachlor)** | 1-2 pts. per acre. Dual
Magnum or Dual II Magnum at 1-2 pts. per acre. Use lower
rates on coarse soils. Apply and incorporate before planting, or
apply after planting before weeds emerge. May also be applied at
1.67 pts. per acre after hilling. Dual Magnum might delay
maturity and/or reduce yield of Superior and other early maturing
varieties if cold, wet soil conditions occur after treatment. Dual
Magnum can be tank-mixed with Lorox, Sencor, Prowl or
Eptam. See labels. Do not exceed 3.6 pts. per acre. REI: 24-hour.
PHI: 60-day if applied before drag-off, or 40-day if applied at
lay-by. WSSA 15.

**Eptam 7E (EPTC)** | Eptam 7E at 3.5-7 pts. per acre, or Eptam
20G at 15-20 lbs. per acre. Apply before planting, after drag-off,
or as directed spray at lay-by. Incorporate immediately. On muck
soils, supplement with linuron or metribuzin products applied
before crop emerges and after drag-off. The Superior variety may
be sensitive. Suppresses nutsedge. REI: 12-hour. PHI: 45-day.
WSSA 8.

**Lorox DF (50) (linuron)** | Use 50DF formulations at 1.5-3 lbs.
per acre. Use 4L formulations at 1.5-4 pts. per acre. Also controls
small, emerged weeds. Apply after planting but before crop
emergence, when weeds are less than 2 inches tall. Seed pieces
must be planted at least 2 inches deep. Do not use on sand, loamy
sand, or soils with less than 1 percent organic matter. REI: 24-
hour to 8-day. WSSA 7.

**Matrix SG (25WSG) ( rimsulfuron)** | 1-1.5 oz. per acre.
Typically combined with full-labeled rates of metribuzin to
improve spectrum of broadleaf control. Use 0.5 pt. of NIS per 25
gals. of spray solution if emerged weeds are present. Apply after
planting before crop emerges, at hilling, drag-off, or reservoir
tillage, to a clean, newly prepared seedbed. Apply post when
weeds are less than 1 inch tall. Avoid using adjuvants when
potatoes are under heat stress. Do not exceed 2.5 oz. per acre per
year. REI: 4-hour. PHI: 30-day. WSSA 2.

**metribuzin products (metribuzin)** | Use 4F formulations at 0.5-
2 pts. per acre, or 75DF formulations at 0.33-1.32 lbs. per acre.
Not for early-maturing or red-skinned varieties. Apply after
planting before crop emerges, or apply up to 1 pt. of metribuzin
4F (1.32 lbs. of 75DF formulations) after emergence. Check label
for sensitive varieties. Avoid spraying when potatoes are 12-15
inches tall. Do not apply within 3 days of cool, wet, or cloudy
weather, or crop injury may occur. Do not apply within 1 day of
other pesticide applications. Do not exceed 2 pts. of 4F
formulations or 1.32 lbs. of 75DF formulations per acre per year.
REI: 12-hour. PHI: 60-day. WSSA 5.

**Outlook (6) (dimethenamid-p)** | 12-21 fl. oz. per acre. Apply
after planting or drag-off and before weeds emerge. In cold and
wet conditions potatoes may emerge slowly or be stunted. May
be tank-mixed with a number of other potato herbicides. REI: 12-
hour. PHI: 40-day. WSSA 15.

**pendimethalin products (pendimethalin)** | Use 3.8
formulations at 1.5-3 pts. per acre. Use 3.3EC formulations at
1.2-3.6 pts. per acre. Use low rates on coarse soils. Broadcast
after planting but before emergence or drag-off, or after potatoes
have fully emerged before potatoes are 6 inches tall. May be
incorporated. Not effective on muck soils. Do not apply
postemergence to stressed potatoes. REI: 24-hour. WSSA 3.

**trifluralin products (trifluralin)** | 0.5-1 lb. a.i. per acre. Use
4EC formulations at 1-2 pts. per acre. Use 10G formulations at
5-10 lbs. per acre. Broadcast and incorporate 1-2 inches after
planting but before emergence, immediately after drag-off, or
after potatoes have fully emerged. Use low rate on coarse soils
with less than 2% organic matter. Not effective on muck or high
organic matter soils. REI: 12-hour. WSSA 3.

**Zidua (85WDG) (pyroxasulfone)** | 2.5-3.25 fl. oz. per acre of
SC formulation. 1.5-2.0 oz. per acre of WG formulation. Apply
after planting and before potatoes emerge. Use with another
herbicide. Some varieties may be sensitive to Zidua. REI: 12-
hour. WSSA 15.

**Broadleaf Weeds Only -
Postemergence**

**Pesticide**

**Aim EC (2) (carfentrazone)** | 0.5-2 fl. oz. per acre. Apply prior
to or within 24 hours of planting, or apply between crop rows
with hooded sprayer. Do not allow spray to contact crop. Use
COC or NIS. Weeds must be actively growing and less than 4
inches tall. Do not exceed 6.1 fl. oz. per acre per season. REI: 12-
hour. PHI: 7-day. WSSA 14.

**League (75WDG) (imazosulfuron)** | 4.0-6.4 oz. per acre. Apply
after planting crop and before crop emerges, or immediately after
hilling. Or use 3.2 oz. per acre and after at least 21 days make a
second application of 3.2 oz. per acre to to control emerged
weeds less than 3 inches tall. Or use 3.2-4 oz. per acre after crop
emerges and before weeds are 3 inches tall; combine this with
other measures to achieve satisfactory control. When emerged
weeds are present use a Valent-recommended surfactant. Use the
high rate in fields with a known history of nutsedge. Do not exceed
two applications and 6.4 oz. per acre per year. REI: 12-
hour. PHI: 45-day. WSSA 2.
**Rhubarb - Horticulture**

Reviewed by Ben Phillips, Liz Maynard – Oct 2020

**Crop Description**

Rhubarb is a plant of unknown European origin, but most commercial varieties are hybrids, *Rheum x hybridum*, that will not produce true from seed. Variety names have been lost, confused, and rebranded over the years. There are only a handful of varieties that can be sourced in the United States, and the varieties most grown commercially are Canada Red, MacDonald, Sutton, and Victoria – all red-stalked varieties. There are more productive varieties that produce green stalks, but red-stalked varieties are more popular at market and are more amenable to a process called “forcing”. After two years of unharvested growth, plants can begin to be annually harvested in the field for 3 to 8 productive years. Alternatively, after three years of unharvested growth, plants can be dug in late fall or early winter and stored in dark indoor facilities where they are sprouted early for a lucrative late winter and early spring harvest, after which the roots are exhausted and discarded. Victoria is the most reliable forcing variety, and the most widely available.

**Planting and Spacing**

Use only young, healthy crowns having preferably 2 or 3 buds. Rows 5 to 6 feet apart. Set crowns in rows 3 feet apart in shallow furrows so crowns will be 2 inches below surface. Break off flower stalks to maintain a strong root system year after year. Infertile soil, extreme heat or cold, drought, or long days that expose plants to too much light may cause bolting, and older plants bolt more. A productive planting can be maintained for 3 to 8 years.

For forcing, crowns are placed in a dark room with about 1 square foot per crown on an open dirt floor, or in apple crates, and a few inches of soil is piled around each crown. Plants can be held dormant with temperatures below 40 degrees.

**Fertilizing**

**pH:** Maintain a soil pH of 6.2 to 6.8.

**New plantings:** Before planting, apply 50 pounds N per acre, 0 to 150 pounds P₂O₅ per acre, and 0 to 200 pounds K₂O per acre based on soil test results and recommendations from your state. Apply an additional 25 pounds P₂O₅ per acre directly in furrows when setting crowns. Sidedress with 50 pounds N per acre after growth starts in the spring.

**Established plantings:** Each year before emergence, apply 50 pounds N per acre by broadcasting and incorporate by lightly tilling. After harvests conclude, apply 30 pounds N per acre. The total amount of N from fertilizer should be 80 pounds N per acre. No P₂O₅ is necessary if adequate fertilization was achieved prior to planting. Every fourth year apply up to 120 pounds K₂O per acre if a soil test recommends it.
**Rhubarb - Insects**

**Harvesting**

Harvest no longer than 4 weeks, beginning with the third season of growth. Harvest for about 8 to 10 weeks after the third season. Do not remove more than two-thirds of the developed stalks from any plant at one time.

Rhubarb is forced by wetting the soils around the crowns and maintaining a temperature between 50° and 65° F. The plants then produce many bright pink stalks for about one month and are usually picked twice a week. After experiencing a forcing process, crowns are generally too weak to produce well again.

**Rhubarb - Diseases**

Reviewed by Dan Egel – Nov 2020

**Recommended Controls**

**Leaf Spot of Rhubarb - Ascochyta Fungus**

**Non-Pesticide**

Fertilize in the fall for growth in the spring. Improves rapid, strong plant growth and uniform establishment, and enhances competitiveness. Remove older yellowed leaves or leaves with lesions in the fall.

**Phytophthora Blight of Multiple Crops - Phytophthora Oomycete**

**Non-Pesticide**

Use disease-free plants. Plant only on well-drained soil.

**Rhubarb - Insects**

Reviewed by Laura Ingwell – Nov 2020

**Recommended Controls**

**Aphids**

**Pesticide**

**Actara (25WDG) (thiamethoxam)** | 1.5-3.0 fl. oz. per acre. Apply as a foliar spray. Do not exceed 11 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Admire Pro (4.6SC) (imidacloprid)** | 4.4-10.5 fl. oz. per acre. Applied at soil. Do not exceed 10.5 fl. oz. per acre per season. REI: 12-hour. PHI: 45-day. IRAC 4A.

**Assail 30SG (acetamiprid)** | Use 30SG formulations at 2.0-4.0 oz. per acre and do not exceed 20 oz. per acre per season. Use 70WP formulations at 0.8-1.7 oz. per acre and do not exceed 8.5 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Belay (2.13SC) (clothianidin)** | For whiteflies suppression only. Soil applications: 9-12 fl. oz. per acre of 2.13SC formulation. 4.8-6.4 oz. per acre of 50WDG formulation. Foliar applications: 3-4 fl. oz. per acre of 2.13SC formulation. 1.6-2.1 oz. per acre of 50WDG formulation. Do not exceed 0.2 lb active ingredient clothianidin per acre per year. See bee warning on label. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Beleaf (50SG) (flonicamid)** | 2-2.8 oz. per acre. REI: 12-hour. PHI: 0-day. IRAC 29.

**Brigade 2EC (bifenthrin)** | 2.1-6.4 fl. oz. per acre. Caterpillars include armyworms, cutworms and loopers. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

**Fulfill (50WDG) (pymetrozine)** | 2.75 oz. per acre. For whiteflies suppression only. Do not exceed 5.5 oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 9B.

**Mustang Maxx (0.8) (zeta-cypermethrin)** | 2.24-4.0 fl. oz. per acre. Caterpillars include armyworm, cutworm, cabbageworm and loopers. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Perm-Up 25DF (permethrin)** | 3.2-12.8 oz. per acre. For armyworms, cutworms, and loopers. Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 64 oz. per acre per season. Use 3.2EC formulations at 2-8 fl. oz. per acre and do not exceed 80 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Platinum 2SC (thiamethoxam)** | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A. RUP.

**Sivanto 200 (1.67SL) (fluopyradifurone)** | Use Sivanto 200SL and Sivanto Prime at 7-14 fl. oz. per acre. Do not exceed 28 fl. oz. per acre per crop season. REI: 4-hour. PHI: 1-day. IRAC 4D.

**Caterpillars**

There are many minor caterpillar pests of rhubarb, including corn earworm/tomato fruitworm, tomato hornworm, European corn borer, cutworms, loopers, and armyworms. Always check the label for the specific list of caterpillars that the product can be used on.
Non-Pesticide

Remove curly dock weeds from fields and field edges. Curly dock is the normal host for common stalk borer caterpillars that feed on rhubarb.

Pesticide

Baythroid XL (1EC) (beta-cyfluthrin) | 0.8-3.2 fl. oz. per acre. For armyworms, cutworms, and loopers. See label for pest-specific rates. Do not exceed 12.8 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

Brigade 2EC (bifenthrin) | 2.1-6.4 fl. oz. per acre. Caterpillars include armyworms, cutworms and loopers. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Coragen (1.67SC) (chlorantraniliprole) | 3.5-7.5 fl. oz. per acre. For armyworms and loopers. Can be applied through soil or foliar applications. Do not exceed 15.4 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

Entrust SC (2) (spinosad) | For armyworms, and loopers. Use 2SC formulations at 1.5-8.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 0.5-2.5 oz. per acre and do not exceed 9 oz. per acre per season. Allow 4 days between applications. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

Exirel (0.83SE) (cyantraniliprole) | 7-17 fl. oz. per acre. For armyworms and loopers. Allow 5 days between treatments. Do not exceed 61.7 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 28.

Intrepid 2F (methoxyfenozide) | 4-10 fl. oz. per acre. For armyworms, and loopers. Do not exceed 64 fl. oz. per acre. REI: 4-hour. PHI: 1-day. IRAC 18.

Mustang Maxx (0.8) (zeta-cypermethrin) | 2.24-4.0 fl. oz. per acre. Caterpillars include armyworm, cutworm, cabbageworm and loopers. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Perm-Up 25DF (permethrin) | 3.2-12.8 oz. per acre. For armyworms, cutworms, and loopers. Use 25W, 25WP or 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 64 oz. per acre per season. Use 3.2EC formulations at 2-8 fl. oz. per acre and do not exceed 80 fl. oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Radiant 1SC (spinetoram) | 5-10 fl. oz. per acre. For armyworms and loopers. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 5.

Sevin XLR Plus (4SC) (carbaryl) | 1-2 qts. per acre. For armyworms. Do not exceed 6 qts. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 1A.

Flea Beetles

Pesticide

Belay (2.13SC) (clothianidin) | For whiteflies suppression only. Soil applications: 9-12 fl. oz. per acre of 2.13SC formulation. 4.8-6.4 oz. per acre of 50WDG formulation. Foliar applications: 3-4 fl. oz. per acre of 2.13SC formulation. 1.6-2.1 oz. per acre of 50WDG formulation. Do not exceed 0.2 lb active ingredient clothianidin per acre per year. See bee warning on label. REI: 12-hour. PHI: 7-day. IRAC 4A.

Brigade 2EC (bifenthrin) | 2.1-6.4 fl. oz. per acre. Caterpillars include armyworms, cutworms and loopsers. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) | 2.24-4.0 fl. oz. per acre. Caterpillars include armyworm, cutworm, cabbageworm and loopers. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Platinum 2SC (thiamethoxam) | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

Leafhoppers

Pesticide

Actara (25WDG) (thiamethoxam) | 1.5-3.0 fl. oz. per acre. Apply as a foliar spray. Do not exceed 11 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

Admire Pro (4.6SC) (imidacloprid) | 4.4-10.5 fl. oz. per acre. Applied at soil. Do not exceed 10.5 fl. oz. per acre per season. REI: 12-hour. PHI: 45-day. IRAC 4A.

Belay (2.13SC) (clothianidin) | For whiteflies suppression only. Soil applications: 9-12 fl. oz. per acre of 2.13SC formulation. 4.8-6.4 oz. per acre of 50WDG formulation. Foliar applications: 3-4 fl. oz. per acre of 2.13SC formulation. 1.6-2.1 oz. per acre of 50WDG formulation. Do not exceed 0.2 lb active ingredient clothianidin per acre per year. See bee warning on label. REI: 12-hour. PHI: 7-day. IRAC 4A.

Brigade 2EC (bifenthrin) | 2.1-6.4 fl. oz. per acre. Caterpillars include armyworms, cutworms and loopers. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.
Rhubarb - Weeds

Mustang Maxx (0.8) (zeta-cypermethrin) | 2.24-4.0 fl. oz. per acre Caterpillars include armyworms, cutworms, cabbage worms and loopers. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Platinum 2SC (thiamethoxam) | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

Sivanto 200 (1.67SL) (flupyradifurone) | Use Sivanto 200SL and Sivanto Prime at 7-14 fl. oz. per acre. Do not exceed 28 fl. oz. per acre per crop season. REI: 4-hour. PHI: 1-day. IRAC 4D.

Rhubarb Curculio Beetle

There are no registered insecticides that will give adequate control.

Non-Pesticide

Remove curly dock weeds from fields and field edges. Curly dock is the normal host for rhubarb curculios.

Stink Bugs

Pesticide

Brigade 2EC (bifenthrin) | 2.1-6.4 fl. oz. per acre. Caterpillars include armyworms, cutworms and loopers. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Whiteflies

Pesticide

Actara (25WDG) (thiamethoxam) | 3.0-5.5 oz. per acre. Apply as a foliar spray. Do not exceed 11 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

Admire Pro (4.6SC) (imidacloprid) | 4.4-10.5 fl. oz. per acre Applied at soil. Do not exceed 10.5 fl. oz. per acre per season. REI: 12-hour. PHI: 45-day. IRAC 4A.

Assail 30SG (acetamiprid) | Use 30SG formulations at 3.0-4.0 oz. per acre and do not exceed 20 oz. per acre per season. Use 70WP formulations at 1.1-1.7 oz. per acre and do not exceed 8.5 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

Baythroid XL (1EC) (beta-cyfluthrin) | 3.2 fl. oz. per acre. Suppression only. Do not exceed 12.8 fl. oz. per acre per year. REI: 12-hour. IRAC 3A. RUP.

Belay (2.13SC) (clothianidin) | For whiteflies suppression only. Soil applications: 9-12 fl. oz. per acre of 2.13SC formulation. 4.8-6.4 oz. per acre of 50WDG formulation. Foliar applications: 3-4 fl. oz. per acre of 2.13SC formulation. 1.6-2.1 oz. per acre of 50WDG formulation. Do not exceed 0.2 lb active ingredient clothianidin per acre per year. See bee warning on label. REI: 12-hour. PHI: 7-day. IRAC 4A.

Brigade 2EC (bifenthrin) | 2.1-6.4 fl. oz. per acre. Caterpillars include armyworms, cutworms and loopers. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Fulfill (50WDG) (pymetrozine) | 2.75 oz. per acre. For whiteflies suppression only. Do not exceed 5.5 oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 9B.

Mustang Maxx (0.8) (zeta-cypermethrin) | 2.24-4.0 fl. oz. per acre Caterpillars include armyworms, cutworms, cabbage worms and loopers. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Platinum 2SC (thiamethoxam) | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 4A.

Sivanto 200 (1.67SL) (flupyradifurone) | Use Sivanto 200SL and Sivanto Prime at 7-14 fl. oz. per acre. Do not exceed 28 fl. oz. per acre per crop season. REI: 4-hour. PHI: 1-day. IRAC 4D.

Rhubarb - Weeds

Reviewed by Stephan Meyers, Ben Phillips – Nov 2020

Recommended Controls

All Weeds

Before establishing a rhubarb planting, reduce perennial weeds in the area to be planted with systemic broad-spectrum herbicides. The herbicides listed below may also be used. Herbicides that control broadleaves must be applied while rhubarb is dormant or with shielded equipment between the row, as stated on the label. Herbicides that kill only emerged grasses may be applied over the top of rhubarb plants.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.
Non-Pesticide

Good weed control in the planting year is especially important. Multivators, tines, rolling cultivators, flame weeder work well before emergence of rhubarb, but it is important to avoid damaging crowns when cultivating. Row-middle cultivate and hand hoe after emergence. After established, and before spring growth, harrow bed thoroughly but carefully to avoid injuring the crowns. During the growing season, cultivate row-middles and hand hoe to keep the planting clean. Following the first light freeze in fall, mulch with 3-4 inches of straw around plants, but not on crowns. If additional mulch is needed in the spring, apply before hot, dry weather. Add more mulch during summer (if needed) to control weeds and retain moisture.

Broadleaf and Grass Weeds - Preemergence

Pesticide

Caparol 4L (prometryn) | 2-4 pts. per acre. Apply to dormant, established rhubarb before leaves emerge in spring. Use low rate on light soils. If weeds are present, add 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gal. of spray solution (0.25% v/v). REI: 12-hour. PHI: 40-day. WSSA 5.

Casoron 4G (dichlobenil) | 50 lb. per acre. Apply before rhubarb emerges in early spring. Broadcast on soil, and thoroughly incorporate granules by watering in. REI: 12-hour. WSSA 20.

Command 3ME (clomazone) | 2 qt. per acre. Apply to dormant rhubarb prior to leaf emergence. Do not make more than one application per crop per year. REI: 12-hour. WSSA 13.

Dual Magnum (7.62EC) (s-metolachlor) | 0.67-1.33 pts. per acre. Apply in spring before rhubarb and weeds emerge. Do not exceed one application and 1.33 pts. per acre per year. REI: 24-hour. PHI: 62-day. WSSA 15.

Kerb SC (3.3) (pronamide) | 2-5 pt. per acre. Michigan only (MI 24c exp. 04/06/22): apply to dormant plants after frost has killed leaves in fall. Suppresses quackgrass. Do not apply to rhubarb the year of planting. Include glyphosate with application for better weed control. REI: 24-hour. PHI: 38-day. WSSA 3. RUP.

