

**Poast (1.5EC) (sethoxydim)** POST  | 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. HRAC 01.

**Sandea (75) (halosulfuron)** POST PRE  | 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. HRAC 02.

**trifluralin products (trifluralin)** PRE  | 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. HRAC 03.

## Onions and Related Crops – Horticulture

Major update by Ben Phillips, Liz Maynard – Oct 2020  
Reviewed by Liz Maynard – Aug 2021

### *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** (*A. 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 seeding, 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° F 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 P<sub>2</sub>O<sub>5</sub> per acre, and up to 100 pounds K<sub>2</sub>O 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 P<sub>2</sub>O<sub>5</sub> per acre, and 0 to 250 pounds K<sub>2</sub>O per acre based on soil test results and recommendations from your state. Or, broadcast half the N and most of the K<sub>2</sub>O before planting, and at planting time band the remaining N, all of the P<sub>2</sub>O<sub>5</sub>, and up to 20 pounds of K<sub>2</sub>O 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 1,000 feet of row in the starter band (2 pounds actual manganese 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.

**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) 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 – Sept 2021

### 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 M01, FRAC M03.

## 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 seedling is slow to emerge.

### Pesticide

**azoxystrobin products (azoxystrobin)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 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 seed treatment 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. Other formulations include MetaStar, Subdue Maxx, Ultra Flourish, and Xyler. Rates vary by formulation. REI: 48-hour. PHI: 0-day. FRAC 04.

**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 04, FRAC 11.

## 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

**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 33, FRAC M05.

**Cymbol Advance (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. Other formulations are available such as Ariston. REI: 12-hour. PHI: 7-day for dry bulb onions, and garlic; 14-day for green bunching onions, shallots, leeks. FRAC M05, FRAC 27.

**Dexter Max (DG) (mancozeb, azoxystrobin)** *Garlic, Onion (Dry), Shallot* | 3.2 lb. per acre. REI: 24-hour. PHI: 7-day. FRAC M03, FRAC 11.

**Dexter Xcel (mancozeb, azoxystrobin, tebuconazole)** *Onion (Dry)* | 56-72 fl. oz. per acre. REI: See label. PHI: 7-day. FRAC M03, FRAC 11, FRAC 03.

**Forum (4.17SC) (dimethomorph)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 6 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 40.

**Gavel 75DF (zoxamide, mancozeb)** *Garlic, Onion (Dry), Shallot* | 1.5-2 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC 22, FRAC M03.

**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 M03.

**Omega 500F (4.17) (fluazinam)** *Garlic, Onion (Dry), Shallot* | 1 pt. per acre. REI: 12-hour. PHI: 7-day. FRAC 29.

**Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil)** *Garlic, Onion (Dry)* | 1.75-2.5 pt. per acre. REI: 12-hour. PHI: 7-day. FRAC 49, FRAC M05.

**Orondis Ultra Premix (SC) (oxathiapiprolin, mandipropamid)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 5.8-8.0 pts. per acre. REI: 4-hour. PHI: 7-day. FRAC 49, FRAC 40.

**Reason 500SC (4.13) (fenamidone)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 5.5 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11.

**Revus (2.08SC) (mandipropamid)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 8 fl. oz. per acre. REI: 4-hour. PHI: 7-day. FRAC 40.

**Ridomil Gold Bravo SC (mefenoxam, chlorothalonil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 2.5 pts. per acre. REI: 48-hour. PHI: 7-day for dry bulb onions, shallots, and garlic; 14-day for green bunching onions and leek. FRAC 04, FRAC M05.

**Ridomil Gold Copper (WSB) (mefenoxam, copper hydroxide)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 2 lbs. per acre. REI: 48-hour. PHI: 7-day for green bunching onions, shallots, and leeks; 10-day for dry bulb onions and garlic. FRAC 04, FRAC M01.

**Ridomil Gold MZ WG (DF) (mefenoxam, mancozeb)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 2.5 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC 04, FRAC M03.

**Viathon (potassium phosphite, tebuconazole)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 2-3 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC 33, FRAC 03.

**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.

**Zing! (zoxamide, chlorothalonil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 30 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 22, FRAC M05.

## Gray Mold of Multiple Crops - Botrytis Fungus

### Pesticide

**ManKocide (DF) (copper hydroxide, mancozeb)** *Garlic, Onion (Dry), Shallot* | 1.5-2.25 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC M01, FRAC M03.

## 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 M01. *OMRI-listed*.

**ManKocide (DF) (copper hydroxide, mancozeb)** *Garlic, Onion (Dry), Shallot* | 1.5-2.25 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC M01, FRAC M03.

## 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

**Aprovia Top (difenoconazole, benzovindiflupyr)** *Onion (Dry), Onion (Green)* | 10.5 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 03, FRAC 07.

**Cabrio EG (20) (pyraclostrobin)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 8-12 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11.

**Fontelis (1.67SC) (penthiopyrad)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 16-24 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 07.

**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 03, FRAC 09.

**Luna Experience (fluopyram, tebuconazole)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 12.8 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 07, FRAC 03.

**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 07, FRAC 09.

**Merivon (fluxapyroxad, pyraclostrobin)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 5.5-11 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 07, FRAC 11.

**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 07, FRAC 11.

**Switch 62.5WG (cyprodinil, fludioxonil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 11-14 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 09, FRAC 12.