Lorox DF (50) (linuron) | 2-3 lbs. per acre. Apply broadcast to dormant rhubarb in the spring before leaves emerge. REI: 24-hour to 8-day. WSSA 7.

Broadleaf Weeds Only - Postemergence

Pesticide

Aim EC (2) (carfentrazone) | 0.5-2.0 fl. oz. per acre. Apply a minimum of 1 day prior to transplanting, or apply between crop rows with hooded sprayer. Do not allow spray to contact crop. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gal. of spray solution (0.25% v/v). Weeds must be actively growing and less than 4 in. tall. Do not exceed 6.1 fl. oz. per acre per season. REI: 12-hour. WSSA 22. RUP.

QuinStar 4L (3.8) (quinclorac) | 12.6 fl. oz. per acre. Apply as a foliar spray to control Canada thistle and field bindweed. Can make a second application 30 days after the first. Do not exceed 25.2 fl. oz. per acre per year. REI: 12-hour. PHI: 30-day. WSSA 4.

Sandea (75) (halosulfuron) | 0.5-1.0 oz. per acre. Apply to dormant rhubarb in the spring. If weeds are present, add 0.5 pt. NIS per 25 gal. of solution (0.25% v/v). May cause crop stunting. Use low rate to determine crop safety under field conditions.
Root Crops - Horticulture

Controls yellow nutsedge. Does not control grass. REI: 12-hour. PHI: 60-day. WSSA 2.

Broadleaf Weeds Only - Preemergence

Pesticide

Callisto (40SC) (mesotrione) | 6 fl. oz. per acre. Apply to dormant, established rhubarb. Applying after growth begins will cause crop stunting and bleaching. If weeds are emerged, add 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gal. of spray solution (0.25% v/v). Has residual activity to control weeds that have not emerged. Do not exceed 6 fl. oz. per acre per year, or 1 application per year. REI: 12-hour. PHI: 21-day. WSSA 27.

Fusilade DX (2EC) (fluazifop-P) | 10-16 fl. oz. per acre. Add 1 qt. COC (1% v/v) or 0.5 NIS per 25 gal. of spray solution (0.25% v/v). Apply to small actively growing grass. Do not exceed 32 fl. oz. per acre per season. Use low rates for annual grasses and high rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. REI: 24-hour. PHI: 30-day. WSSA 1.

Poast (1.5EC) (sethoxydim) | 1-1.5 pts. per acre. Add 1 qt. COC per 25 gal. of spray solution (1% v/v). Spray on actively growing grass. Do not exceed 3 pt. per acre per growing season. REI: 12-hour. PHI: 15-day in Illinois, Indiana, Michigan, and Minnesota; 30-day in other states. WSSA 1.

Grass Weeds Only - Postemergence

Pesticide

clethodim products (clethodim) | Use 2EC formulations at 6-8 fl. oz. per acre with 1 qt. COC per 25 gals. of spray solution (1% v/v). Do not exceed 32 fl. oz. of 2EC formulations per acre per season. Use Select Max at 9-16 fl. oz. per acre with 8 fl. oz. NIS per 25 gals. of spray solution (0.25% v/v). Do not exceed 64 fl. oz. of Select Max per acre per season. Use low rates for annual grasses and high rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. REI: 24-hour. PHI: 30-day. WSSA 1.

Sandea (75) (halosulfuron) | 0.5-1.0 oz. per acre. Apply to dormant rhubarb in the spring. If weeds are present, add 0.5 pt. NIS per 25 gal. of solution (0.25% v/v). May cause crop stunting. Use low rate to determine crop safety under field conditions. Controls yellow nutsedge. Does not control grass. REI: 12-hour. PHI: 60-day. WSSA 2.

Root Crops - Horticulture

Reviewed by Ben Phillips, Liz Maynard – Dec 2020

Crop Description

Most root crops are biennial plants that do not normally flower within a typical production season unless they are under stress. They come from a few different plant groups and species. Most are amenable to direct seeding before last frost, and some can be transplanted. Some are short season crops that offer double-cropping opportunities, while others are some of the longest season vegetable crops grown in an annual production system. It is important to know the botanical relationships of root crops because similar pests will go to related plants. Root crops come from at least five botanical families. Within those family groups you can expect similar pests. In this guide we try to provide some precision to this. However, when using pesticides, you must abide by the EPA Crop Groupings on pesticide labels.

Apiaceae, the Carrot family, contains Carrots, Celeriac, and Parsnips classified as “root and tuber vegetables” in EPA Crop Group 1. But this family also includes Celery, Cilantro, Coriander, Dill, Fennel, Florence Fennel, and Parsley (EPA Crop Groups 4 and 19). The pests for plants in this family are shared with the Celery, and Leafy Vegetables and Herbs chapters.

Brassicaceae, the Mustard family, contains Horseradish, Radish, Rutabaga, and Turnip classified as “root and tuber vegetables” in EPA Crop Group 1. But, this family also includes cole crop and mustard-type plants (EPA Crop Groups 4 and 5). The pests for plants in this family are shared with the Cole Crops and Brassica Leafy Greens, and Leafy Vegetables and Herbs chapters.

Chenopodiaceae, the Goosefoot family, contains Beets classified as “root and tuber vegetables” in EPA Crop Group 1. The pests for plants in this family are shared with Spinach and Swiss chard (EPA Crop group 4) in the Leafy Greens and Herbs chapter.

Convolvulaceae, the Morningglory family, contains Sweet Potato classified as a “root and tuber vegetable” in EPA Crop Group 1. Please refer to the Sweet Potato Chapter.

Solanaceae, the Nightshade family, contains Potato classified as a “root and tuber vegetable” in EPA Crop Group 1. Please refer to the Potato Chapter.

Planting, Spacing, and Harvesting

Beet

Sugar beets, table beets, and Swiss chard are all the same species (Beta vulgaris) bred for different purposes. Table beets come in red, striped, white, and gold. They are typically round, but there are some longer shaped beets that are utilized for slicing and pickling. Most beet varieties are multigerm types that grow multiple plants from one seedball. There are monogerm beet varieties, such as Solo and Moneta.

Beets can be direct-seeded in rows 18 to 24 inches apart. Plant 6 to 12 seeds per foot of row, depending on sprout count and desired size. Seed 8 to 10 pounds per acre for bunching. Mechanical harvesters are common for beets, lifting them from their tops, or digging them with an undercutting chain conveyor. Some growers choose monogerm varieties for more reliable sizing in a one-pass harvest with machines. Other growers choose multigerm varieties and hand-harvest large “bully” beets first, allowing small “runts” to size up for later harvests. Time from seeding to harvest ranges from 50 to 60 days.
Carrot and Parsnip

Carrots (*Daucus carota*) and parsnips (*Pastinaca sativa*) have similar production systems. There are five broad types of carrot varieties. Chantenay carrot types have short, girthy, sometimes globe shaped roots that do well in heavy soils. Danvers carrot types are typically diced processing carrots and are thinner, longer, and more cone shaped than Chantenays and require the longest time to maturity. Imperator carrot types are good fresh market carrots that have long and slender roots with a higher sugar content; they require loose and deep soils. Nantes carrot types are good multi-market carrots for processing and fresh market with a more cylindrical root than Danvers, but girthier than Imperators, and an earlier maturation time than Imperators or Danvers. These four types all include orange, yellow, red, purple, and white varieties. The parsnip is a white-rooted plant related to carrots. Parsnip varieties differ in their size and time to harvest, but most are shaped like Danvers carrots.

Carrots and parsnips can be direct-seeded in single rows 16 to 30 inches apart, or in three-row beds with 10 to 12 inches between rows and 36 inches between beds, center to center. Plant 20 to 30 per foot for slicing/fresh market; 10 to 20 plants per foot for dicing. Seed 2 to 4 pounds per acre.

Both mechanical and hand harvest is common and starts when roots are of suitable size for the market between August and November. Undercutting chain-conveyor harvesters are more likely to break roots than top-puller harvesters. Time from seeding to harvest ranges from 60 days for baby carrots to 120 days for parsnips and full-size Danvers type carrots. Parsnips can be harvested up to freeze-up and continued as soon as soils can be worked in the spring.

Celeriac

This type of celery (*Apium graveolens* var. *rapaceum*) has been bred as a root crop with low-growing bushy foliage and a large, bearded, globe-shaped root with a celery flavor.

Start as transplants 8 to 10 weeks before planting, and plant in early spring before last frost date. Transplant in rows 24 to 30 inches apart with plants 6 to 8 inches apart in row. For an acre of transplanted celeriac, you will need 2 to 4 ounces of seed to start in the greenhouse.

The full flavor is only reached after first frost. Time from transplanting to harvest ranges from 80 to 90 days. From seeding in cell trays, add 20 days.

Horseradish

This perennial Brassica (*Armoracia rusticana*) is grown commercially in Illinois and Wisconsin as an annual crop from root cuttings. The roots are not eaten raw, but grated as a spice for condiments and flavoring. Type I varieties produce large smooth roots and are highly resistant to turnip mosaic virus and white rust. Type III varieties produce large roots but are highly susceptible to those two diseases. Type II varieties produce large roots with bark-like exterior, with intermediate resistance to those two diseases. Numbered commercial varieties are maintained by a small breeding effort supported directly by the largest growers of the commodity.

Plant root sets in early spring before last frost date. Sets should be 1/2 to 3/4 inches in diameter and 10 to 16 inches long. Root set ends that were closest to the plant (thicker end) and the ends that were farthest from the plant (thinner end) have to be planted thick end to thin end along the row, with the thick ends elevated about 2 inches higher than the thin end. This is accomplished by first scooping divots in rows 36 inches apart and 12 to 24 inches apart in-row. Then lay roots by hand into the divots with the thin end in the deepest part. That is roughly 10,000 sets per acre. Cover the roots with a disc-hiller to a depth of 5 to 8 inches.

Horseradish puts the most size on their roots in the late summer and fall. Mechanical harvests with an undercutting chain conveyor take place in November until freeze-up and continues as soon as soils can be worked in the spring. Time from transplanting to harvest ranges from 200 to 250 days.

Radish, Rutabaga, and Turnip

The roots of these Brassica plants are strong to mildly-flavored and come in diverse size, colors, and shapes. For all of these crops, the flavor is sweeter or milder when roots reach marketable size in cool conditions.

Radishes (*Raphanus sativus*) come in globe-shaped bright red varieties that are the most common in United States markets, but market opportunities exist for the torpedo-shaped varieties, as well as for white, black, yellow, green, pink and deep red varieties. Most have white internal flesh, but some have pink internal flesh. Radishes become pungent during hot weather. They can be direct-seeded in single rows 16 to 30 inches apart, or in three-row beds with 10 to 12 inches between rows and 36 inches between beds, center to center. Plant 12 to 15 per foot of row. Seed 10 to 15 pounds per acre.

Rutabagas (*Brassica napus* supsp. *rapifera*) are the largest and mildest-flavored of these root crops. They are commonly white or yellow skinned with white internal flesh. Some develop a pink, purple, or green blush on the shoulders of the root when exposed to the sun. They can be direct-seeded in single rows 24 to 30 inches apart. Plant 3 to 4 seeds per foot of row. Seed 1 to 2 pounds per acre.

Turnip roots (*Brassica rapa* subsp. *rapa*) are larger than a radish, but smaller than a rutabaga, with a flavor that is an intermediate intensity between radish and rutabaga. The variety options are similar in appearance to rutabaga. They can be direct-seeded in single rows 14 to 18 inches apart. Plant 2 to 3 inches apart in row. Seed 1 to 2 pounds per acre.

Both mechanical and hand harvest is common and starts when roots are of suitable size for the market. Time from seeding to harvest ranges from 30 to 60 days for radishes and turnips, or 80 to 100 days for rutabagas.
Root Crops - Diseases

**Fertilizing**

**pH:** Maintain a soil pH of 6.0 to 6.8. For beets, maintain a soil pH of 6.5 to 7.0.

Before planting, apply 60 pounds N per acre, 0 to 160 pounds P₂O₅ per acre, and 0 to 200 pounds K₂O per acre based on soil test results and recommendations from your state.

For beets grown on sandy soils, light-colored silt and clay loams, and alkaline, dark-colored soils apply boron at 2.5 to 5 pounds per acre applied over the row at planting. Do not let boron contact seed. Beans, peas and cucurbits are sensitive to boron so use caution if these crops will follow beets, especially in the same season.

For carrots grown on muck soil with a pH greater than 6.0, apply 6 pounds of manganese sulfate per acre applied over the row at planting, or in a starter band.

For horseradish, add 1 to 2-1/2 pounds per acre boron and 15 to 25 pounds per acre sulfur with the initial N–P–K broadcast application. An optional sidedress application of 50 to 75 lb/acre N can be made 8 to 12 weeks after planting, but overapplication of nitrogen reduces root quality.

For most other root crops, sidedress with 30 to 60 pounds N per acre 4 to 6 weeks after planting. Most radishes mature quickly and do not require sidedressing. Reduce the amount of fertilizer N applied by the value of N credits from green manures, legume crops grown in the previous year, compost and animal manures, and soils with more than 3 percent organic matter. The total amount of N from fertilizer (including starter) and other credits should be 50 (radish), 90 (turnip), 100 (beets, fresh market carrots, horseradish, parsnip, rutabaga), 120 (processing carrots), or 150 (celeriac) pounds N per acre on mineral soils, and 50 pounds less on muck soils.

**Root Crops - Diseases**

Reviewed by Dan Egel – Nov 2020

**Recommended Controls**

**Aster Yellows (Purple-Top Wilt) of Multiple Crops - Phytoplasma Mollicutes**

This pathogen is transmitted by leafhoppers. Infection rates can jump when adjacent crops are harvested mid-season, such as alfalfa or wheat.

**Non-Pesticide**

*Beet, Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* | Use disease-free seed. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122 F for 20 minutes for carrot, rutabaga and turnip, 122 F for 15 minutes for radish, or 118 F for 30 minutes for celeriac. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up. Destroying perennial weed hosts near high-value crops can reduce inoculum that is transmitted by leafhoppers.

**Pesticide**

**Insecticides** *Beet, Carrot, Celeriac, Parsnip* | Use an insecticide to control leafhoppers that transmit the disease. Leafhoppers must be controlled before they feed. See Insect section.

**Brittle Root of Horseradish - Spiroplasma Bacteria**

This pathogen is transmitted by leafhoppers. The symptoms include inward curling and yellowing of leaves, stunting of new growth, and an eventual collapse of the foliar portion of the plant. Root tissue becomes tan to black and they become easy to snap off.

**Pesticide**

**Insecticides** *Horseradish* | For TuMV: maintain an aphid management program. See Insects section. For Brittle Root: maintain a leafhopper management program. See Insects section.

**Cavity Spot of Carrots - Pythium Oomycete**

Cavity spot can affect root quality and yield.

**Pesticide**

**Presidio (4SC) (fluopicolide)** *Carrot* | 4 fl. oz. per acre. Labeled for in-furrow applications. Use 5-10 gallons of water per acre. REI: 12-hour. PHI: 7-day FRAC 43.

**Ranman 400SC (34.5) (cyazofamid)** *Carrot* | 6 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 21.

**Reason 500SC (4.13) (fenamidone)** *Carrot* | 8.2 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 11.

**Ridomil Gold Bravo SC (mefenoxam, chlorothalonil)** *Carrot* | 1.5-2.5 pts. per acre. REI: 48-hour. PHI: 7-day. FRAC 4, FRAC M5.

**Ridomil Gold SL (4SC) (mefenoxam)** *Carrot* | 0.25-1.0 pt. per acre Begin applications 28 days after planting as broadcast sprays, or 40 days after planting for banded sprays. Do not exceed 2.8 pts. per acre per season. REI: 48-hour. PHI: 7-day. FRAC 4.

**Damping-Off Seed and Seedling Rots of Multiple Crops - Multiple Pathogens**

**Non-Pesticide**

*Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | Avoid excess moisture to young plants by monitoring irrigation frequency. Plant in warm field soils. The fungi
responsible for damping-off in field soils cause more loss when the seedling is slow to emerge.

**Pesticide**

**azoxyystrobin products (azoxyystrobin)** Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Use 2 lb. a.i. per gallon formulations (Quadris) at 0.4-0.8 fl. oz. per 1,000 row feet. Use 3.3 lb. per gallon formulations (Azteroid) at 0.24-0.48 fl. oz. per 1,000 row feet. Use 0.83 lb. per gallon formulations (Dynasty) for treating seed at 0.10-0.38 fl. oz. per 100 lbs. of seed. REI: 4-hour. PHI: 0-day. FRAC 11.

**Presidio (4SC) (fluopicolide)** Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Use 2 lb. a.i. per gallon formulations (Quadris) at 0.4-0.8 fl. oz. per 1,000 row feet. Use 3.3 lb. per gallon formulations (Azteroid) at 0.24-0.48 fl. oz. per 1,000 row feet. Use 0.83 lb. per gallon formulations (Dynasty) for treating seed at 0.10-0.38 fl. oz. per 100 lbs. of seed. REI: 4-hour. PHI: 0-day. FRAC 11.


**Uniform (L) (mefenoxam, azoxystrobin)** Beet, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 0.34 fl. oz. per acre per 1,000 ft. of row. Make one application per crop season. For damping-off caused by Pythium or Rhizoctonia spp. REI: 0-hour. PHI: NA FRAC 4, FRAC 11.

**Internal Root Discoloration of Horseradish - Fusarium and Verticillium Fungi**

This long-lived complex of soil pathogens reduce marketability by discoloring roots to a black color.

**Non-Pesticide**

**Horseradish** | Use disease-free root stocks generated from tissue-culture. Hot water seed treatment may reduce this disease in root clones. Use temperatures and times of 115 F for 10 minutes. Control volunteer horseradish in rotation years.

**Leaf Blight of Carrots - Xanthomonas Bacteria**

Copper products that are labeled for Cercospora may be helpful; however, bacteria may become resistant to copper products. Early bacterial leaf blight symptoms may mimic Alternaria leaf spot.

Bacteria may occur on seed and can survive on carrot debris in soil. Bacteria spread within a field by rain or overhead irrigation. Under dry conditions, low levels of bacterial leaf blight may not result in significant crop loss. Under hot and wet conditions, high levels of bacterial blight may develop and lead to premature defoliation and an inability to harvest the roots via a mechanical harvester.

**Non-Pesticide**

**Carrot** | Use disease-free seed. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122 F for 20 minutes for carrot. Rotate to non-host crops for 2 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

**copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide)** Carrot | Several formulations of copper (Badge, Champ, Kocide) products are labelled for use and may slow the spread of bacterial blight. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

**Leaf Blight of Root Crops - Alternaria Fungus**

Scout fields to initiate a spray program when foliar blights are first detected (trace of disease). TOM-CAST with 15 disease severity values (DSVs) can help carrot farmers time their fungicide applications for control of foliar blights. See Disease Forecasting Systems for details. Cercospora leaf spot is sometimes known as early blight. Alternaria leaf blight is sometimes known as late blight.

**Non-Pesticide**

**Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip** | Use disease-free seed. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122 F for 20 minutes for carrot, rutabaga and turnip, 122 F for 15 minutes for radish, or 118 F for 30 minutes for celeriac. Rotate to non-host crops for 2 years. Varieties with partial resistance are available. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

**azoxyystrobin products (azoxyystrobin)** Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-20.0 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-12.8 fl. oz. per acre. REI: 4-hour. PHI: 0-day. FRAC 11.

**Cabrio EG (20) (pyraclostrobin)** Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 8-12 oz. per acre. REI: 12-hour. PHI: 0-day FRAC 11.

**chlorothalonil products (chlorothalonil)** Carrot, Horseradish, Parsnip | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates and crops. See label for directions. REI: 12-hour. PHI: 0-day for carrot; 10-day for parsnip; 14-day for horseradish. FRAC M5.
Leaf Spot of Root Crops - Cercospora Fungus

Scout fields to initiate a spray program when foliar blights are first detected (trace of disease). TOM-CAST with 15 disease severity values (DSVs) can help carrot farmers time their fungicide applications for control of foliar blights. See Disease Forecasting Systems for details. Cercospora leaf spot is sometimes known as early blight. Alternaria leaf blight is sometimes known as late blight.

Non-Pesticide

Bean, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip
| Use disease-free seed. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122 F for 20 minutes for carrot, rutabaga and turnip, 122 F for 15 minutes for radish, or 118 F for 30 minutes for celeriac. Rotate to non-host crops for 2 years. Varieties with partial resistance are available. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

azoxystrobin products (azoxystrobin) Bean, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-20.0 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-12.8 fl. oz. per acre. REI: 4-hour. PHI: 0-day. FRAC 11.

chlorothalonil products (chlorothalonil) Carrot, Horseradish, Parsnip | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates and crops. See label for directions. REI: 12-hour. PHI: 0-day for carrot; 10-day for parsnip; 14-day for horseradish. FRAC M5.

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) Bean, Carrot, Celeriac | Several formulations of copper (Badge, Champ, Kocide) products are labelled for use and may slow the spread of Cercospora. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M1.

Flint Extra (4.05) (trifloxystrobin) Bean, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 2.0-2.9 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11.

Fontelis (1.67SC) (penthiopyrad) Bean, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 5.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7.
Quadris Opti (SC) (azoxystrobin, chlorothalonil) Carrot | 2.4 pts. per acre. REI: 12-hour. PHI: 0-day. FRAC 11, FRAC M5.

Quadris Top (SC) (azoxystrobin, difenoconazole) Carrot | 12-14 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC 3.

Quilt (SE) (azoxystrobin, propiconazole) Carrot | 14 oz. per acre. Late blight suppression only. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC 3.

tebuconazole products (tebuconazole) Beet | 3.0-7.2 fl. oz. per acre. There are many brand names (Monsoon, Onset, Vibe) with 3.6 lbs. a.i. per gallon that use the same rate. REI: 12-hour to 18-acre. Late blight suppression only. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC 3.

Nematodes

Northern root knot nematode (NRKN) has a wide host range, including most broadleaf crops and weeds, but seem to have a disproportionate effect on carrots resulting in large yield losses if uncontrolled. Carrot cyst nematodes (CCN) are also found throughout the region and only feed on carrots. Sugar Beet Cyst Nematode (SBCN) will infect beets, radishes, rutabagas, and turnips.

Non-Pesticide

Beet, Carrot, Horseradish, Radish, Rutabaga, Turnip | Collect soil samples for nematodes in the fall and avoid fields with high numbers. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue and displace nematodes is an important method to prevent nematode build-up. Anaerobic soil disinfection (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain nematodes. For NRKN: rotate to a non-broadleaf crop, such as grass grains or sweet corn for >3 years. For SBCN: a late-summer, or early-fall cover crop of 'Defender', 'Concorde', or 'Control' radishes are effective trap crops for SBCN.

Pesticide

Sectagon K42 (4.2L) (metam sodium) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 37.5-75 gals. per acre. Use high rates on muck, and lower rates on sands. In the fall, when soil at 6 inches is above 50 F and moist, place Sectagon K42 or VAPAM HL about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, Telone II may be applied through drip irrigation under unperforated plastic beds at 9-12 gals. per acre. In the spring or fall, when soil at 6 inches is above 50 F and moist, place Telone II about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, Telone EC may be applied through drip irrigation under unperforated plastic beds at 9-18 gals. per acre on mineral soils only. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 3-5-day. IRAC UN, FRAC NC, IRAC 8B. RUP.

Telone C-17 (L) (1,3-dichloropropene, chloropicrin) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Muck soils: Use C-17 formulation at 27.4-30 gals. per acre, and C-35 formulation at 33-36 gals. per acre. Mineral soils: Use C-17 formulation at 10.8-17.1 gals. per acre, and C-35 formulation at 13-20.5 gals per acre. In the fall, when soil at 6 inches is above 50 F and moist, place Telone C-17 or C-35 about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing, irrigation, or plastic. Or, in the spring, InLine may be applied through drip irrigation under unperforated plastic beds at 13-20.5 gals. per acre on mineral soils only. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC UN, FRAC M3, WSSA 17. RUP.

Telone II (9.85L) (1,3-dichloropropene) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Muck soils: Use at 25 gals. per acre. Mineral soils: Use at 9-12 gals. per acre. In the spring or fall, when soil at 6 inches is above 50 F and moist, place Telone II about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, Telone EC may be applied through drip irrigation under unperforated plastic beds at 9-18 gals. per acre on mineral soils only. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC UN, FRAC NC. RUP.

Vydate L (2WSL) (oxamyl) Carrot | 1-2 gal. per acre. Apply as a banded or Shank-injected pre-plant, at-plant in-furrow or directed post-plant soil treatment with at least 20 gals. water per acre incorporated 2-4 inches deep by water or mechanical means, or overhead chemigate before crop emergence to deliver in 0.5 inch of irrigation water. Allow 14 days between applications. IA, IL, KS, MN, and MO use low rate only and do not exceed 4 applications or 2.5 gals. per acre per season. IN, MI, OH use high rate and do not exceed 8 applications or 8 gals. per acre per season. REI: 48-hour. PHI: 14-day. IRAC 1A. RUP.

Viruses of Multiple Crops - Multiple Pathogens

Turnip Mosaic Virus is transmitted by multiple species of aphids. In horseradish the pathogen can increase with each growing season as root clones are propagated.

Non-Pesticide

Horseradish | For TuMV: start new plantings with virus-free root stocks generated from tissue-culture.
Root Crops - Insects

**Pesticide**

**Insecticides** *Horseradish* | For TuMV: maintain an aphid management program. See Insects section.  
For Brittle Root: maintain a leafhopper management program. See Insects section.

**White Mold (Timber Rot, Drop, Stem Rot) of Multiple Crops - Sclerotinia Fungus**

This soil pathogen is long-lived in the soil, and has a wide host range on broadleaved crops and weeds, including beans, vine crops, lettuce, tomatoes, peppers, and cole crops. It goes by other names in other crops, such as Drop, White Mold, Stem Rot, and Timber Rot.

It is more commonly found where humidity and temperatures are high. The fungus often infects flowers, which then drop off and infect the stems that they land on. The stems take on a woody appearance and can split open. On root crops, the pathogen infects the root crown and stem, which makes the leaves drop and rot. Inspection of the stems will reveal small black pellets that are the overwintering body of the pathogen.

**Non-Pesticide**

*Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | Avoid fields with a history of the problem. Rotate to a non-broadleaf crop, such as grass grains or sweet corn for >6 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up. Anaerobic soil disinfestation (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain this pathogen.

**Pesticide**

*Endura (WG) (boscalid)* *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | 7.8 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 7.

*Fontelis (1.67SC) (penthiopyrad)* *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | 16-30 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7.

*Omega 500F (4.17) (fluazinam)* *Carrot* | 1 pt. per acre. REI: 12-hour. PHI: 7-day. FRAC 29.

**White Rust of Multiple Crops - Albugo Oomycete**

**Non-Pesticide**

*Horseradish, Radish, Rutabaga, Turnip* | Use disease-free seed and transplants. Hot water seed treatment may reduce this seedborne disease. Use temperatures and times of 122 F for 20 minutes for rutabaga and turnip, 122 F for 15 minutes for radish. Rotate to non-host crops for 2 years. Varieties with partial resistance are available. Brassica weeds like shepherd's purse, yellow rocket, and wild mustard can host the pathogen and should be managed. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

*Cabrio EG (20) (pyraclostrobin)* *Horseradish, Radish, Rutabaga, Turnip* | 8-16 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 11.

*Ridomil Gold Copper (WSB) (mefenoxam, copper hydroxide)* *Radish* | Use as a foliar spray. REI: 48-hour. PHI: 7-day. FRAC 4, FRAC M1.

**Recommended Controls**

**Aphids**

**Pesticide**

*Actara (25WDG) (thiamethoxam)* *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | 1.5-3.0 oz. per acre. REI: 12-hour. PHI: 7-day. IRAC 4A.

*Admire Pro (4.6SC) (imidacloprid)* *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | 0.31-0.74 fl. oz. per 1,000 ft. of row. Apply as chemigation through drip, as an in-furrow spray, shanked in to seed trench, or as a narrow banded spray over eventual row within 14 days of planting. Do not apply more than once per season. REI: 12-hour. PHI: 7-day. IRAC 4A.

*Beleaf (50SG) (flonicamid)* *Beet, Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* | 2.0-2.8 oz. per acre. Use lower rate for building populations and use higher rate for greater populations or dense foliage. Do not exceed 8.4 oz. per acre per year. Allow 7 days between applications. REI: 12-hour. PHI: 3-day IRAC 9.

*Brigade 2EC (bifenthrin)* *Beet* | Use 2EC formulation at 5.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season.
Use 10DF, 10 WP, or 10WSB formulations at 12.8-16.0 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Brigade 2EC (bifenthrin)** *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | Use 2EC formulation at 5.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10 WP, or 10WSB formulations at 12.8-16.0 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 21-day. IRAC 3A. RUP.

**Lannate LV (2.4L) (methomyl)** *Horseradish* | 1.5 pts. per acre. REI: 48-hour. PHI: 65-day. IRAC 1A. RUP.

**M-Pede (3.8) (potassium salts of fatty acids)** *Beet, Carrot, Horseradish, Parsnip, Radish, Rutabaga* | 1-2% by volume. Must contact aphids to be effective. REI: 12-hour. PHI: 0-day. IRAC UN. FRAC NC. OMRI-listed.

**Malathion 5EC (malathion)** *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | Use 5EC formulations at 1.5-2.0 pts. per acre on beets, parsnips and horseradish; 1.5 pts. per acre on radishes and rutabagas; or 1.0-2.0 pts. per acre on turnips. Use 57EC formulations at 1.5-2.0 pts. per acre on beets, carrots, and parsnips; 1.0-1.6 pts. per acre on radish and rutabagas; or 1.0-2.0 pts. per acre on horseradish and turnips. Do not exceed 3 applications per season. Allow 7 days between applications. REI: 12 to 24-hour. PHI: 7-day. IRAC 1B.

**Neemix (0.39) (azadirachtin)** *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | 5-7 fl. oz. per acre. Suppression of nymphs and adult feeding deterrence. REI: 4-hour. PHI: 0-day. IRAC UN. OMRI-listed.

**Platinum 2SC (thiamethoxam)** *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | Use 2SC formulations as a soil treatment at 5.0-12.0 fl. oz. per acre on beet, carrot, parsnip, rutabaga, and turnip or 5.0-6.5 fl. oz. per acre on radish, and do not exceed 12 fl. oz. per acre per season on beet, carrot, parsnip, rutabaga, and turnip or 6.5 fl. oz. per acre on radish. Use 75SG formulations as a soil treatment at 1.7-4.0 oz. per acre on beet, carrot, parsnip, rutabaga, and turnip or 1.7-2.2 fl. oz. per acre on radish, and do not exceed 4.0 oz. per acre per season on beet, carrot, parsnip, rutabaga, and turnip or 2.2 oz. per acre on radish. REI: 12-hour. IRAC 4A.

**Sivanto 200 (1.67SL) (flupyramiduron)** *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | 7.0-10.5 fl. oz. per acre. Do not exceed 28.0 fl. oz. per acre per season. Allow 10 days between applications. REI: 4-hour. PHI: 7-day. IRAC 4D.

**Carrot Weevil Beetle**

**Pesticide**

**Asana XL (0.66EC) (esfenvalerate)** *Carrot* | 9.6 fl. oz. per acre. Begin treatment when weevils become active. Thorough spray coverage of crown area is essential. Do not exceed 96 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

**Baythroid XL (1EC) (beta-cyfluthrin)** *Carrot, Radish* | 2.8 fl. oz. per acre. Do not exceed 14.0 fl. oz. per acre per season. Do not harvest tops for human consumption. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Vydate L (2WSL) (oxamyl)** *Carrot* | 2-4 pts. per acre. Apply as a soil-directed spray with at least 20 gals. water per acre, incorporated 2-4 inches deep by water or mechanical means. Start when eggs or larvae are first seen and repeat in 2 to 3 weeks. Allow 14 days between applications. IA, IL, KS, MN, and MO do not exceed 3 applications per season. REI: 12-hour. PHI: 14-day. IRAC 1A. RUP.

**Caterpillars**

For cutworm caterpillars, treatment is warranted when 25% of plants are infested.

**Pesticide**

**Asana XL (0.66EC) (esfenvalerate)** *Carrot* | 5.8-9.6 fl. oz. per acre. For cutworms. Do not exceed 96 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

**Baythroid XL (1EC) (beta-cyfluthrin)** *Carrot, Radish* | 1.6-2.8 fl. oz. per acre. For cutworms. Do not exceed 14.0 fl. oz. per acre per season. Do not harvest tops for human consumption. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Brigade 2EC (bifenthrin)** *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | For armyworms, cabbageworms, and cutworms. Use 2EC formulation at 5.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10 WP, or 10WSB formulations at 12.8-16.0 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day for beet. 21-day for carrot, celeriac, parsnip, radish, rutabaga and turnip. IRAC 3A. RUP.

**Coragen (1.67SC) (chlorantraniliprole)** *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | 3.5-7.5 fl. oz. per acre. For armyworms. Do not exceed 15.4 fl. oz. per acre per crop, or 16.4 fl. oz. per acre per year. Allow 3 days between applications. REI: 4-hour. PHI: 1-day. IRAC 28.

**Diazinon AG500 (4ES) (diazinon)** *Beet, Carrot, Radish* | For cutworms. Use 50W formulations at 4-8 lbs. per acre as a pre-plant incorporation and do not exceed 8 lbs. per acre per season. Use AG500 formulations at 2-4 lbs. per acre for radish and beet, 4 lbs. per acre for carrot as a pre-plant incorporation. Do not exceed 4 lbs. per acre per season. Use AG600 formulations at 51-102 fl. oz. per acre as a pre-plant incorporation and do not exceed 102 fl. oz. per acre per season. REI: 3-day. PHI: 2 to 4-day. IRAC 1B. RUP.

**Entrust SC (2) (spinosad)** *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* | For armyworms, and looppers. Use 2SC formulations at 3.0-10.0 fl. oz. per acre and do not exceed 21 fl. oz. per acre per season. Use 80WP formulations
Root Crops - Insects

at 1.0-3.0 oz. per acre and do not exceed 9 oz. per acre per season. Allow 5 days between applications on carrots, celeriac, horseradish, parsnip, radish, rutabaga, and turnip. Allow 7 days between applications on beets. REI: 4-hour. PHI: 21-day. IRAC 5. OMRI-listed.

Lannate LV (2.4L) (methomyl) Beet, Carrot | For cutworms. Use 1.5 pts. per acre for beets. Use 0.75-1.5 pts. per acre for carrots. Do not exceed 12 pts. per acre per season for beets. Do not exceed 21 pts. per acre per season for carrots. REI: 48-hour. PHI: 1-day. PHI: 0-day for beet roots, 10-day for beet tops, 1-day for carrot. IRAC 1A. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 1.28-4.0 fl. oz. per acre. For cutworms. Do not exceed 24 fl. oz. per acre per season. Allow 4 days between applications. Leaves cannot be used for food or feed. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Radiant 1SC (spinetoram) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 6-8 fl. oz. per acre. For armyworms. Do not exceed 24 fl. oz. per acre per season for radish, rutabaga, and turnip. Do not exceed 28 fl. oz. per acre per season for carrot and parsnip. Do not exceed 32 fl. oz. per acre per season for beet. Allow 7 days between applications. REI: 4-hour. PHI: 3-day for carrot, parsnip, radish, rutabaga, and turnip; 7-day for beet. IRAC 5.

Sevin XLR Plus (4SC) (carbaryl) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 0.5-1 qts. per acre. For armyworms, and cutworms. Do not exceed 6 qts. per acre. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Flea Beetles

Pesticide

Actara (25WDG) (thiamethoxam) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 1.5-3.0 oz. per acre. Apply as a foliar spray. Do not exceed 4.0 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

Asana XL (0.66EC) (esfenvalerate) Radish, Turnip | 5.8-9.6 fl. oz. per acre. Do not exceed 77 fl. oz. per acre per season for turnip. Do not exceed 19.4 fl. oz. per acre per season for radish. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Baythroid XL (1EC) (beta-cyfluthrin) Carrot, Radish | 1.6-2.8 fl. oz. per acre. Do not exceed 14.0 fl. oz. per acre per season. Do not harvest tops for human consumption. REI: 12-hour. PHI: 0-day IRAC 3A. RUP.

Brigade 2EC (bifenthrin) Beet | Use 2EC formulation at 5.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10 WP, or 10WSB formulations at 12.8-16.0 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Brigade 2EC (bifenthrin) Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Use 2EC formulation at 5.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Use 10DF, 10 WP, or 10WSB formulations at 12.8-16.0 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 48-hour. PHI: 1-day. IRAC 1A. RUP.

Platinum 2SC (thiamethoxam) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Use 2SC formulations as a soil treatment at 5.0-12.0 fl. oz. per acre on beet, carrot, parsnip, rutabaga, and turnip or 5.0-6.5 fl. oz. per acre on radish, and do not exceed 12 fl. oz. per acre per season on beet, carrot, parsnip, rutabaga, and turnip or 6.5 fl. oz. per acre on radish. Use 75SG formulations as a soil treatment at 1.7-4.0 oz. per acre on beet, carrot, parsnip, rutabaga, and turnip or 1.7-2.2 fl. oz. per acre on radish, and do not exceed 4.0 oz. per acre per season on beet, carrot, parsnip, rutabaga, and turnip or 2.2 oz. per acre on radish. REI: 12-hour. IRAC 4A.

Sevin XLR Plus (4SC) (carbaryl) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Do not exceed 6 qts. per acre. REI: 12-hour. PHI: 7-day. IRAC 1A.

Leafhoppers

For susceptible varieties: 20 leafhoppers per 100 sweeps.

Pesticide

Actara (25WDG) (thiamethoxam) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Use as a soil treatment at 5.0-12.0 fl. oz. per acre on beet, carrot, parsnip, radish, and turnip or 5.0-6.5 fl. oz. per acre on radish. Use 10DF, 10 WP, or 10WSB formulations at 12.8-16.0 oz. per acre and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 21-day. IRAC 3A. RUP.

Admire Pro (4.6SC) (imidacloprid) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 0.31-0.74 fl. oz. per 1,000 ft. of row. Apply as chemigation through drip, as an in-furrow spray, shanked in to seed trench, or as a narrow banded spray over eventual row within 14 days of planting. Do not apply more than once per season. REI: 12-hour. PHI: 21-day. IRAC 4A.

Asana XL (0.66EC) (esfenvalerate) Carrot | 5.8-9.6 fl. oz. per acre. Do not exceed 96 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 4A.

Baythroid XL (1EC) (beta-cyfluthrin) Carrot, Radish | 1.6-2.8 fl. oz. per acre. Do not exceed 14.0 fl. oz. per acre per season. Do not harvest tops for human consumption. REI: 12-hour. PHI: 0-day IRAC 3A. RUP.
Platinum 2SC (thiamethoxam) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Use 2SC formulations as a soil treatment at 5.0-12.0 fl. oz. per acre on beet, carrot, parsnip, rutabaga, and turnip or 5.0-6.5 fl. oz. per acre on radish, and do not exceed 12 fl. oz. per acre per season on beet, carrot, parsnip, rutabaga, and turnip or 6.5 fl. oz. per acre on radish. Use 75SG formulations as a soil treatment at 1.7-4.0 oz. per acre on beet, carrot, parsnip, rutabaga, and turnip or 1.7-2.2 fl. oz. per acre on radish, and do not exceed 4.0 oz. per acre per season on beet, carrot, parsnip, rutabaga, and turnip or 2.2 oz. per acre on radish. REI: 12-hour. PHI: 7-day. IRAC 4A.

Sevin XLR Plus (4SC) (carbaryl) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 0.5-1 qts. per acre. Do not exceed 6 qts. per acre. REI: 12-hour. PHI: 7-day. IRAC 1A.

Sivanto 200 (1.67SL) (flupyradifurone) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 7.0-10.5 fl. oz. per acre. Do not exceed 28.0 fl. oz. per acre per season. Allow 10 days between applications. REI: 4-hour. PHI: 7-day. IRAC 4D.

Seed and Root Maggots

Non-Pesticide

Radish, Rutabaga, Turnip | Plant after the peak flight and egg-laying window of the first generation of flies looking to lay eggs around 700 GDD base 40. Handle seeds carefully to prevent cracking. Plow winter vegetation under early in the spring and thoroughly cover to limit attractiveness of rotting vegetation to the first generation of flies to lay eggs on.

Pesticide

Diazinon AG500 (4ES) (diazinon) Rutabaga | Use 50W formulations at 4-6 lbs. per acre as a pre-plant incorporation and do not exceed 6 lbs. per acre per season. Use AG500 formulations at 2-4 lbs. per acre as a pre-plant incorporation and do not exceed 4 lbs. per acre per season. Use AG600 formulations at 51-102 fl. oz. per acre as a pre-plant incorporation and do not exceed 102 fl. oz. per acre per season. REI: 2 to 4-day. IRAC 1B. RUP.

Lorsban 4E (chlorpyrifos) Radish, Rutabaga, Turnip | 4.6-9.2 oz. per 1,000 fl. of row. Use 4E formulations at 4.0-5.5 pts. per acre as a pre-plant incorporation, or 1.0-3.2 fl. oz. per 1,000 foot of row as an at-plant soil drench. Use 15G formulations at 3.3-9.2 oz. per 1,000 foot of row as an at-plant application. Use 75WG formulations at 3.0-3.67 lb. per acre as a pre-plant incorporation or 0.67-2.15 oz. per 1000 linear ft. of row as an at-plant soil drench. Do not apply to foliage. Do not exceed one application per acre per season. REI: 24-hour to 3-day. PHI: 30-day. IRAC 1B. RUP.

Root Crops - Weeds

Recommended Controls

All Weeds

Herbicide are not widely labeled across the many root crops. Instead, herbicides are labeled based on the plant families the crops come from. For example, beets have several herbicides that can be applied over the top of the crop that would damage any other root crop.

Prepare a stale seedbed several weeks in advance of planting, allow weeds to emerge, and kill weeds without bringing new weed seeds to the surface with a burndown herbicide. It may be possible to plant without killing the weeds, and then kill them just before the crop emerges. For crops like carrots and parsnips that take a long time to emerge, controlling these weeds is especially useful, but it can also pay off for faster-emerging species like radishes or beets.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

Non-Pesticide

Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Weed control in root crops often relies heavily on cultivation and hand weeding for full season weed control. These operations are most efficient when planting arrangement is designed with weed control in mind and is designed to work with available weed control equipment. Specialized weeding equipment for leafy vegetables includes basket weeders, narrow-bladed hoes, finger weeders, and others. Prepare a stale seedbed with flaming or very shallow cultivation, instead of herbicides.

Broadleaf and Grass Weeds - Postemergence

Pesticide

Caparol 4L (prometryn) Carrot, Celeriac | Use lower rates on sandy soils. For carrot: Apply 2-4 pts. per acre preemergence and/or postemergence through the 6-leaf stage of carrot development. Do not exceed 8 pts. per acre per year. For transplanted celeriac: Make a single application of 1.6-4 pts. per acre after crop the crop has 6-8 leaves. REI: 12-hour. PHI: 30-day for carrot, 60-day for celeriac. WSSA 5.

glyphosate products (glyphosate) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations containing 3 lbs. ae per gal. (4 lbs. isopropylamine salt per gal.) at 1-5 qts. per
Root Crops - Weeds

acre, or formulations containing 4.5 lbs. ae per gal. (5 lbs. potassium salt per gal.) at 0.66-3.3 qt. per acre. Broadcast before seeding, or apply between crop rows with wipers or hooded or shielded sprayers. Use lower rate for annuals and higher rates for perennials. For carrot and rutabaga only wipers may be used over top of crop, see label. See label for suggested application volume and adjuvants. REI: 4 to 12-hour. PHI: 14-day for foliar applications directed between rows, 7-day for wiper applications on carrot only. WSSA 9.

Lorox DF (50) (linuron) Carrot, Celeriac, Horseradish, Parsnip | Use low rate on coarse soils and higher rate on heavy soils and muck. Do not use on sand, loamy sand, or soils with less than 1% organic matter. For carrot: In Minnesota only, apply 1-2 lbs. per acre after planting but before carrots emerge. In Michigan and Ohio only, apply 1-3 lbs. per acre after planting but before carrots emerge. Do not exceed 4 lbs. per acre per season. In all states, an additional application of 1.5-3 lbs. per acre can be made after carrots seedlings are 3 inches tall. For celeriac: Make a single application of up to 3 lbs. per acre as a broadcast spray after celeriac has been transplanted and established, but before celeriac is 8 inches tall. Do not add surfactants, nitrogen (or other fertilizers), or other pesticides to the spray mix. For horseradish: Make a single application of up to 3 lbs. per acre as a broadcast spray after planting or during dormancy, but before leaves emerge in spring. After planting, allow rainfall or irrigation of at least 0.5 inch prior to application. For parsnip: Make a single application of 1.5-3 lbs. per acre as a broadcast spray after planting but prior to crop emergence. Plant at least 0.5 inch deep. REI: 24-hour to 8-day. PHI: 14-day for carrot, 60-day for celeriac. WSSA 7.

Nortron SC (4) (ethofumesate) Beet | Apply 60 fl. oz. per acre at (or soon after) seeding and before weed seeds germinate, 5.25 fl. oz. per acre. When beets have 2-4 true leaves, or 10.5 fl. oz. per acre when beets have 6-8 true leaves. May cause temporary leaf fusion. May injure stressed plants. Use on mineral soils only. Do not exceed 96 fl. oz. per acre per season. REI: 12-hour. PHI: 64-day for carrot. WSSA 15.

Nortron SC (4) (ethofumesate) Beet | Apply 60 fl. oz. per acre at (or soon after) seeding and before weed seeds germinate, 5.25 fl. oz. per acre. When beets have 2-4 true leaves, or 10.5 fl. oz. per acre when beets have 6-8 true leaves. May cause temporary leaf fusion. May injure stressed plants. Use on mineral soils only. Do not exceed 96 fl. oz. per acre per season. REI: 12-hour. PHI: 64-day for carrot. WSSA 15.

Outlook (6) (dimethenamid-p) Horseradish | 12-21 fl. oz. per acre. Apply from 2-leaf stage to 8-leaf stage of horseradish. Cold, wet conditions at application may stunt horseradish. Will not control emerged weeds. REI: 12-hour. PHI: 40-day. WSSA 15.

pendimethalin products (pendimethalin) Carrot | Apply 3.8 lb. per gallon formulations at 2 pts. per acre within 2 days after seeding and before crop and weeds emerge. Or apply at layby as a directed spray between rows. Do not allow spray to contact carrot plants. Will not control emerged weeds. Do not exceed 2 pts. per acre per season. REI: 24-hour. PHI: 60-day. WSSA 3.

Ro-Neet (6) (cyloate) Beet | 0.5-0.67 gals. per acre. Apply before planting and incorporate immediately. Use on mineral soils only. REI: 48-hour. WSSA 8.

trifluralin products (trifluralin) Carrot, Radish | 0.5-0.75 lb. a.i. per acre. Use 4EC formulations at 1-1.5 pts. per acre. Use 10G formulations at 5-7.5 lbs. per acre. Apply and incorporate 1-2 inches before planting. Use low rate on coarse soils with less than 2% organic matter. Not effective on muck or high organic matter soils. Not effective on muck or high organic matter soils. REI: 12-hour. WSSA 3.

Broadleaf and Grass Weeds - Preemergence

Pesticide

Caparol 4L (prometryn) Carrot, Celeriac | Use lower rates on sandy soils. For carrot: Apply 2-4 pts. per acre preemergence and/or postemergence through the 6-leaf stage of carrot development. Do not exceed 8 pts. per acre per year. For transplanted celeriac: Make a single application of 1.6-4 pts. per acre after crop the crop has 6-8 leaves. REI: 12-hour. PHI: 30-day for carrot, 60-day for celeriac. WSSA 5.

Dual Magnum (7.62EC) (s-metolachlor) Beet, Carrot, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Illinois, Indiana, Michigan, Minnesota, and Ohio only. IL 24c exp. 12/31/20. MI 24c exp. 12/31/21. MN 24c exp. 12/31/20. OH 24c exp. 12/31/22. For carrot in states listed above: apply 0.5-1.33 pts. per acre after planting but before carrots emerge, or 0.67-1.33 pts. per acre after carrots have 3-5 true leaves. Increase rates to 1.33-2.0 pts. per acre on muck soils. Do not apply both pre- and postemergence. Only the postemergence application is allowed in Ohio. For beet, parsnip, radish, rutabaga, and turnip in states listed above: 0.67-1.0 pt. per acre before planting with or without incorporation, or apply after seeding before crop emerges. Risk of crop injury is generally greater with preplant incorporated applications and on coarse-textured soils with less than 1.5% organic matter. Increase rate to 1.33 pts. per acre on muck soils. Do not exceed 1.3 pts. per acre per crop or 1 application per crop. Horseradish in all states: Apply after planting but before weeds emerge. Do not exceed 1 application per crop. PHI: 24-hour. PHI: 64-day for carrot. WSSA 15.

Broadleaf Weeds Only - Postemergence

Pesticide

Aim EC (2) (carfentrazone) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 0.5-2.0 fl. oz. per acre. Apply with hooded sprayers as a directed application.
between crop rows. Use COC or NIS. Weeds must be actively growing and less than 4 inches tall. Do not allow spray to contact crop. Do not exceed 6.1 fl. oz. per acre per season. REI: 12-hour. WSSA 14.

**metribuzin products** (**metribuzin**) Carrot | Apply 0.5 pts. per acre for 4F, 0.33 lbs. per acre for 75DF. Broadcast after carrots have 5-6 true leaves and when weeds are less than 1 inch tall or across. Do not apply within 3 days of cool, cloudy weather or other pesticide application, or when temperature is above 85 F. Do not exceed 1 application per season if carrots are rotated with onions; otherwise do not exceed 1 pt. of 4F products per acre per season, or 0.66 lb. of 75DF products per acre per season. REI: 12-hour. PHI: 60-day. WSSA 5.

**Spartan Charge (SE)** (**carfentrazone, sulfentrazone**) Horseradish | 2.9-10.2 fl. oz. per acre Broadcast in the spring before planting or after planting but at least 5 days before crop emergence; or band into row middles after crop emergence. Applications made in the spring shortly before planting may be incorporated, but do not incorporate at other times. Rainfall or irrigation is required to move herbicide into the soil when not incorporated. Do not broadcast if sprouts are close to soil surface, or over top of emerged crop. Do not use on sandy soils with less than 1% organic matter. Do not exceed 10.2 fl. oz. of Spartan Charge per 12-month period. REI: 12-hour. WSSA 14.

**Spin-Aid (1.3)** (**phenmedipham**) Beet | 1.5-3 pts. per acre in 10-20 gals. of water. Apply to beets with at least 4 true leaves to avoid injury. Do not apply if beets are stressed. Do not exceed 3 applications. Does not control pigweed. REI: 12-hour. PHI: 60-day. WSSA 5. RUP.

**Stinger (3)** (**clopyralid**) Beet, Turnip | 4-8 fl. oz. per acre. Apply to beets when crop has 2-8 true leaves. Controls primarily composites and nightshade. Do not exceed 8 fl. oz. per acre per crop for beet. Do not exceed 1 application per crop for turnip. REI: 12-hour. PHI: 30-day. WSSA 4.

**UpBeet (50DF)** (**triflusulfuron**) Beet | 0.5 oz. per acre. Apply postemergence when beets have 2-4 and 4-6 leaves to control velvetleaf and mustards. Suppresses lambquarters, pigweed, nightshade, ragweed, smartweed, and wild buckwheat. Add 8 fl. oz. NIS per 25 gals. spray solution. Do not exceed 1.5 oz. per acre per season. REI: 4-hour. PHI: 30-day. WSSA 2.

**Broadleaf Weeds Only - Preemergence**

**Pesticide**

**GoalTender (4)** (**oxyfluorfen**) Horseradish | 1 pt. per acre for GoalTender 4SC, or 2 pts. per acre for Goal 2XL. Apply after planting but prior to crop emergence. REI: 24 to 48-hour. WSSA 14.

**Spartan 4F** (**sulfentrazone**) Horseradish | 2.25-8.0 fl. oz. per acre Broadcast in the spring before planting or after planting but at least 5 days before crop emergence; or band into row middles after crop emergence. Applications made in the spring shortly before planting may be incorporated, but do not incorporate at other times. Rainfall or irrigation is required to move herbicide into the soil when not incorporated. Do not broadcast if sprouts are close to soil surface, or over top of emerged crop. Do not use on sandy soils with less than 1% organic matter. Do not exceed 8 fl. oz. of Spartan 4F per 12-month period. REI: 12-hour. WSSA 14.

**Spartan Charge (SE)** (**carfentrazone, sulfentrazone**) Horseradish | 2.9-10.2 fl. oz. per acre Broadcast in the spring before planting or after planting but at least 5 days before crop emergence; or band into row middles after crop emergence. Applications made in the spring shortly before planting may be incorporated, but do not incorporate at other times. Rainfall or irrigation is required to move herbicide into the soil when not incorporated. Do not broadcast if sprouts are close to soil surface, or over top of emerged crop. Do not use on sandy soils with less than 1% organic matter. Do not exceed 10.2 fl. oz. of Spartan Charge per 12-month period. REI: 12-hour. WSSA 14.

**Grass Weeds Only - Postemergence**

**Pesticide**

**clethodim products** (**clethodim**) Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip | Use 2EC formulations at 6-8 fl. oz. per acre with 1 q.t. of COC per 25 gals. of spray solution (1% v/v). Use Select Max at 9-16 fl. oz. per acre with 8 fl. oz. of NIS per 25 gals. of spray solution (0.25% v/v). Spray on actively growing grass. Use lower rates for annual grasses, the higher rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. Do not exceed 32 fl. oz. of 2EC formulations or 64 fl. oz. of Select Max per acre per season. REI: 24-hour. PHI: 15-day for radish, 30-day for beet, carrot, celeriac, horseradish, parsnip, rutabaga, and turnip. WSSA 1.

**Fusilade DX (2EC)** (**fluazifop-P**) Carrot | 10-12 fl. oz. per acre. Use 1-2 pts. of COC or 0.5-1 pt. of NIS per 25 gals. of spray solution. Spray on actively growing grass. REI: 12-hour. PHI: 45-day. WSSA 1.

**Poast (1.5EC)** (**sethoxydim**) Beet, Carrot, Horseradish, Parsnip, Radish, Rutabaga, Turnip | 1.0-1.5 pts. per acre. Use 1 q.t. of COC per acre. Spray on actively growing grass. Do not exceed 2.5 pts. per acre per season for parsnip, radish, rutabaga, and turnip or 5 pts. per acre per season for beet, carrot, and horseradish. REI: 12-hour. PHI: 14-day for parsnip, radish, rutabaga, and turnip, 30-day for carrot, and 60-day for beet and horseradish. WSSA 1.
Sweet Corn - Horticulture

Sweet Corn - Horticulture
Reviewed by Ben Phillips, Liz Maynard, Bill Tracy – Oct 2020

Crop Description

Sweet corn (Zea mays subsp. mays) originates from a wild relative in Central America. Sweet corn is usually described by color (yellow, bicolor, or white) and by the major gene names that make it sweet. Despite the many marketing terms and trademarked names, sweet corn can be categorized into five major types.

The original sweet corn (called standard, sugary, or su) contains the su1 genetic variant that makes it sweet instead of starchy like field corn. Sugary sweet corn is grown today primarily for processing and specialized markets.

A second type of sweet corn (called sugar-enhanced, sugary enhancer, EH, or se) contains the se1 genetic variant that increases sugar content and makes the kernels more tender. Heterozygous se corn has one copy of the se1 mutation and homozygous se corn has two copies of the se1 mutation, increasing its effect. Sugar-enhanced sweet corn is grown primarily for direct retail sales and local wholesale markets.

A third type of sweet corn (called supersweet, ultrasweet, extra sweet, or shrunken-2) contains the sh2 genetic variation. This type typically has a higher sugar content than su corn, and the sugar content does not decline rapidly after picking, so it remains sweet for several days after harvest. Kernels typically are not as tender as se corn. Shrunken-2 (sh2) types are grown for retail sales, local fresh markets, and wholesale shipping markets.

Many of the newest sweet corn varieties combine the sh2 (or similar genes) with se and/or su genetics. Sugar-enhanced sweet corn that also includes sh2 (or similar) genes is called synergistic, and may be abbreviated as sesh2, syn, or sy corn. Current synergistic varieties are typically very sweet and very tender. Shrunken-2 sweet corn varieties with genetics increasing tenderness and flavor are categorized as augmented or improved supersweet or sh2, sometimes abbreviated shA. These varieties are typically extremely sweet and tender. Many of these varieties have performed well in midwestern trials and receive top ratings for eating quality. The new types are often identified by trademarked brand names.

Sweet corn varieties with resistance to certain insects, and/or glyphosate or glufosinate herbicides are also available.

Planting and Spacing

Common spacing 30 to 40 inches apart between rows. Plant early varieties 8 to 10 inches apart in the row, late varieties 9 to 12 inches apart in the row. Seed 10 to 15 pounds per acre.

Sweet corn flavor is affected by pollen source. Isolate all sweet corns from all other non-sweet corns, including dent (field), flint (Indian), flour, and popcorn by 250 feet or by a 14-day difference in tasseling dates. Likewise, supersweet (sh2) and augmented (sh4) sweet corn varieties must be isolated from sugary (su), sugar-enhanced (se) and synergistic (sy) types. If not isolated, kernels of both varieties will be starchy instead of sweet. Refer to the table below for isolation requirements or check with your seed supplier.

To maintain color purity, isolate white corn from yellow or bi-color corn. Pollen from yellow or bi-color corn will cause some yellow kernels in white varieties. Pollen from yellow corn will lead to extra yellow kernels in bi-color varieties. Pollen from white corn will not affect yellow or bi-color varieties.

Sweet Corn Isolation Requirements

<table>
<thead>
<tr>
<th>Type</th>
<th>Isolate from</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugary (su)</td>
<td>sh2, shA</td>
</tr>
<tr>
<td>Sugar-enhanced (se)</td>
<td>sh2, shA</td>
</tr>
<tr>
<td>Shrunken-2 (sh2)</td>
<td>su, se, syn</td>
</tr>
<tr>
<td>Synergistic (se x sh2 = sy)</td>
<td>sh2, shA</td>
</tr>
<tr>
<td>Augmented (su x sh2 = sh4)</td>
<td>su, se, syn</td>
</tr>
</tbody>
</table>

Fertilizing

pH: Maintain the soil pH between 6.0 and 6.5.

Before planting, apply 40 to 60 pounds N per acre, 0 to 100 pounds P2O5 per acre, and 0 to 150 pounds K2O per acre based on soil test results and recommendations from your state. For early plantings, apply a starter fertilizer at planting 2 inches below and 2 inches to the side of the seed, but do not exceed 80 to 100 pounds of N plus K2O per acre. On irrigated sandy soils reduce N to 10 to 20 pounds per acre and apply in a band of starter fertilizer. On sandy soils, broadcast 30 pounds or band 15 pounds of sulfur per acre.

Sidedress with 30 to 60 pounds N per acre when plants are 5 to 10 inches tall. On irrigated sandy soils, apply two sidedressings of approximately 40 pounds N per acre each: one when 4 to 5 inches tall (4th to 5th leaf), and the other at 10 inches tall (10th to 12th leaf).

Reduce the amount of fertilizer N applied by the value of N credits from green manures, legume crops grown in the previous year, compost and animal manures, and soils with more than 3 percent organic matter. The total amount of N from fertilizer (including starter) and other credits should be 100 to 120 pounds per acre.

Harvesting

Sweet corn is harvested when the kernels plump up and flavor is good. Normally 18 to 21 days after 50% of the plants have silked sweet corn will be ready to harvest. Sugary and sugar-enhanced varieties should be harvested promptly when they are ready to reduce starchy buildup in the kernels. Synergistic, supersweet and augmented supersweet varieties can be harvested over a slightly longer period. Hand picking is common, but there are single-row and multi-row mechanical harvester options.
Sweet Corn - Diseases
Reviewed by Dan Egel – Nov 2020

Recommended Controls

Anthracnose of Corn - Colletotrichum Fungus

Non-Pesticide

Rotate to non-host crops for 1-3 years. Varieties with resistance are available. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Aproach (2.08SC) (picoxystrobin) | 3-12 fl. oz. per acre. Use 3-6 fl. oz rate for single application for early disease control between V4 and V7. Use the 6-12 fl. oz. rate for repeated applications for continued season long control between VT and R3. REI: 12-hour. PHI: 7-day. FRAC 11.

azoxystrobin products (azoxystrobin) | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. REI: 4-hour. PHI: 7-day. FRAC 11.

Elatus (WG) (azoxystrobin, benzovindiflupyr) | 5-7.3 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC 7.

Headline (SC) (2.08) (pyraclostrobin) | 6-12 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11.

Headline AMP (pyraclostrobin, metconazole) | 10-14.4 fl. oz. per acre. REI: 12-hour. PHI: 20-day. FRAC 11, FRAC 3.

Priaxor (fluxapyroxad, pyraclostrobin) | 4-8 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 11.

Quilt (SE) (azoxystrobin, propiconazole) | 10.5-14.0 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC 3.

Stratego (propiconazole, trifloxystrobin) | 10 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 3, FRAC 11.

Goss' Wilt of Corn - Clavibacter Bacteria

This pathogen primarily infects leaves that have been wounded by wind, sandblasting, hail, and insect feeding. It overwinters on plant residue on the soil surface.

Non-Pesticide

Rotate to non-host crops for at least 1 year. Use disease-free seed and resistant varieties. Control grassy weeds that are also hosts to the pathogen. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Northern Corn Leaf Blight of Corn - Exserohilum or Helminthosporium Fungus

Non-Pesticide

Rotate to non-host crops for at least 1 year. Varieties with resistance are available. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

Aproach (2.08SC) (picoxystrobin) | 3-12 fl. oz. per acre. Use 3-6 fl. oz rate for single application for early disease control between V4 and V7. Use the 6-12 fl. oz. rate for repeated applications for continued season long control between VT and R3. REI: 12-hour. PHI: 7-day. FRAC 11.

azoxystrobin products (azoxystrobin) | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. REI: 4-hour. PHI: 7-day. FRAC 11.

chlorothalonil products (chlorothalonil) | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 14-day. FRAC M5.

Elatus (WG) (azoxystrobin, benzovindiflupyr) | 5-7.3 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC 7.

Headline (SC) (2.08) (pyraclostrobin) | 6-12 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11.

Headline AMP (pyraclostrobin, metconazole) | 10-14.4 fl. oz. per acre. REI: 12-hour. PHI: 20-day. FRAC 11, FRAC 3.

mancozeb products (mancozeb) | Several formulations of mancozeb (Dithane, Manzate, Pennczeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 7-day. FRAC M3.

Priaxor (fluxapyroxad, pyraclostrobin) | 4-8 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 11.

propiconazole products (propiconazole) | 2-4 fl. oz. per acre. PropiMax EC and Tilt are labeled. REI: 12-hour. PHI: 14-day. FRAC 3.

Quilt (SE) (azoxystrobin, propiconazole) | 7-14 fl. oz. per acre. Use lower rate for early season applications and increase rate with disease pressure. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC 3.

Stratego (propiconazole, trifloxystrobin) | 10 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 3, FRAC 11.
Sweet Corn - Diseases

**tebuconazole products (tebuconazole)** | 4-6 fl. oz. per acre.
There are many brand names (Monsoon, Onset, Vibe) with 3.6 lbs. a.i. per gallon that use the same rate. In sweet corn, REI is longer than the PHI, and pickers may require PPE if timing is not planned. REI: 12-hour to 18-day. PHI: 7-day. FRAC 3.

**Northern Corn Leaf Spot of Corn - Bipolaris Fungus**

**Non-Pesticide**
Rotate to non-host crops for at least 1 year. Varieties with resistance are available. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

**Pesticide**

**Aproach (2.08SC) (picoxystrobin)** | 3-12 fl. oz. per acre. Use 3-6 fl. oz rate for single application for early disease control between V4 and V7. Use the 6-12 fl. oz. rate for repeated applications for continued season long control between VT and R3. REI: 12-hour. PHI: 7-day. FRAC 11.

**Azoxystrobin products (azoxystrobin)** | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. REI: 4-hour. PHI: 7-day. FRAC 11.

**Chlorothalonil products (chlorothalonil)** | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 14-day. FRAC M5.

**Elatus (WG) (azoxystrobin, benzovindiflupyr)** | 5-7.3 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC 7.

**Headline (SC) (2.08) (pyraclostrobin)** | 6-12 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11.

**Headline AMP (pyraclostrobin, metconazole)** | 10-14.4 fl. oz. per acre. REI: 12-hour. PHI: 20-day. FRAC 11, FRAC 3.

**Mancozeb products (mancozeb)** | Several formulations of mancozeb (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 7-day. FRAC M3.

**Priaxor (fluxapyroxad, pyraclostrobin)** | 4-8 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 11.

**Propiconazole products (propiconazole)** | 2-4 fl. oz. per acre. PropiMax EC and Tilt are labeled. REI: 12-hour. PHI: 14-day. FRAC 3.

**Quilt (SE) (azoxystrobin, propiconazole)** | 7-14 fl. oz. per acre. Use lower rate for early season applications and increase rate with disease pressure. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC 3.

**Stratego (propiconazole, trifloxystrobin)** | 10 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 3, FRAC 11.

**Tebuconazole products (tebuconazole)** | 4-6 fl. oz. per acre. There are many brand names (Monsoon, Onset, Vibe) with 3.6 lbs. a.i. per gallon that use the same rate. In sweet corn, REI is longer than the PHI, and pickers may require PPE if timing is not planned. REI: 12-hour to 18-day. PHI: 7-day. FRAC 3.

Rust of Multiple Crops - Puccinia Fungus

This pathogen can severely reduce yields of grain corn late in the season through defoliation of the plant, but because sweet corn is harvested long before maturity they are less impacted. If rust shows up before tassel then it is worth spraying for in sweet corn to keep healthy leaves until harvest.

**Non-Pesticide**
Plant resistant hybrids. Sweet corn hybrid resistance to rust will depend on the hybrid's particular Rp-resistant gene, its general (background) resistance, and the race(s) of the rust prevalent in the planting.

**Pesticide**

**Aproach (2.08SC) (picoxystrobin)** | 3-12 fl. oz. per acre. Use 3-6 fl. oz rate for single application for early disease control between V4 and V7. Use the 6-12 fl. oz. rate for repeated applications for continued season long control between VT and R3. REI: 12-hour. PHI: 7-day. FRAC 11.

**Azoxystrobin products (azoxystrobin)** | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. REI: 4-hour. PHI: 7-day. FRAC 11.

**Chlorothalonil products (chlorothalonil)** | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 14-day. FRAC M5.

**Elatus (WG) (azoxystrobin, benzovindiflupyr)** | 5-7.3 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC 7.

**Headline (SC) (2.08) (pyraclostrobin)** | 6-12 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11.

**Headline AMP (pyraclostrobin, metconazole)** | 10-14.4 fl. oz. per acre. REI: 12-hour. PHI: 20-day. FRAC 11, FRAC 3.

**Mancozeb products (mancozeb)** | Several formulations of mancozeb (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 7-day. FRAC M3.

**Priaxor (fluxapyroxad, pyraclostrobin)** | 4-8 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 11.
propiconazole products (propiconazole) | 2-4 fl. oz. per acre. PropiMax EC and Tilt are labeled. REI: 12-hour. PHI: 14-day. FRAC 3.

Quilt (SE) (azoxystrobin, propiconazole) | 10.5-14.0 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 11, FRAC 3.

Stratego (propiconazole, trifloxystrobin) | 10 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 3, FRAC 11.

tebuconazole products (tebuconazole) | 4-6 fl. oz. per acre. There are many brand names (Monsoon, Onset, Vibe) with 3.6 lbs. a.i. per gallon that use the same rate. In sweet corn, REI is longer than the PHI, and pickers may require PPE if timing is not planned. REI: 12-hour to 18-day. PHI: 7-day. FRAC 3.

Smut of Corn - Ustilago Fungus
This pathogen is common at low levels, but it can be worse when roots and stalks are damaged from close cultivation that nips the roots, wind lodging and wind sandblasting, or in times of drought stress. When under drought stress, tasseling and silking do not line up. Tassels come first and silks last longer than usual because they are not getting pollinated. This provides an entry for the fungus into the ears. Flowering patterns and response to environmental stress are unique to each variety. Planting field position in relation to prevailing winds, timing and variety are likely factors for disease occurrence.

Non-Pesticide
Some hybrids tend to have fewer infections. Use past experience to choose successful hybrids. Avoid mechanical damage to corn plant. Avoid plant stresses that affect pollen production and silk emergence.

Southern Corn Leaf Blight of Corn - Bipolaris Fungus

Non-Pesticide
Rotate to non-host crops for at least 1 year. Varieties with resistance are available. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide
Approach (2.08SC) (picoxystrobin) | 3-12 fl. oz. per acre. Use 3-6 fl. oz rate for single application for early disease control between V4 and V7. Use the 6-12 fl. oz. rate for repeated applications for continued season long control between VT and R3. REI: 12-hour. PHI: 7-day. FRAC 11.

azoxystrobin products (azoxystrobin) | Use 2 lb. a.i. per gallon formulations (Quadris) at 6.0-15.5 fl. oz. per acre. Use 3.3 lb. per gallon formulations (Azteroid) at 3.9-9.7 fl. oz. per acre. REI: 4-hour. PHI: 7-day. FRAC 11.

chlorothalonil products (chlorothalonil) | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 14-day. FRAC M5.

Elatus (WG) (azoxystrobin, benzovindiflupyr) | 5-7.3 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC 7.

Headline (SC) (2.08) (pyraclostrobin) | 6-12 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11.

Headline AMP (pyraclostrobin, metconazole) | 10-14.4 fl. oz. per acre. REI: 12-hour. PHI: 20-day. FRAC 11, FRAC 3.

mancozeb products (mancozeb) | Several formulations of mancozeb (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 7-day. FRAC M3.

Priaxor (fluxapyroxad, pyraclostrobin) | 4-8 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 7, FRAC 11.

propiconazole products (propiconazole) | 2-4 fl. oz. per acre. PropiMax EC and Tilt are labeled. REI: 12-hour. PHI: 14-day. FRAC 3.

Quilt (SE) (azoxystrobin, propiconazole) | 7-14 fl. oz. per acre. Use lower rate for early season applications and increase rate with disease pressure. REI: 12-hour. PHI: 14-day. FRAC 11.

Stratego (propiconazole, trifloxystrobin) | 10 fl. oz. per acre. REI: 12-hour. PHI: 14-day. FRAC 3, FRAC 11.

tebuconazole products (tebuconazole) | 4-6 fl. oz. per acre. There are many brand names (Monsoon, Onset, Vibe) with 3.6 lbs. a.i. per gallon that use the same rate. In sweet corn, REI is longer than the PHI, and pickers may require PPE if timing is not planned. REI: 12-hour to 18-day. PHI: 7-day. FRAC 3.

Stewart's Wilt of Corn - Pantoea Bacteria
This bacterial disease is spread by overwintered flea beetles in the spring time. If the plants become infected at the seedling stage, they become severely stunted and have white striping on the leaves and internal browning of stem tissue. Infections after the seedling stage will cause leaf blight and are generally not as economically severe as seedling infections. Early infection of seedling plants can lead to total yield loss in some plantings. Severity of the disease is directly related to overwintering survival of the flea beetle, and beetle survival depends directly on temperature. See insect section.

Non-Pesticide
Plant wilt-resistant, or partially resistant hybrids. Monitor overwintering flea beetle population.
Sweet Corn - Insects

Pesticide

Insecticides | Use an insecticide or seed treatment to control the flea beetles that transmit Stewart's wilt. Insecticide treatments are more likely to be necessary in season following a mild winter and when using susceptible varieties.

Viruses of Multiple Crops - Multiple Pathogens

Non-Pesticide

Virus diseases include maize dwarf mosaic, chlorotic dwarf, wheat streak mosaic. Plant resistant or partially resistant varieties. Control Johnson grass and volunteer wheat.

Sweet Corn - Insects

Reviewed by Laura Ingwell – Nov 2020

Recommended Controls

Aphids

Non-Pesticide

Heavy corn leaf aphid infestations are often limited to early-season plantings that develop on late whorl to early tassel sweet corn. During this time, several beneficial organisms (including lady beetles, minute pirate bugs, and parasitoids) will keep those infestations in check.

Pesticide

Asana XL (0.66EC) (esfenvalerate) | 2.9-9.6 fl. oz. per acre. Caterpillars include cutworms, corn borers, and earworns. Do not exceed 9.6 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Assail 30SG (acetamiprid) | Use 30SG formulations at 2.1-2.9 oz. per acre and do not exceed 11.2 oz. per acre per season. Use 70WP formulations at 0.9-1.2 oz. per acre and do not exceed 4.8 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 4A.

Capture LFR (1.5) (bifenthrin) | 2.8-8.5 fl. oz. per acre. Apply as a foliar spray. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Lannate LV (2.4L) (methomyl) | 0.75 - 1.5 pts. per acre. Do not exceed 21 pts. per acre per crop. Some varieties are susceptible to methomyl injury, determine crop safety before full scale spraying. REI: 48-hour. PHI: 0-day for ears, 3-day for forage. IRAC 1A. RUP.

Mustang Maxx (0.8) (zeta-cypermethrin) | 2.8-4.0 fl. oz. per acre. For armyworms, corn borers, cutworms, and earworns. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

Caterpillars

All moths can be monitored with pheromone traps. When moths are being caught in traps, it means they are mating and laying eggs in the crop.

European corn borer (ECB) eggs are laid on leaves, usually on the undersides, in the region of the ear. Larvae feed on the leaves and later may migrate to the ears (if present). Corn borers can be controlled by spraying during the late whorl, tasseling, and silking stages. The migrating larvae should contact a lethal dose of insecticide while moving to the ear zone.

Western bean cutworm (WBC) eggs are laid on the top surface of leaves on corn that is in pre-tassel. They have one generation per year from mid-July to early August. Sweet corn that has well-developed ears during flight is less likely to be infested; however, tillers (suckers) that have not tasseled may be attractive for egglaying.

Corn earworm (CEW) eggs are laid directly on green silks. The larvae that hatch from those eggs will follow the silks down into the tips of the ears. Corn earworms must be controlled by directing sprays at the silks, such as using drop nozzles, so larvae will immediately contact the insecticide after hatching, prior to being protected once they enter the ear.

Fall armyworm (FAW) eggs are laid on corn leaves, and newly emerged larvae consume large quantities of foliage as they rapidly grow. FAW will feed on all stages and parts of the plant, but the pre-tassel whorl is preferred. Caterpillars can directly penetrate husks and damage ears.

These caterpillars are likely to co-occur in a sweet corn field during some parts of the year. Do not treat separately for European corn borer and corn earworm

ECB: treatment is justified when more than 10 moths per night are caught in traps while corn is in late whorl stage or when 20 percent or more of the plants show larval feeding. One application during the late whorl stage, followed by additional treatments every five days up until seven days of harvest, usually provides adequate control.

WBC: treatment is justified when moths are being caught in pheromone traps or larval damage is present when corn is in late whorl stage.

CEW: treatment is justified when moths are being caught in traps while green silks are present. In general, the higher the moth catches, the shorter the interval between sprays. If fewer than 5 moths are being caught per night, a five-day spray interval should be adequate. As moth catches approach 50 to 100 per night, a two- to three-day spray interval would be more appropriate. If no field corn in the area is silking, moths will lay eggs primarily on silking sweet corn. In this situation, use a threshold of 1-3 moths per trap per night. Stop treating for corn earworms when 90 percent of the silks are brown.
**Pesticide**

**Asana XL (0.66EC) (esfenvalerate)** | 2.9-9.6 fl. oz. per acre. Caterpillars include cutworms, corn borers, and earworms. Do not exceed 9.6 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Baythroid XL (1EC) (beta-cyfluthrin)** | 0.8-2.8 fl. oz. per acre. For armyworms, corn borers, cutworms, and earworms. Do not exceed 28 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Besiège (ZC) (chlorantraniliprole, lambda-cyhalothrin)** | 6-10 fl. oz. per acre. For armyworms, corn borers, cutworms, and earworms. Do not exceed 31 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 28, IRAC 3A. RUP.

**Brigade 2EC (bifenthrin)** | For armyworms, and cutworms use 2EC formulations at 0.3 fl. oz. per 1,000 linear ft. of row in a minimum of 3 gals. of finished spray as a 5- to 7-inch band over an open seed furrow (T-band) and do not exceed 6.4 fl. oz. per acre per season at plant application. For armyworms, corn borers, cutworms, and earworms, use 2EC formulations as a foliar application at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season (including any soil applications). Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for sweet corn. Allow 7 days between applications. REI: 12-hour. PHI: 30-day for soil applications, 1-day for foliar applications. IRAC 3A. RUP.

**Bt varieties (Cry1Ab, Cry2Ab, Cry1A.105, Vip3A)** | There are four Bt proteins bred into sweet corn for control of armyworms, corn borers, earworms, and cutworms. Cry1Ab is effective on European corn borer but has never been effective on western bean cutworm. It is moderately effective on fall armyworm and corn earworm. Field corn with this single trait is not marketed for control of corn earworm or fall armyworm, but sweet corn still is. To slow down counter-resistance in pest populations the field corn market is moving away from single-trait varieties. Syngenta Attribute I Series sweet corn has this trait. Cry2Ab2 is always paired with Cry1A.105 and is effective on European corn borer and fall armyworm. It is moderately effective on western bean cutworm, and in some places is no longer effective on corn earworm. There are reports of corn earworm resistance in North Carolina field corn, and sweet corn in Maryland. Seminis Performance Series has these traits. Vip3A is the only effective protein on corn earworm, western bean cutworm, and fall armyworm. Syngenta Attribute II and Attribute Plus series corn has both Vip3A and Cry1Ab traits. IRAC 11A.

**Capture LFR (1.5) (bifenthrin)** | For armyworms, corn borers, cutworms, and earworms. Apply to soil as pre-plant or pre-emergent application at 0.2-0.78 fl. oz. per acre per 1,000 linear ft. row at planting, or as a foliar spray at 2.8-8.5 fl. oz. per acre. Do not exceed 17 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Coragen (1.67SC) (chlorantraniliprole)** | 3.5-7.5 fl. oz. per acre. For armyworms, corn borers, cutworms, and earworms. Do not exceed 15.4 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

**Entrust SC (2) (spinosad)** | For armyworms, corn borers, cutworms, and earworms. Use 2SC formulations at 1.5-6.0 fl. oz. per acre and do not exceed 21 fl. oz. per acre per season. Use 80WP formulations at 0.5-2.0 oz. per acre and do not exceed 9 oz. per acre per season. Allow 7 days between applications. Observe resistance management restrictions. REI: 4-hour. PHI: 1-day. IRAC 5. OMRI-listed.

**Ethos 3D (bifenthrin, Bacillus amyloliquefaciens strain D-747)** | 0.21 to 1.05 fl. oz per 1,000 linear feet of row. Armyworm and cutworm caterpillars. Apply in-furrow with seed. Must be applied with a 3RIVE 3D system. Do not apply more than 0.2 lb. bifenthrin active ingredient per acre per season. REI: 12-hour. IRAC 3A, FRAC 44. RUP.

**Force CS (2.1SC) (tefluthrin)** | For cutworms. Apply Force Evo (2.1CS) at 0.46-0.57 fl. oz. per 1,000 linear ft. of row. Apply Force 6.5G at 1.8-2.3 oz. per 1,000 linear ft. of row. Apply Force 3G at 3-4 oz. per 1,000 linear ft. of row. Apply Force 10G at 1.25-1.5 oz. per 1,000 linear ft. or row. Apply at planting. Do not exceed 1 application per crop. REI: 12-hour. IRAC 3A. RUP.

**Helicovex (0.6) (Helicoverpa armigera nucleopolyhedrovirus strain BV-0003)** | 0.5-2.5 fl. oz. per acre. For corn earworm only. Apply 0.5-1.5 fl. oz. per acre every 3 days during silking. REI: 4-hour. PHI: 0-day. IRAC 31. OMRI-listed.

**Lannate LV (2.4L) (methomyl)** | 0.75 - 1.5 pts. per acre. For armyworms, corn borers, cutworms, and earworms. Do not exceed 21 pts. per acre per crop. Has ovidical properties. Some varieties are susceptible to methomyl injury, determine crop safety before full scale spraying. REI: 48-hour. PHI: 0-day for ears, 3-day for forage. IRAC 1A. RUP.

**Lorsban 4E (chlorpyrifos)** | For armyworms, corn borers, cutworms, and earworms. Use 4E formulations at 1-2 pts. per acre pre-plant, at-plant, pre-emergence, or post-emergence and do not exceed 6 pts. per acre per season. Use 15G formulations at 8 oz. per acre pre-plant, at-plant, or pre-emergence and do not exceed 19.5 lbs. per acre per season. Use 75WG formulations at 0.67-1.33 lbs. per acre pre-plant, at-plant, pre-emergence, or post-emergence and do not exceed 4 lbs. per acre per season. REI: 24-hour to 3-day. PHI: 21-day. IRAC 1B. RUP.

**Mustang Maxx (0.8) (zeta-cypermethrin)** | 2.8-4.0 fl. oz. per acre. For armyworms, corn borers, cutworms, and earworms. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

**Perm-Up 25DF (permethrin)** | For armyworms, corn borers, cutworms, and earworms. Use 25W, 25WP, and 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2 oz. per acre per season. Allow 7 days between applications. Do not exceed 32 fl. oz. per acre per season. Apply...
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every 3-5 days as needed. Control is poor when temperatures are above 90 degrees F. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Radiant ISC (spinetoram)** | 3-6 fl. oz. per acre. For armyworms, corn borers, cutworms, and earworns. Do not exceed 36 fl. oz. per acre per season. Do not make applications less than 4 days apart. The only cutworm labeled is the western bean cutworm. REI: 4-hour. PHI: 1-day for ears. 3-day for forage. IRAC 5.

**Sevin XLR Plus (4SC) (carbaryl)** | 2 qts. per acre. For armyworms, corn borers, earworns and Western bean cutworm only. Do not exceed 8 applications or 16 qts. per acre per season. Machine harvest only. REI: 12-hour. PHI: 2-days for ears. 14-day for forage. IRAC 1A.

**Warrior II (2.08CS) (lambda-cyhalothrin)** | For armyworms, corn borers, earworns and cutworms, use a foliar application at 1.28-1.92 fl. oz. per acre. Do not exceed 30.72 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 3A. RUP.

**Warrior II (2.08CS) (lambda-cyhalothrin)** | 0.33 oz. per 1,000 linear ft. of row. For cutworm caterpillars and corn rootworm larvae use a soil application at 0.33 fl. oz. per 1,000 ft. of row. Apply in furrow or as a 5- to 7-inch band. Do not exceed 30.72 fl. oz. per acre per season. REI: 24-hour. PHI: 21-day. IRAC 3A. RUP.

**Corn Rootworm Beetles**

If few or no rootworm beetles were present in the field in the previous year, you grew sweet corn in a field the previous year and followed a regular spray schedule during silking, there is little chance of a damaging infestation.

Corn rootworm adults may prevent pollination by feeding on green silks. Treat when silks are being clipped.

**Pesticide**

**Assail 30SG (acetamiprid)** | Use 30SG formulations at 4.0-5.3 oz. per acre and do not exceed 11.2 oz. per acre per season. Use 70WP formulations at 1.7-2.3 oz. per acre and do not exceed 4.8 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Baythroid XL (1EC) (beta-cyfluthrin)** | 0.8-2.8 fl. oz. per acre. For armyworms, corn borers, cutworms, and earworns. Do not exceed 28 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Besiege (ZC) (chlorantraniliprole, lambda-cyhalothrin)** | 6-10 fl. oz. per acre. Do not exceed 31 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 28, IRAC 3A. RUP.

**Brigade 2EC (bifenthrin)** | 2.1-6.4 fl. oz. per acre. Use 2EC formulations as a foliar application at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season (including any soil applications). Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for sweet corn. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Mustang Maxx (0.8) (zeta-cypermethrin)** | 2.24-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

**Perm-Up 25DF (permethrin)** | Use 25W, 25WP, and 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2 oz. per acre per season. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Apply every 3-5 days as needed. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Corn Rootworm Larvae**

If few or no rootworm beetles were present in the field in the previous year, or you grew sweet corn in a field the previous year and followed a regular spray schedule during silking, there is little chance of a damaging infestation.

Corn rootworm adults may prevent pollination by feeding on green silks. Treat when silks are being clipped.

**Pesticide**

**Aztec 2.1G (cyfluthrin, phostebupirim)** | Aztec 2.1G application rate 6.7 oz. per 1,000 linear ft. of row. Aztec 4.67G application rate 3.0 oz. per 1,000 linear ft. of row. Apply in furrow in a 7-inch band over the row and behind the planter shoe in front of the press wheel. Incorporate with tines and drag chains. REI: 48-hour. IRAC 3A, IRAC 1B. RUP.

**Brigade 2EC (bifenthrin)** | Use 2EC formulations at 0.3 fl. oz. per 1,000 linear ft. of row in a minimum of 3 gals. of finished spray as a 5- to 7-inch band over an open seed furrow (T-band) and do not exceed 6.4 fl. oz. per acre per season at plant application. Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for sweet corn. Allow 7 days between applications. REI: 12-hour. PHI: 30-day. IRAC 3A. RUP.

**Capture LFR (1.5) (bifenthrin)** | 0.39-0.98 fl. oz. per 1,000 linear ft. of row. Apply at planting in furrow or a T-band. See label. REI: 12-hour. IRAC 3A. RUP.

**Counter 20G Smartbox (terbufos)** | 4.5-6.0 oz. per 1,000 linear ft. or row. Do not exceed 1 application per acre per crop. REI: 48-hour. IRAC 1B. RUP.

**Ethos 3D (bifenthrin, Bacillus amyloliquefaciens strain D-747)** | 0.52 to 1.05 fl. oz. per 1,000 square feet Apply in-furrow with seed. Must be applied with a 3RIVE 3D system. Do not apply more than 0.2 lb. bifenthrin active ingredient per acre per season. REI: 12-hour. IRAC 3A, FRAC 44. RUP.

**Force CS (2.1SC) (tefluthrin)** | 0.46-0.57 fl. oz. per 1,000 linear ft. of row. Apply Force CS (2.1SC) at 0.46-0.57 fl. oz. per 1,000 linear ft. of row. Apply Force 6.5G at 1.8-2.3 oz. per 1,000 linear ft. of row. Apply Force 3G at 4-5 oz. per 1,000 liner ft. of row. Apply Force 10G at 1.25-1.5 oz. per 1,000 linear ft. or row.
Apply at planting. Do not exceed 1 application per crop. REI: 12-hour. IRAC 3A. RUP.

**Lorsban 4E (chlorpyrifos)** Use 4E formulations at 1-2 pts. per acre pre-plant, at-plant, preemergence, or postemergence and do not exceed 6 pts. per acre per season. Use 15G formulations at 8 oz. per acre pre-plant, at-plant, or preemergence and do not exceed 19.5 lbs. per acre per season. Use 75WG formulations at 0.67-1.33 lbs. per acre pre-plant, at-plant, preemergence, or postemergence and do not exceed 4 lbs. per acre per season. REI: 24-hour to 3-day. PHI: 21-day. IRAC 1B. RUP.

**Mocap 15G (ethoprop)** 8 oz. per 1,000 linear ft. of row. Apply in band over closed seed furrow and incorporate with tines or drag chains. Do not place in the furrow or in direct contact with the seed. Do not exceed 1 application per acre per crop. REI: 48-hour. IRAC 1B. RUP.

**Thimet 20G (phorate)** 4.5-6 oz. per 1,000 linear ft. of row. Place in a 7-inch band over the row behind the planter shoe and in front of or behind the press wheel and lightly incorporate. REI: 48-hour. IRAC 1B. RUP.

**Warrior II (2.08CS) (lambda-cyhalothrin)** 0.33 oz. per 1,000 linear ft. of row. For cutworm caterpillars and corn rootworm larvae use a soil application at 0.33 fl. oz. per 1,000 ft. of row. Apply in furrow or as a 5- to 7-inch band. Do not exceed 30.72 fl. oz. per acre per season. REI: 24-hour. PHI: 21-day. IRAC 3A. RUP.

**Flea Beetles**

**Non-Pesticide**

Plant varieties that are resistant to Stewart's wilt, which is vectored by flea beetles.

**Pesticide**

**Asana XL (0.66EC) (esfenvalerate)** 2.9-9.6 fl. oz. per acre. Caterpillars include cutworms, corn borers, and earworns. Do not exceed 9.6 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Assail 30SG (acetamiprid)** Use 30SG formulations at 4.0-5.3 oz. per acre and do not exceed 11.2 oz. per acre per season. Use 70WP formulations at 1.7-2.3 oz. per acre and do not exceed 4.8 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Baythroid XL (1EC) (beta-cyfluthrin)** 0.8-1.6 fl. oz. per acre. Do not exceed 28 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Besseige (ZC) (chioralantrinilprole, lambda-cyhalothrin)** 6-10 fl. oz. per acre. Do not exceed 31 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 28, IRAC 3A. RUP.

**Brigade 2EC (bifenthrin)** 2.1-6.4 fl. oz. per acre. Use 2EC formulations as a foliar application at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season (including any soil applications). Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for sweet corn. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Capture LFR (1.5) (bifenthrin)** 2.8-8.5 fl. oz. per acre. Apply as a foliar spray. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Lannate LV (2.4L) (methomyl)** 0.75 - 1.5 pts. per acre. Do not exceed 21 pts. per acre per crop. Some varieties are susceptible to methomyl injury, determine crop safety before full scale spraying. REI: 48-hour. PHI: 0-day for ears, 3-day for forage. IRAC 1A. RUP.

**Lorsban 4E (chlorpyrifos)** Use 4E formulations at 1-2 pts. per acre as a foliar spray or through irrigation and do not exceed 6 pts. per acre per season. Use 75WG formulations at 0.67-1.33 lbs. per acre as a foliar spray or through irrigation and do not exceed 4 lbs. per acre per season. REI: 24-hour to 3-day. PHI: 21-day. IRAC 1B. RUP.

**Mustang Maxx (0.8) (zeta-cypermethrin)** 2.24-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

**Perm-Up 25DF (permethrin)** Use 25W, 25WP, and 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2 oz. per acre per season. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season. Apply every 3-5 days as needed. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

**Sevin XLR Plus (4SC) (carbaryl)** 1-2 qts. per acre. Do not exceed 8 applications or 16 qts. per acre per season. Machine harvest only. REI: 12-hour. PHI: 2-day. IRAC 1A.

**Thimet 20G (phorate)** 4.5-6 oz. per 1,000 linear ft. of row. Place in a 7-inch band over the row behind the planter shoe and in front of or behind the press wheel and lightly incorporate. REI: 48-hour. IRAC 1B. RUP.

**Warrior II (2.08CS) (lambda-cyhalothrin)** 1.28-1.92 fl. oz. per acre. Foliar Application. Do not exceed 30.72 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 3A. RUP.

**Seed and Root Maggots**

**Non-Pesticide**

Plant after the peak flight and egg-laying window of the first generation of flies looking to lay eggs around 360 GDD base 40. Handle seeds carefully to prevent cracking. Plow winter vegetation under early in the spring and thoroughly cover to limit attractiveness of rotting vegetation to the first generation of flies to lay eggs on.

**Pesticide**

**Aztec 2.1G (cyfluthrin, phostebupirim)** Aztec 2.1G application rate 6.7 oz. per 1,000 linear ft. of row. Aztec 4.67G
Seed Corn - Insects

application rate 3.0 oz. per 1,000 linear ft. of row. Apply in furrow in a 7-inch band over the row and behind the planter shoe in front of the press wheel. Incorporate with tines and drag chains. REI: 48-hour. IRAC 3A, IRAC 1B. RUP.

**Brigade 2EC (bifenthrin)** | Use 2EC formulations at 0.3 fl. oz. per 1,000 linear ft. of row in a minimum of 3 gals. of finished spray as a 5- to 7-inch band over an open seed furrow (T-band) and do not exceed 6.4 fl. oz. per acre per season at plant application. Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for sweet corn. Allow 7 days between applications. REI: 12-hour. PHI: 30-day. IRAC 3A. RUP.

**Counter 20G Smartbox (terbufos)** | 4.5-6.0 oz. per 1,000 linear ft. or row. Do not exceed 1 application per acre per crop. REI: 48-hour. IRAC 1B. RUP.

**Ethos 3D (bifenthrin, Bacillus amyloliquefaciens strain D-747)** | 0.21 to 1.05 fl. oz. per 1,000 linear feet of row. Armyworm and cutworm caterpillars. Apply in-furrow with seed. Must be applied with a 3RIVE 3D system. Do not apply more than 0.2 lb. bifenthrin active ingredient per acre per season. REI: 12-hour. IRAC 3A, FRAC 44. RUP.

**Force CS (2.1SC) (tefluthrin)** | 0.46-0.57 fl. oz. per 1,000 linear ft. of row. Apply Force Evo (2.1CS) at 0.46-0.57 fl. oz. per 1,000 linear ft. of row. Apply Force 6.5G at 1.8-2.3 oz. per 1,000 linear ft. of row. Apply Force 3G at 4-5 oz. per 1,000 linear ft. of row. Apply Force 10G at 1.25-1.5 oz. per 1,000 linear ft. or row. Apply at planting. Do not exceed 1 application per crop. REI: 12-hour. IRAC 3A, FRAC 44. RUP.

**Lorsban 4E (chlorpyrifos)** | Use 4E formulations at 1-2 pts. per acre pre-plant, at-plant, preemergence, or postemergence and do not exceed 6 pts. per acre per season. Use 15G formulations at 8 oz. per acre pre-plant, at-plant, or preemergence and do not exceed 19.5 lbs. per acre per season. Use 75WG formulations at 0.67-1.33 lbs. per acre pre-plant, at-plant, preemergence, or postemergence and do not exceed 4 lbs. per acre per season. REI: 24-hour to 3-day. PHI: 21-day. IRAC 1B. RUP.

**Thimet 20G (phorate)** | 4.5-6 oz. per 1,000 linear ft. of row. Place in a 7-inch band over the row behind the planter shoe and in front of or behind the press wheel and lightly incorporate. REI: 48-hour. IRAC 1B. RUP.

**Seedcorn Beetles**

**Pesticide**

**Aztec 2.1G (cyfluthrin, phostebupirim)** | Aztec 2.1G application rate 6.7 oz. per 1,000 linear ft. of row. Aztec 4.67G application rate 3.0 oz. per 1,000 linear ft. of row. Apply in furrow in a 7-inch band over the row and behind the planter shoe in front of the press wheel. Incorporate with tines and drag chains. REI: 48-hour. IRAC 3A, IRAC 1B. RUP.

**Brigade 2EC (bifenthrin)** | Use 2EC formulations at 0.3 fl. oz. per 1,000 linear ft. of row in a minimum of 3 gals. of finished spray as a 5- to 7-inch band over an open seed furrow (T-band) and do not exceed 6.4 fl. oz. per acre per season at plant application. Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for sweet corn. Allow 7 days between applications. REI: 12-hour. PHI: 30-day. IRAC 3A. RUP.

**Capture LFR (1.5) (bifenthrin)** | 0.2-0.78 fl. oz. per 1,000 linear bed ft. of row. Apply at planting in furrow or a T-band. See label. REI: 12-hour. IRAC 3A. RUP.

**Counter 20G Smartbox (terbufos)** | 4.5-6.0 oz. per 1,000 linear ft. or row. Do not exceed 1 application per acre per crop. REI: 48-hour. IRAC 1B. RUP.

**Ethos 3D (bifenthrin, Bacillus amyloliquefaciens strain D-747)** | 0.21 to 1.05 fl. oz. per 1,000 linear feet of row. Armyworm and cutworm caterpillars. Apply in-furrow with seed. Must be applied with a 3RIVE 3D system. Do not apply more than 0.2 lb. bifenthrin active ingredient per acre per season. REI: 12-hour. IRAC 3A, FRAC 44. RUP.

**Force CS (2.1SC) (tefluthrin)** | 0.46-0.57 fl. oz. per 1,000 linear ft. of row. Apply Force Evo (2.1CS) at 0.46-0.57 fl. oz. per 1,000 linear ft. of row. Apply Force 6.5G at 1.8-2.3 oz. per 1,000 linear ft. of row. Apply Force 3G at 4-5 oz. per 1,000 linear ft. of row. Apply Force 10G at 1.25-1.5 oz. per 1,000 linear ft. or row. Apply at planting. Do not exceed 1 application per crop. REI: 12-hour. IRAC 3A. RUP.

**Lorsban 4E (chlorpyrifos)** | Use 4E formulations at 1-2 pts. per acre pre-plant, at-plant, preemergence, or postemergence and do not exceed 6 pts. per acre per season. Use 15G formulations at 8 oz. per acre pre-plant, at-plant, or preemergence and do not exceed 19.5 lbs. per acre per season. Use 75WG formulations at 0.67-1.33 lbs. per acre pre-plant, at-plant, preemergence, or postemergence and do not exceed 4 lbs. per acre per season. REI: 24-hour to 3-day. PHI: 21-day. IRAC 1B. RUP.

**Thimet 20G (phorate)** | 4.5-6 oz. per 1,000 linear ft. of row. Place in a 7-inch band over the row behind the planter shoe and in front of or behind the press wheel and lightly incorporate. REI: 48-hour. IRAC 1B. RUP.
Stink Bugs

Pesticide

Baythroid XL (1EC) (beta-cyfluthrin) | 0.8-2.8 fl. oz. per acre. For armyworms, corn borers, cutworms, and earworms. Do not exceed 28 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

Besiège (ZC) (chlorantraniliprole, lambda-cyhalothrin) | 6-10 fl. oz. per acre. Do not exceed 31 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 28, IRAC 3A. RUP.

Brigade 2EC (bifenthrin) | 2.1-6.4 fl. oz. per acre. Use 2EC formulations as a foliar application at 2.1-6.4 fl. oz. per acre and do not exceed 12.8 fl. oz. per acre per season (including any soil applications). Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for sweet corn. Allow 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Capture LFR (1.5) (bifenthrin) | 2.8-8.5 fl. oz. per acre. Apply as a foliar spray. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Hero (bifenthrin, zeta-cypermethrin) | 4.0-10.3 fl. oz. per acre. Do not exceed 27.39 fl. oz. per acre per season. Allow 3 days between applications. REI: 12-hour. PHI: 3-day. IRAC 3A. RUP.

Lannate LV (2.4L) (methomyl) | 1.5 pts. per acre. Brown Marmorated Stink Bug only. Do not exceed 21 pts. per acre per crop. Some varieties are susceptible to methomyl injury, determine crop safety before full scale spraying. REI: 48-hour. PHI: 0-day for ears, 3-day for forage. IRAC 1A. RUP.

Warrior II (2.08CS) (lambda-cyhalothrin) | 1.28-1.92 fl. oz. per acre. Foliar Application. Do not exceed 30.72 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 3A. RUP.

Wireworms

Pesticide

Aztec 2.1G (cyfluthrin, phostebupirim) | Aztec 2.1G application rate 6.7 fl. oz. per 1,000 linear ft. of row. Aztec 4.67G application rate 3.0 oz. per 1,000 linear ft. of row. Apply in furrow in a 7-inch band over the row and behind the planter shoe in front of the press wheel. Incorporate with tines and drag chains. REI: 48-hour. IRAC 3A, IRAC 1B. RUP.

Brigade 2EC (bifenthrin) | Use 2EC formulations at 0.3 fl. oz. per 1,000 linear ft. of row in a minimum of 3 gals. of finished spray as a 5- to 7-inch band over an open seed furrow (T-band) and do not exceed 6.4 fl. oz. per acre per season at plant application. Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for sweet corn. Allow 7 days between applications. REI: 12-hour. PHI: 30-day. IRAC 3A. RUP.

Capture LFR (1.5) (bifenthrin) | 0.2-0.78 fl. oz. per 1,000 linear bed ft. of row. Apply at planting in furrow or a T-band. See label. REI: 12-hour. IRAC 3A. RUP.

Counte 20G Smartbox (terbufos) | 4.5-6.0 oz. per 1,000 linear ft. or row. Do not exceed 1 application per acre per crop. REI: 48-hour. IRAC 1B. RUP.

Force CS (2.1SC) (tefluthrin) | 0.46-0.57 fl. oz. per 1,000 linear ft. of row. Apply Force Evo (2.1CS) at 0.46-0.57 fl. oz. per 1,000 linear ft. of row. Apply Force 6.5G at 1.8-2.3 oz. per 1,000 linear ft. of row. Apply Force 3G at 4-5 oz. per 1,000 linear ft. of row. Apply Force 10G at 1.25-1.5 oz. per 1,000 linear ft. or row. Apply at planting. Do not exceed 1 application per crop. REI: 12-hour. IRAC 3A. RUP.

Mocap 15G (ethoprop) | 8 oz. per 1,000 linear ft. of row. Apply in band over closed seed furrow and incorporate with tines or drag chains. Do not place in the furrow or in direct contact with the seed. Do not exceed 1 application per acre per crop. REI: 48-hour. IRAC 1B. RUP.

Seed treatments (thiamethoxam, mefenoxam, fludioxonil, azoxystrobin, thiabendazole, spinosad, abamectin) | Plant seed that has been treated with an insecticide prior to planting. Although most sweet corn seed has been treated with fungicide, it is seldom treated with an insecticide to prevent seed and seedling damage. Use diazinon, Cruiser, or Poncho. Follow label directions. IRAC 4A, FRAC 4, FRAC 12, FRAC 11, FRAC 1, IRAC 5, IRAC 6.

Thimet 20G (phorate) | 4.5-6 oz. per 1,000 linear ft. of row. Place in a 7-inch band over the row behind the planter shoe and in front of or behind the press wheel and lightly incorporate. REI: 48-hour. IRAC 1B. RUP.

Sweet Corn - Weeds

Recommended Controls

All Weeds

Weed control methods in sweet corn vary by production system and variety. The challenges for those who rely on herbicides include the chance of injuring crops under adverse weather, the relatively short residual of preemergence herbicides, and replant restrictions for other vegetable crops for certain corn herbicides that are shared with field crops.

For sweet corn that is no-till direct-seeded into a killed crop (such as after a rye cover crop, or wheat) growers often use a burndown herbicide with a preemergence herbicide. If residue is not sufficient to suppress later-emerging weeds, growers may use postemergence herbicides, or shielded applications of nonselective herbicides.

For sweet corn direct-seeded into tilled soil, growers often combine one or more preemergence herbicides at planting with one or more cultivations. Sometimes, growers also apply a preemergence herbicide at the last cultivation to improve control of late-emerging weeds. If needed, growers may use...
postemergence herbicides or shielded applications of nonselective herbicides.

For early sweet corn direct-seeded under vented plastic row cover, some herbicides are applied before laying the plastic to prevent germinating weeds along with the early corn. But, without good incorporation or irrigation for activation these rows will usually need extensive clean up after the row-cover comes off.

There are also sweet corn varieties that are tolerant of glyphosate (RoundUp-Ready), glufosinate (Liberty-Link), or sethoxydim (Poast-Protected) applications over top of the crop.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table. Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

Non-Pesticide

Weed pressure may be substantially reduced when growers prepare seedbeds several weeks in advance of planting and kill the first one or two flushes of weeds before planting without stirring up new weed seeds. Later plantings of sweet corn lend themselves to this stale seedbed practice because they are often planted after common weeds have emerged in tilled soil. Uniform and close plant spacing in the row promotes rapid canopy cover, and fresh market growers can keep larger between row spacing clean with between row cultivation tools for hand-picking or towable mechanical harvesters. For densely populated broad acre mechanically-harvested processing crops, rolling cultivators on wide tool-bars offer effective high-speed cultivation.

Broadleaf and Grass Weeds - Postemergence

Pesticide

Accent Q (54.5WDG) (nicosulfuron) | 0.45-0.90 oz. per acre. Use 1 qt. of COC or 8 fl. oz. of NIS per 25 gals. of spray solution. Apply broadcast or with drop nozzles on corn up to 12 inches tall or up through 5 leaf collars. For corn 12-18 inches tall use drop nozzles. Do not apply to corn more than 18 inches tall or showing 6 leaf collars or more. Cultivars differ in sensitivity to this herbicide; get information on cultivars prior to use. Not recommended for use on corn previously treated with Counter, Lorsban, or Thimet insecticides. REI: 4-hour. WSSA 2.

Anthem (2.15SE) (pyroxasulfone, fluthiacet-methyl) | 2.5-6.5 fl. oz. per acre. Apply 4-13 fl. oz. of Anthem or 2-6.5 fl. oz. Anthem Maxx per acre. Adjust rate based on soil organic matter and texture, and pre or postemergence use, see label. Preplant surface applications are not recommended for sweet corn. Apply post from crop emergence through V4 growth stage. Add an adjuvant such as a NIS, COC, or MSO for best activity. Before applying to corn, confirm that your line has Anthem tolerance with your seed company or supplier to avoid injury to sensitive lines. Avoid postemergence application when crop foliage is wet or prior to or after a rain because a crop injury can occur. However, the crop will recover. Do not apply if crop is under stress and do not irrigate within 4 hours of a postemergence application. REI: 12-hour. PHI: 45-day. WSSA 15, WSSA 14.

Anthem ATZ (4.505) (atrazine, pyroxasulfone, fluthiacet-methyl) | 1.5-4 pts. per acre. Adjust rate based on soil organic matter and texture, and pre or postemergence use, see label. Preplant surface applications are not recommended for sweet corn. Apply post from crop emergence through V4 growth stage. Add an adjuvant such as a NIS, COC, or MSO. Before applying to corn, confirm that your line has Anthem selectivity with your seed company or supplier to avoid injury to sensitive lines. Avoid postemergence application when crop foliage is wet or prior to or after a rain because a crop response can occur. However, the crop will recover. Do not apply if crop is under stress and do not irrigate within 4 hours of a postemergence application. REI: 12-hour. PHI: 45-day. WSSA 5, WSSA 15, WSSA 14. RUP.

atrazine products (atrazine) | Apply 4L formulations at 1-2 qts. per acre and 90W formulations at 1.1-2.2 lbs. per acre. To control small, emerged broadleaves, include COC. Apply before planting and incorporate, after planting but before corn emerges, or after emergence but before corn is 12 inches tall. Many atrazine products are available. See labels for details. REI: 12-hour. WSSA 5. RUP.

glyphosate products (glyphosate) | 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations containing 3 lbs. ae per gal. at 16-48 fl. oz. per acre or formulations containing 4.5 lbs. ae per gal. at 11-32 fl. oz. per acre. Broadcast before or after planting but before crop emerges, or apply up to 0.75 lb. acid equivalent between crop rows with wipers, hooded or shielded sprayers after corn is 12 inches tall. Use low rate for annuals and higher rates for perennials. See label for suggested application volume and adjuvants. For RoundUp-Ready sweet corn only - will kill other varieties: postemergence applications may be made over-the-top of corn through the 8 leaf-collar stage (V-8) or until corn is 30 inches tall. Drop nozzles are recommended if corn is more than 24 inches tall, and must be used if corn is more than 30 inches tall to prevent spraying into whorls. Do not apply to corn more than 30 inches tall or if it has reached the reproductive stage. See product label for maximum use rates. REI: 4 to 12-hour. PHI: 7-day. WSSA 9.

Impact (2.8) (topramezone) | 0.5-1 fl. oz. per acre. Add MSO or COC and urea ammonium nitrate (UAN), ammonium phosphate (10-34-0), or ammonium sulfate. See label for additive rates. Not recommended if products containing mesotrione have been or will be applied to crop. REI: 12-hour. PHI: 45-day. WSSA 27.

Laudis (3.5) (tembotrione) | 3 oz. per acre. Apply with 1% v/v MSO plus 8.5 lbs. of AMS per 100 gals. of spray solution. COC is less efficacious than MSO but can be used instead of MSO when broadleaves are the main target and conditions for control are excellent. Tank-mixing with atrazine will improve efficacy
and spectrum of weed species controlled. REI: 12-hour. PHI: 45-day. WSSA 27.

**Liberty 280 SL (2.34) (glufosinate)** | Apply 29-43 fl. oz. per acre as a burndown application prior to planting. For Liberty-Link sweet corn varieties only - will kill other varieties: apply 22 fl. oz. per acre postemergence. Do not exceed 2 postemergence applications per season. Applications must be at least 7 days apart. Add AMS at 3 lb. per acre. Also available as Interline herbicide. REI: 12-hour. PHI: 50-day. WSSA 10.

**paraquat products (paraquat)** | 2-4 pt. per acre of 2 lb. per gal. formulation or 1.3-2.7 pt. per acre of 3 lb. per gal. formulation. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS (0.25% v/v) per 25 gals. of solution. Apply before or after seeding but before crop emerges. Or apply after crop emergence and use a hooded or shielded sprayers to prevent spray from contacting crop. Or wait until corn is more than 10 inches tall and apply between rows using directed spray that reaches no higher than 3 inches up the corn stalk. Corn plants contacted by spray may be injured or killed. Certified applicators must successfully complete an EPA-approved training program before mixing, loading, and/or applying paraquat. REI: 12 to 24-hour. WSSA 22. RUP.

**Revulin Q (nicosulfuron, mesotrione)** | 3.4 to 4.0 oz. per acre. Use with NIS after emergence until 12 inches tall or 5 leaf-collar stage. Use drop nozzles for corn between 12 and 18 inches tall. Do not apply to sweet corn taller than 18 inches or at 6 leaf-collar stage or later. Do not use AMS or UAN adjuvants. Because of the adjuvant restrictions, better results will be obtained when applied to smaller weeds. Can use COC under dry conditions to improve weed control, but may increase crop injury. Possible hybrid sensitivity. REI: 12-hour. PHI: 45-day. WSSA 2, WSSA 27.

**Shieldex (3.33SC) (tolpyralate)** | 1-1.35 fl. oz. per acre. Apply as a broadcast spray over corn when weeds are small. Apply to corn up to 20 inches tall and showing no more than 6 leaf collars. Use higher rate for larger weeds. Add NIS or COC. Do not exceed 2 applications per year or 2.7 fl. oz. per acre per year. REI: 12-hour. PHI: 35-day. WSSA 27.

**Broadleaf and Grass Weeds - Preemergence**

**Pesticide**

**acetochlor + atrazine products (acetochlor, atrazine)** | Apply 2.2-3.4 qts. per acre Breakfree ATZ, 1.6 to 3 qts. per acre Breakfree ATZ Light or Keystone LA, 2.9-3.7 qts. per acre Degree Xtra, 2.5-5 qts. per acre FullTime, 1.8-3.3 qts. per acre Harness Xtra, 1.4-3 qts. per acre Harness Extra 5.6L, or 2.2-3.4 qts. per acre Keystone. Do not apply postemergence. Use lower rates on coarse soils with low organic matter. Apply before planting and incorporate, or apply after planting before sweet corn emerges. Do not apply to light textured soils specified in the label where ground water is at 30 ft. or less. REI: 12-hour. WSSA 15, WSSA 5. RUP.

**acetochlor products (acetochlor)** | Apply 1.5-3 pts. per acre for Harness 7E, 1.5-3.75 pts. per acre for Surpass 6.4EC, or 2-3 pts. per acre TopNotch 3.2M. Do not apply postemergence. Use lower rates on coarse soils with low organic matter. Apply before planting and incorporate, or apply after planting but before sweet corn emerges. May be mixed with atrazine or simazine. See label for details. Do not apply to light textured soils specified in the label where ground water is at 30 ft. or less. REI: 12-hour. WSSA 15.

**Acuron (atrazine, mesotrione, s-metolachlor, bicyclopyrone)** | 2.5 qts. per acre on soil with less than 3% organic matter; 3 qts. per acre on soil with more than 3% organic matter. For control of most broadleaf and grass weeds. Control may be reduced on soils with >10% organic matter. Do not apply after sweet corn has emerged or severe crop injury may occur. 18-month replant restriction for all crops except corn types (no restrictions); small grains (4 months); dry beans, potato, and soybean (10 months). Contains atrazine so state restrictions for atrazine apply. REI: 24-hour. PHI: 45-day for grazing or forage feeding, 60-day for forage harvest. WSSA 5, WSSA 27, WSSA 15. RUP.

**Anthem (2.15SE) (pyroxasulfone, fluthiacet-methyl)** | 2.5-6.5 fl. oz. per acre. Apply 4-13 fl. oz. of Anthem or 2-6.5 fl. oz. Anthem Maxx per acre. Adjust rate based on soil organic matter and texture, and pre or postemergence use, see label. Preplant surface applications are not recommended for sweet corn. Apply post from crop emergence through V4 growth stage. Add an adjuvant such as a NIS, COC, or MSO for best activity. Before applying to corn, confirm that your line has Anthem tolerance with your seed company or supplier to avoid injury to sensitive lines. Avoid postemergence application when crop foliage is wet or prior to or after a rain because a crop injury can occur. However, the crop will recover. Do not apply if crop is under stress and do not irrigate within 4 hours of a postemergence application. REI: 12-hour. PHI: 40-day. WSSA 15, WSSA 14.

**Anthem ATZ (4.505) (atrazine, pyroxasulfone, fluthiacet-methyl)** | 1.5-4 pts. per acre. Adjust rate based on soil organic matter and texture, and pre or postemergence use, see label. Preplant surface applications are not recommended for sweet corn. Apply post from crop emergence through V4 growth stage. Add an adjuvant such as a NIS, COC, or MSO for best activity. Before applying to corn, confirm that your line has Anthem selectivity with your seed company or supplier to avoid injury to sensitive lines. Avoid postemergence application when crop foliage is wet or prior to or after a rain because a crop response can occur. However, the crop will recover. Do not apply if crop is under stress and do not irrigate within 4 hours of a postemergence application. REI: 12-hour. PHI: 45-day. WSSA 5, WSSA 15, WSSA 14. RUP.
dimethenamid-p plus atrazine products (dimethenamid-p, atrazine) | Apply Commit ATZ at 2.5-4.6 pts. per acre, Commit ATZ Lite at 2.0 to 3.5 pts. per acre, or Guardsman Max at 2.5-4.6 pts. per acre. Use low rates on coarse soils with low organic matter. Apply before planting and incorporate, or after planting before corn emerges, or after emergence before corn is 12 inches tall. Rates may be reduced if corn will be cultivated or full-season control is not needed. If multiple applications are made, do not exceed maximum rate per acre per year. REI: 12-hour. PHI: 45-day. WSSA 15, WSSA 5, WSSA 27.

pendimethalin products (pendimethalin) | Apply 3.3 lb. per gallon formulations at 1.8-4.8 pts. per acre and 3.8 lb ai per gallon formulations at 2-4 pts. per acre. Use low rates on coarse soils with low organic matter. Apply after planting but before corn emerges, or after emergence until corn is 20-24 in. tall or shows 8 leaf collars. Plant corn at least 1.5 inches deep and make sure seed is well covered. Use drop nozzles and directed spray for post applications, if necessary, to get spray to soil. Do not exceed one application per season. REI: 24-hour. PHI: 50-day. S-METOLACHLOR

sandea (75) (halosulfuron) | 2/3-1 oz. per acre. Apply over-the-top or with drop nozzles from the spike through layby stages. Has some soil residual activity. A second application of 2/3 oz. per acre may be made only with drop nozzles aimed to avoid application into whorls. Do not exceed 2 applications per 12-month period. Additional halosulfuron products are available. See labels for details. REI: 12-hour. PHI: 30-day. WSSA 2.

Outlook (6) (dimethenamid-p) | 12-21 fl. oz. per acre. Use lower rate on coarse soils. Apply before planting and incorporate, or apply after planting but before corn emerges. May also be applied as a directed spray between rows when corn is 5-40 inches tall. Incorporate to control nutsedge. May be mixed with atrazine, see label for details. Do not exceed 3.9 pts. per acre per year. Dual II Magnum contains a safener and may used instead of Dual Magnum to limit crop injury under cool soil conditions. REI: 24-hour. PHI: 30-day. WSSA 15.

Lexar EZ (s-metolachlor, atrazine, mesotrione) | Use Lexar EZ at 3 or 3.5 qts. per acre or Lumax EZ at 2.7 or 3.25 qts. per acre. Use the lower rate on soils with organic matter less than 3% and the higher rate on soils with organic matter greater than 3%. Apply up to 14 days before planting or apply after planting but before corn emerges. Can be combined with glyphosate or paraquat products to control emerged weeds. REI: 24-hour. PHI: 60-day. WSSA 15, WSSA 5, WSSA 27. RUP.

Aim EC (2) (carfentrazone) | 0.5-2.0 fl. oz. per acre. Apply to actively growing weeds up to 4 in. tall from prior to planting up to V-14 stage. To reduce injury, use drop nozzles to make applications in corn from V8-V14 stages or apply with a hooded-sprayer to minimize application to the whorl. Add 0.5 pt. NIS per 25 gal. of spray solution (0.25% v/v). Do not exceed 2 fl. oz. per acre per season. For burndown applications, consider tank-mixing with an additional broad-spectrum herbicide such as glyphosate. REI: 12-hour. S-METOLACHLOR

Basagran (4) (bentazon) | Use 4L formulations at 1.5-2 pt. per acre and 5L formulations at 1.2 to 1.6 pts. per acre. Add 1 qt. of COC per 25 gals. spray solution (1% v/v). Apply to small weeds. Also controls nutsedge. Do not apply to corn that is stressed because injury may result. Combine with atrazine to broaden weed control spectrum. Do not exceed 2 lbs. of bentazon per acre, per season. REI: 48-hour. WSSA 6.

Cadet (0.91EC) (fluthiacet-methyl) | 0.6-0.9 fl. oz. per acre. For processing sweet corn only. Apply from preplant until corn reaches 48 inches tall, but before tasseling. Controls velvetleaf and several other broadleaves. May be tank-mixed with labeled postemergence herbicides. Add COC or NIS. Do not exceed 1.25 fl. oz. per acre per year. REI: 12-hour. PHI: 40-day. WSSA 14.
**Sweet Potato - Horticulture**

Reviewed by Ben Phillips, Liz Maynard – Oct 2020

**Crop Description**

Sweet potatoes (*Ipomoea batatas*) are of tropical origin and are related to morning glories. They can perform well in the Midwest too. The varieties that are easiest to get, and that perform well in the Midwest are listed below. Some varieties need up to 140 frost free days to mature. Sweet potatoes can make for a productive hoophouse crop, and in this way the longer maturing varieties can also be grown. Asian sweet potato varieties are starchier than more commonly grown varieties, and often are white or purple fleshed, instead of orange. In the table below, FW = Fusarium wilt resistant, SRKN = Southern root knot nematode resistant, SSR = Streptomyces soil rot resistant, * = varieties that performed well in midwestern trials.

### Orange-fleshed varieties

<table>
<thead>
<tr>
<th>Variety</th>
<th>Skin Color</th>
<th>Type</th>
<th>Days to Maturity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Beauregard</em></td>
<td>Red, flesh</td>
<td>vine type</td>
<td>90-100</td>
<td>FW, SSR</td>
</tr>
<tr>
<td><em>Carolina Ruby</em></td>
<td>Red, flesh</td>
<td>vine type</td>
<td>95-100</td>
<td>FW</td>
</tr>
<tr>
<td><em>Centennial</em></td>
<td>Orange</td>
<td>vine type</td>
<td>100</td>
<td>FW</td>
</tr>
<tr>
<td><em>Covington</em></td>
<td>Red, flesh</td>
<td>bush type</td>
<td>95-105</td>
<td>FW, SRKN, SSR</td>
</tr>
<tr>
<td>Evangeline</td>
<td>Orange</td>
<td>vine type</td>
<td>100</td>
<td>FW, SRKN, SSR</td>
</tr>
<tr>
<td>Georgia Jets</td>
<td>Orange</td>
<td>vine type</td>
<td>120</td>
<td>FW, SRKN, SSR</td>
</tr>
<tr>
<td>Porto Rico</td>
<td>Orange</td>
<td>bush type</td>
<td>100</td>
<td>FW</td>
</tr>
<tr>
<td>Vardaman</td>
<td>Red, flesh</td>
<td>bush type</td>
<td>100</td>
<td>FW</td>
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</table>

### White-fleshed varieties

<table>
<thead>
<tr>
<th>Variety</th>
<th>Skin Color</th>
<th>Type</th>
<th>Days to Maturity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murasaki</td>
<td>Purple</td>
<td>bush type</td>
<td>120</td>
<td>FW, SRKN, SSR</td>
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<tr>
<td>O-Henry</td>
<td>White</td>
<td>vine type</td>
<td>90-100</td>
<td>FW, SSR</td>
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<tr>
<td>White Bonita</td>
<td>White</td>
<td>vine type</td>
<td>110-115</td>
<td>SRKN</td>
</tr>
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</table>

### Purple-fleshed varieties

<table>
<thead>
<tr>
<th>Variety</th>
<th>Skin Color</th>
<th>Type</th>
<th>Days to Maturity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molokai Purple</td>
<td>Purple</td>
<td>vine type</td>
<td>120</td>
<td>Starchy</td>
</tr>
<tr>
<td>Okinawan Purple</td>
<td>Beige</td>
<td>type</td>
<td>140</td>
<td>Starchy</td>
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<tr>
<td><em>Red Japanese</em></td>
<td>Purple</td>
<td>vine type</td>
<td>110</td>
<td>Starchy</td>
</tr>
</tbody>
</table>

### Planting and Spacing

**Root production:** Water wheel and finger-style transplanters work well for mechanically planting sweet potato slips. Common spacing is 1 foot apart in the row, with rows 3 to 4 feet apart.
Sweet Potato - Diseases

depending upon the cultivating and harvesting equipment used. 14,520 slips per acre are required at the 1 foot by 3 feet spacing, while 10,890 are needed at the 1 foot by 4 feet spacing. Transplant only strong, stocky slips. Yields can be increased up to 100 bushels per acre by using strong transplants. It is common for the tops to wither after transplanting until they root. Transplanting with water is important to improve their rooting recovery time. Slips may be transplanted into beds covered with plastic mulch; the warmed soil will enhance growth and mulch will help with control.

Slip/cutting production: Select seed stock from high-yielding hills that are smooth, well-shaped, and free of diseases (scurf, internal cork, wilt, black rot) and insect injury. When possible, obtain certified G1 or G2 (generation) seed stock. Store seed stock in new crates to avoid disease contamination. Seed potatoes should be at least 1-1/2 inches in diameter. One bushel of small-to medium-sized roots should produce 500 to 800 sprouts in 10 to 15 square feet of bed area (one cut).

Slip/cutting production should be in movable protected systems (low or high tunnels) for early planting in the field to maximize production season. Before bedding, seed stock should be pre-sprouted at 85° F and 90% relative humidity for 3 to 4 weeks until the sprouts are 1 to 1-1/2 inch. Treat seed stock before planting with Mertect 340F to protect roots from soil-borne diseases. Bed the seed stock in clean land that has not been planted with sweet potato for 4 years. Optimal temperature for growth is 75° F to 85° F. Remove tunnels 7 days prior to planting to harden the slips.

Fertilizing

pH: Maintain the soil pH above 5.0.

Before planting, apply 30 pounds N per acre, 0 to 75 pounds P₂O₅ per acre, and 0 to 250 pounds K₂O per acre based on soil test results and recommendations from your state. Set the slips with a starter solution at the rate of 1 cup (8 fl. oz.) per plant.

Sidedress with 30 to 50 pounds N per acre three to four weeks after transplanting on irrigated sands. Finer textured soils usually do not need sidedressing. Reduce the amount of fertilizer N applied by the value of N credits from green manures, legume crops grown in the previous year, compost and animal manures, and soils with more than 3 percent organic matter. The total amount of N from fertilizer (including starter) and other credits should be 80 pounds per acre or less.

Harvesting

The last month or so of production is when sweet potato roots put on all their size. Thin, long roots indicate that they are still bulking up. Harvests can begin when roots reach a desired size but should be finished before regular freezing temperatures begin. Tops can freeze off without damaging roots right away, but the decomposing tops can eventually lead to rots in the roots. As soil temperatures go below 65° F tuber growth stops.

Remove vines by cutting with a rotary mower 5 to 7 days before harvest to toughen the skin. Plowing out and hand-collecting sweet potatoes is a common harvest method because their thin skins are easily damaged from chain-diggers. Dig only those potatoes that can be picked up immediately. Potatoes will sunburn if left in direct sunlight for more than an hour. To prevent skinnning and bruising use cotton gloves when placing potatoes in crates. Field grading is important. Overnight temperatures below 55° F can chill any dug sweet potatoes that were not collected and cause internal breakdown in storage.

Flavor improves and sweetens a few weeks after digging. Uncured sweet potatoes will last 3 to 6 months in storage. To cure them for 6- to 12-month storage, immediately place them at 80° to 85° F and 85% to 95% humidity for 4 to 7 days. After curing, the temperature may be gradually dropped to 58° F. Hold this temperature until potatoes are marketed or used for producing slips.

Sweet Potato - Diseases

Reviewed by Dan Egel – Nov 2020

Recommended Controls

Black Rot of Sweet Potatoes - Ceratocystis Fungus

Non-Pesticide

Plant disease-free seed and/or resistant varieties. Follow 3-4 year crop rotations. Prevent bruising. Cure and store only healthy, blemish-free tubers, and maintain proper storage temperatures.

Pesticide

Mertect 340-F (SC) (thiabendazole) | 8 fl. oz. per 7.5 gal. of water. One application only. REI: 12-hour. PHI: 0-day. FRAC 1.

Foot Rot of Sweet Potatoes - Plenodomus Fungus

Non-Pesticide

Plant disease-free seed and/or resistant varieties. Follow 3-4 year crop rotations. Prevent bruising. Cure and store only healthy, blemish-free tubers, and maintain proper storage temperatures.

Pesticide

Mertect 340-F (SC) (thiabendazole) | 8 fl. oz. per 7.5 gal. of water. One application only. REI: 12-hour. PHI: 0-day. FRAC 1.
**Scurf of Sweet Potatoes - Monilochaetes Fungus**

**Non-Pesticide**

Plant disease-free seed and/or resistant varieties. Follow 3-4 year crop rotations. Prevent bruising. Cure and store only healthy, blemish-free tubers, and maintain proper storage temperatures.

**Pesticide**

**Botran 75W (dichloro-nitroaniline)** | Use as seed potato dip or plant bed spray. REI: 12-hour. PHI: 0-day. FRAC 14.

**Mertect 340-F (SC) (thiabendazole)** | 8 fl. oz. per 7.5 gal. of water. One application only. REI: 12-hour. PHI: 0-day. FRAC 1.

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**Storage Rots of Sweet Potato**

**Non-Pesticide**

Prevent bruising. Cure and store only healthy, blemish-free tubers, and maintain proper storage temperatures.

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**Wilt of Multiple Crops - Fusarium Fungus**

**Non-Pesticide**

Plant disease-free seed and/or resistant varieties. Follow 3-4 year crop rotations. Prevent bruising. Cure and store only healthy, blemish-free tubers, and maintain proper storage temperatures.

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**Sweet Potato - Insects**

Reviewed by Laura Ingwell, Donald Lewis – Nov 2020

**Recommended Controls**

**Aphids**

**Pesticide**

**Actara (25WDG) (thiamethoxam)** | 1.5-3.0 oz. per acre. Do not exceed 6 oz. per acre per season. Control may require two applications. Allow 7 days between applications. See pollinator precautions. REI: 12-hour. PHI: 14-day. IRAC 4A.

**Admire Pro (4.6SC) (imidacloprid)** | 1.2 fl. oz. per acre foliar application, 4.4-10.5 fl. oz. per acre or 0.26 fl. oz. per 1,000 ft. of row soil application. Do not exceed 10.5 fl. oz. or 1 application per acre per season. REI: 12-hour. PHI: 7-day for foliar applications, or 125-day for soil applications. IRAC 4A.

**Assail 30SG (acetamiprid)** | Use 30SG formulations at 1.5-4.0 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 0.6-1.7 oz. per acre and do not exceed 7.0 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 4A.

**Baythroid XL (1EC) (beta-cyfluthrin)** | 2.8 fl. oz. per acre. Do not exceed 16.8 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Belay (2.13SC) (clothianidin)** | Soil applications: 9-12 fl. oz. per acre. Foliar applications: 2-4 fl. oz. per acre. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 4A.

**Beleaf (50SG) (flonicamid)** | 2.0-2.8 oz. per acre. Do not exceed 8.4 oz. per acre per season. REI: 12-hour. PHI: 7-day. FRAC 29.

**Fulfill (50WDG) (pyrethroide)** | 2.75-5.50 oz. per acre. Do not exceed 11 oz. per acre per season. REI: 12-hour. PHI: 14-day. FRAC 9B.

**Movento (2SC) (spirotetramat)** | 4-5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 23.

**Platinum 2SC (thiamethoxam)** | Use 2SC formulations at 5-8 fl. oz. per acre and do not exceed 8 fl. oz. per acre per season. Use 75SG formulations at 1.66-2.67 oz. per acre and do not exceed 2.67 oz. per acre per season. Apply as in-furrow spray during planting, as a directed spray to base of plant at emergence, as a broadcast spray during last hilliing operation, or as an overhead chemigation after last hilliing. REI: 12-hour. IRAC 4A.

**Sivanto 200 (1.67SL) (flupyradifurone)** | 7.0-10.5 fl. oz. per acre. Apply at planting or as foliar spray. Do not exceed 28 fl. oz. per acre per season. REI: 4-hour. PHI: 7-day. IRAC 4D.

**Transform WG (50) (sulfoxaflor)** | 0.75-1.0 oz. per acre. Do not exceed 8.5 oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 4C.

**Voliam Flexi (WDG) (thiamethoxam, chlorantraniliprole)** | 4 oz. per acre. Do not exceed 8 oz. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 4A, IRAC 28.

**Warrior II (2.08CS) (lambda-cyhalothrin)** | 1.28-1.92 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 3A. RUP.

**Caterpillars**

**Pesticide**

**Avaunt (30WDG) (indoxacarb)** | 2.5-6.0 oz. per acre. For loopers. Do not exceed 24 oz. per acre per season. REI: 12-hour. PHI: 7-day. FRAC 22.

**Baythroid XL (1EC) (beta-cyfluthrin)** | 0.8-1.6 fl. oz. per acre. For cutworms, and loopers. Do not exceed 16.8 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

**Entrust SC (2) (spinosad)** | For armyworms, and loopers. Use 2SC formulations at 4.5-10.0 fl. oz. per acre and do not exceed 21 fl. oz. per acre per season. Use 80WP formulations at 1.5-3.0 oz. per acre and do not exceed 9 oz. per acre per season. Allow 7
Cucumber Beetles

Pesticide

Assail 30SG (acetamiprid) | Use 30SG formulations at 1.5-4.0 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 0.6-1.7 oz. per acre and do not exceed 7.0 oz. per acre per season. Allow 7 days between applications. PHI: 12-hour. IRAC 4A.

Baythroid XL (1EC) (beta-cyfluthrin) | 1.6-2.8 fl. oz. per acre. Do not exceed 16.8 fl. oz. per acre per season. PHI: 0-day. IRAC 3A. RUP.

Brigade 2EC (bifenthrin) | Use 2EC formulations at 2.1-6.4 fl. oz. per acre as a soil surface preplant and do not exceed 32 fl. oz. per acre per season at plant application. Do not use 10DF, 10WP, or 10WSP formulations as they are not labeled for sweet potatoes. Allow 21 days between applications. PHI: 12-hour. IRAC 3A. RUP.

Capture LFR (1.5) (bifenthrin) | Apply at planting at 12.75-25.5 fl. oz. per acre, or apply as a soil surface preplant at 2.8-8.5 fl. oz. per acre. Do not exceed 2 applications per season. PHI: 12-hour. IRAC 3A. RUP.

Flea Beetles

Pesticide

Actara (25WDG) (thiamethoxam) | 1.5-3.0 oz. per acre. Do not exceed 6 oz. per acre per season. Control may require two applications. Allow 7 days between applications. See pollinator precautions. PHI: 12-hour. IRAC 4A.

Admire Pro (4.6SC) (imidacloprid) | 1.2 fl. oz. per acre foliar application, 4.4-10.5 fl. oz. per acre or 0.26 fl. oz. per 1,000 ft. of row soil application. Do not exceed 10.5 fl. oz. or 1 application per acre per season. PHI: 12-hour. PHI: 7-day for foliar applications, or 125-day for soil applications. IRAC 4A.

Assail 30SG (acetamiprid) | Use 30SG formulations at 1.5-2.5 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 0.6-1.1 oz. per acre and do not exceed 7.0 oz. per acre per season. Allow 7 days between applications. PHI: 12-hour. PHI: 7-day for foliar applications, or 125-day for soil applications. IRAC 4A.

Baythroid XL (1EC) (beta-cyfluthrin) | 1.6-2.8 fl. oz. per acre. Do not exceed 16.8 fl. oz. per acre per season. PHI: 0-day. IRAC 3A. RUP.

Delay (2.13SC) (clothianidin) | Soil applications: 9-12 fl. oz. per acre. Foliar applications: 2-4 fl. oz. per acre. Do not exceed 12 fl. oz. per acre per season. PHI: 12-hour. PHI: 14-day. IRAC 4A.

Brigade 2EC (bifenthrin) | Use 2EC formulations at 2.1-6.4 fl. oz. per acre as a foliar spray and do not exceed 32 fl. oz. per acre per season at plant application. Do not use 10DF, 10WP, or 10WSP formulations as they are not labeled for sweet potatoes. Allow 21 days between applications. PHI: 12-hour. PHI: 21-day. IRAC 3A. RUP.

Capture LFR (1.5) (bifenthrin) | Apply at planting at 12.75-25.5 fl. oz. per acre, or apply as a soil surface preplant at 2.8-8.5 fl. oz. per acre. Do not exceed 2 applications per season. PHI: 12-hour. PHI: 21-day. IRAC 3A. RUP.
Platinum 2SC (thiamethoxam) | Use 2SC formulations at 5-8 fl. oz. per acre and do not exceed 8 fl. oz. per acre per season. Use 75SG formulations at 1.66-2.67 oz. per acre and do not exceed 2.67 oz. per acre per season. Apply as in-furrow spray during planting, as a directed spray to base of plant at emergence, as a broadcast spray during last hilling operation, or as an overhead chemigation after last hilling. REI: 12-hour. IRAC 4A.

Sevin XLR Plus (4SC) (carbaryl) | 0.5-1.0 qts. per acre. Do not exceed 6 qts. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 1A.

Tombstone (2EC) (cyfluthrin) | 1.6-2.8 fl. oz. per acre. Do not exceed 16.8 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Voliam Flexi (WDG) (thiamethoxam, chlorantraniliprole) | 4 oz. per acre. Do not exceed 8 oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 3A. RUP.

Warrior II (2.08CS) (lambda-cyhalothrin) | 1.28-1.92 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 3A. RUP.

Leafhoppers

Pesticide

Actara (25WDG) (thiamethoxam) | 1.5-3.0 oz. per acre. Do not exceed 6 oz. per acre per season. Control may require two applications. Allow 7 days between applications. See pollinator precautions. REI: 12-hour. PHI: 14-day. IRAC 4A.

Admire Pro (4.6SC) (imidacloprid) | 1.2 fl. oz. per acre foliar application, 4.4-10.5 fl. oz. per acre or 0.26 fl. oz. per 1,000 ft. of row soil application. Do not exceed 10.5 fl. oz. or 1 application per acre per season. REI: 12-hour. PHI: 7-day for foliar applications, or 125-day for soil applications. IRAC 4A.

Assail 30SG (acetamiprid) | Use 30SG formulations at 1.5-4.0 oz. per acre and do not exceed 16 oz. per acre per season. Use 70WP formulations at 0.6-1.7 oz. per acre and do not exceed 7.0 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day IRAC 4A.

Baythroid XL (1EC) (beta-cyfluthrin) | 0.8-1.6 fl. oz. per acre. Do not exceed 16.8 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. IRAC 3A. RUP.

Belay (2.13SC) (clothianidin) | Soil applications: 9-12 fl. oz. per acre. Foliar applications: 2-4 fl. oz. per acre. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 4A.

Malathion 5EC (malathion) | Use 5EC and 57EC formulations at 1.5-2.5 pts. per acre. Do not exceed 2 applications per season. Allow 7 days between applications. REI: 12 to 24-hour. PHI: 0-3-day. IRAC 1B.

Mustang Maxx (0.8) (zeta-cypermethrin) | 1.28-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 3A. RUP.

Platinum 2SC (thiamethoxam) | Use 2SC formulations at 5-8 fl. oz. per acre and do not exceed 8 fl. oz. per acre per season. Use 75SG formulations at 1.66-2.67 oz. per acre and do not exceed 2.67 oz. per acre per season. Apply as in-furrow spray during planting, as a directed spray to base of plant at emergence, as a broadcast spray during last hilling operation, or as an overhead chemigation after last hilling. REI: 12-hour. IRAC 4A.

Sivanto 200 (1.67SL) (flupyradifurone) | 7.0-10.5 fl. oz. per acre. Apply at planting or as foliar spray. Do not exceed 28 fl. oz. per acre per season. REI: 4-hour. PHI: 7-day. IRAC 4D.

Transform WG (50) (sulfoxaflor) | 0.75-1.0 oz. per acre. Do not exceed 8.5 oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 4C.

Voliam Flexi (WDG) (thiamethoxam, chlorantraniliprole) | 4 oz. per acre. Do not exceed 8 oz. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 4A, IRAC 28.

Warrior II (2.08CS) (lambda-cyhalothrin) | 0.96-1.60 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 3A. RUP.

Thrips

Pesticide

Admire Pro (4.6SC) (imidacloprid) | In-furrow spray or side dress 4.4-10.5 fl. oz. per acre or 0.31-0.74 fl. oz. per 1,000 ft. of row. Do not exceed 10.5 fl. oz. or 1 application per acre per season. REI: 12-hour. PHI: 125-day. IRAC 4A.

Entrust SC (2) (spinosad) | Use 2SC formulations at 4.5-10.0 fl. oz. per acre and do not exceed 21 fl. oz. per acre per season. Use 80WP formulations at 1.5-3.0 oz. per acre and do not exceed 9 oz. per acre per season. REI: 4-hour. PHI: 7-day. IRAC 5. OMRI-listed.

Radiant 1SC (spinetoram) | 6.0-8.0 fl. oz. per acre. Do not exceed 32 fl. oz. per acre per season. REI: 4-hour. PHI: 7-day. IRAC 5.

Warrior II (2.08CS) (lambda-cyhalothrin) | 1.28-1.92 fl. oz. per acre. Do not exceed 7.68 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 3A. RUP.
**Sweet Potato - Weeds**

### Wireworms

**Pesticide**

**Brigade 2EC (bifenthrin)** | 9.6-19.2 fl. oz. per acre. Use 2EC formulations at 9.6-19.2 fl. oz. per acre and do not exceed 6.4 fl. oz. per acre season as a preplant-incorporated broadcast, directed bed-spray, or T-band spray into the planting furrow and do not exceed 32 fl. oz. per acre season.. Do not use 10DF, 10WP, or 10WSB formulations as they are not labeled for sweet potatoes. Allow 21 days between applications. REI: 12-hour. PHI: 21-day. IRAC 3A. RUP.

**Capture LFR (1.5) (bifenthrin)** | Apply at planting at 12.75-25.5 fl. oz. per acre, or apply as a foliar spray at 2.8-8.5 fl. oz. per acre. Do not exceed 2 applications per season. REI: 12-hour. PHI: 21-day, IRAC 3A. RUP.

**Lorsban 4E (chlorpyrifos)** | Use 4E formulations at 4 pts. per acre. Use 15G formulations at 13.5 lbs. per acre. Use 75WG formulations at 2.67 lbs. per acre. Evenly spread granules or spray soil surface preplant and incorporate to a depth of 4-6 inches. Plant sweet potatoes no more than 14 days after treatment. Do not exceed 1 application per season. REI: 24-hour to 3-day. PHI: 125-day. IRAC 1B. RUP.

### Recommended Controls

**All Weeds**

The critical period for weed control in sweet potato is between 2-6 weeks after transplanting.

Herbicide choices are limited, and the products that can be broadcast do not control many broadleaf weeds, so it is important to include mechanical control in the weed management plan.

Sweet potatoes are warm-season crops transplanted from slips that are cut from sprouted roots. There are several herbicides labeled for the control of weeds preemergence, applied after crops are transplanted.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

**Non-Pesticide**

Because these are warm-season, transplanted crops, there should be enough time in the spring to prepare a stale seedbed before planting, which should reduce weed pressure in the crop. The more quickly vines cover the soil surface, the better they will suppress late-emerging weeds. Closer row spacing promotes rapid vine cover, and growers can increase in-row spacing to maintain a constant plant population. Uniform plant spacing in the row will also promote uniform vine cover. These crops can also benefit from the soil warming properties of plastic mulch in addition to the in-row weed control. Mulches provide good weed control when planted into. Biodegradable plastic makes harvest easier. Straw mulch can delay growth by suppressing soil temperatures. Weeds between rows and along the edges of beds can be controlled with a combination of cultivation, mowing, or hand hoeing/pulling. Weeds along the edge of the mulches can be a particular challenge to avoid ripping the mulch. Some fresh market plantings it may make more sense to mechanically cultivate with tow-able tools between plastic rows or between bare-soil rows. In bare-soil production, rolling cultivators on wide tool-bars offer effective high-speed cultivation between rows and can also hill before row closure from vines.

**Broadleaf and Grass Weeds - Postemergence**

**Pesticide**

**glyphosate products (glyphosate)** | 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations of 3 lbs. ae per gal. (4 lbs. isopropylamine salt per gal.) at 1-5 qts. per acre or formulations containing 4.5 lbs. ae per gal. (5 lbs. potassium salt per gal.) at 0.66-3.3 qts. per acre. Broadcast before planting, or apply between crop rows with wipers or hooded or shielded sprayers. Use low rate for annuals and higher rates for perennials. REI: 4 to 12-hour. PHI: 14-day for foliar applications directed between rows, 7-day for wiper applications. WSSA 9.

**paraquat products (paraquat)** | 1-2 pt of 2 lb. per gal. formulation. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS (0.25% v/v) per 25 gal. of solution and apply to emerged weeds less than 6" tall prior to transplanting. Certified applicators must successfully complete an EPA-approved training program before mixing, loading, and/or applying paraquat. REI: 12 to 24-hour. WSSA 22. RUP.

**Broadleaf and Grass Weeds - Preemergence**

**Pesticide**

**Command 3ME (clomazone)** | 1.4-4.0 pt. per acre. Use a lower rate on coarse textured soils. Apply in a single application immediately after transplanting and before weeds emerge. When used alone, may not adequately control pigweed species and does not control carpetweed. REI: 12-hour. PHI: 95-day for rates up to 3.3 pt. per acre, 125-day for rates over 3.3 pt. per acre. WSSA 13.

**Dacthal W-75 (DCPA)** | Apply Dacthal W-75 at 6-14 lbs. per acre, or Dacthal Flowable at 6-14 pts. per acre. Apply at
transplanting or at layby up to 6 weeks after transplanting. May be applied over the top of transplants. REI: 12-hour. WSSA 3.

Devrinol DF-XT (50) (napropamide) | 2-4 lbs. per acre. Apply immediately after transplanting. If rain does not occur within 24 hours, incorporate shallowly or irrigate with 0.5 inch of water. REI: 24-hour. WSSA 15.

Dual Magnum (7.62EC) (s-metolachlor) | 1.0-1.3 pts. per acre. Apply to prepared planting beds prior to transplanting. Do not use on greenhouse-grown transplants, or on transplants harvested more than 2 days before transplanting. Do not use on varieties other than Beauregard unless you have tested for phytotoxicity under your conditions. Provides suppression of many grass weeds. REI: 12-hour. PHI: 60-day. WSSA 15.

Broadleaf Weeds Only - Postemergence

Pesticide

Aim EC (2) (carfentrazone) | 0.5-2 fl. oz. per acre. Apply as a burndown application prior to transplanting or apply with a hooded sprayer as a directed application between crop rows. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gal. of spray solution (0.25% v/v). Weeds must be actively growing and less than 4 in. tall. Do not allow spray to contact crop. Do not exceed 11.6 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. WSSA 14.

Broadleaf Weeds Only - Preemergence

Pesticide

Valor SX (51WDG) (flumioxazin) | 2-3 oz. per acre. Apply to prepared planting beds prior to transplanting. Do not use on greenhouse-grown transplants, or on transplants harvested more than 2 days before transplanting. Do not use on varieties other than Beauregard unless you have tested for phytotoxicity under your conditions. Provides suppression of many grass weeds. REI: 12-hour. WSSA 14.

Grass Weeds Only - Postemergence

Pesticide

clethodim products (clethodim) | Use 2EC formulations at 6-16 fl. oz. per acre with 1 qt. COC per 25 gals. of spray solution (1% v/v). Do not exceed 32 fl. oz. per acre per season. Use Select Max at 9-32 fl. oz. per acre with 0.5 pt. NIS per 25 gals. of spray solution (0.25% v/v). Do not exceed 64 fl. oz. per acre per season. Use low rates for annual grasses and high rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. REI: 24-hour. PHI: 30-day. WSSA 1.

Fusilade DX (2EC) (fluazifop-P) | 10-12 fl. oz. per acre. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gals. of spray solution (0.25% v/v). Apply to actively growing grass. Do not exceed 4 applications or 48 fl. oz. per acre per season. REI: 12-hour. PHI: 14-day. WSSA 1.