## Leaf Blight of Alliums - Botrytis 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

**azoxystrobin products (azoxystrobin)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 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)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 12 oz. per acre. Suppression only. REI: 12-hour. PHI: 7-day. FRAC 11.

**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 M05.

**Custodia (SC) (azoxystrobin, tebuconazole)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 12.9 fl. oz. per acre. Suppression only. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC 03.

**Dexter Max (DG) (mancozeb, azoxystrobin)** *Garlic, Onion (Dry), Shallot* | 3.2 lb. per acre. REI: 24-hour. PHI: 7-day. FRAC M03, FRAC 11.

**Dexter Xcel (mancozeb, azoxystrobin, tebuconazole)** *Onion (Dry)* | 56-72 fl. oz. per acre. REI: See label. PHI: 7-day. FRAC M03, FRAC 11, FRAC 03.

**Endura (WG) (boscalid)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 6.8 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 07.

**Fontelis (1.67SC) (penthiopyrad)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 16-24 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 07.

**Gavel 75DF (zoxamide, mancozeb)** *Garlic, Onion (Dry), Shallot* | 1.5-2 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC 22, FRAC M03.

**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 03, FRAC 09.

**iprodisone products (iprodisone)** *Onion (Dry)* | Formulations of iprodisone include Nevado and Rovral. REI: 24-hour. PHI: 14-day. FRAC 02.

**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 07, FRAC 03.

**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 07, FRAC 09.

**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 M03.

**Merivon (fluxapyroxad, pyraclostrobin)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 8-11 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 07, FRAC 11.

**Omega 500F (4.17) (fluazinam)** *Garlic, Onion (Dry), Shallot* | 1 pt. per acre. REI: 12-hour. PHI: 7-day. FRAC 29.

**Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil)** *Garlic, Onion (Dry)* | 1.75-2.5 pt. per acre. REI: 12-hour. PHI: 7-day. FRAC 49, FRAC M05.

**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 07, 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 03.

**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 M05.

**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 03.

**Ridomil Gold Bravo SC (mefenoxam, chlorothalonil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 2.5 pts. per acre. REI: 48-hour. PHI: 7-day for dry bulb onions,

shallots, and garlic; 14-day for green bunching onions and leek. FRAC 04, FRAC M05.

**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 09.

**Switch 62.5WG (cyprodinil, fludioxonil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 11-14 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 09, FRAC 12.

**Vanguard WG (75) (cyprodinil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 10 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 09.

**Zing! (zoxamide, chlorothalonil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 30 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 22, FRAC M05.

## 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 M01. *OMRI-listed*.

**ManKocide (DF) (copper hydroxide, mancozeb)** *Garlic, Onion (Dry), Shallot* | 1.5-2.25 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC M01, FRAC M03.

## 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 M01. *OMRI-listed*.

**ManKocide (DF) (copper hydroxide, mancozeb)** *Garlic, Onion (Dry), Shallot* | 1.5-2.25 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC M01, FRAC M03.

## 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).

### Pesticide

**chlorothalonil products (chlorothalonil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | Suppression only. 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 M05.

**Dexter Max (DG) (mancozeb, azoxystrobin)** *Garlic, Onion (Dry), Shallot* | 3.2 lb. per acre. REI: 24-hour. PHI: 7-day. FRAC M03, FRAC 11.

**Dexter Xcel (mancozeb, azoxystrobin, tebuconazole)** *Onion (Dry)* | 48-72 fl. oz. per acre. REI: See label. PHI: 7-day. FRAC M03, FRAC 11, FRAC 03.

**Fontelis (1.67SC) (penthiopyrad)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 16-24 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 07.

**Gavel 75DF (zoxamide, mancozeb)** *Garlic, Onion (Dry), Shallot* | 1.5-2 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC 22, FRAC M03.

**iprodione products (iprodione)** *Onion (Dry)* | Formulations of iprodione include Nevado and Rovral. REI: 24-hour. PHI: 14-day. FRAC 02.

**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 07, FRAC 03.

**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 07, FRAC 09.

**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 M03.

**Merivon (fluxapyroxad, pyraclostrobin)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 8-11 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 07, 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 07, FRAC 11.

**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 M05.

**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 09.

**Switch 62.5WG (cyprodinil, fludioxonil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 11-14 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 09, FRAC 12.

**Vanguard WG (75) (cyprodinil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 10 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 09.

**Zing! (zoxamide, chlorothalonil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 30 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 22, FRAC M05.

## 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.

## Pesticide

**Fontelis (1.67SC) (penthiopyrad)** *Onion (Dry)* | 24 fl. oz. per acre. *Michigan only-applicators must possess Section 2*

*(ee) label.* Use as a preplant broadcast and incorporate, then follow with a broadcast or banded application before plants are 3 inches tall before a rain for incorporation. REI: 12-hour. PHI: 3-day. FRAC 07.

## 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 03, FRAC 07.

**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.

**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 33, FRAC M05.

**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 M05.

**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 03.

**Cymbol Advance (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. Other formulations are available such as Ariston. REI: 12-hour. PHI: 7-day for dry bulb onions, and garlic; 14-day for green bunching onions, shallots, leeks. FRAC M05, FRAC 27.

**Dexter Max (DG) (mancozeb, azoxystrobin)** *Garlic, Onion (Dry), Shallot* | 3.2 lb. per acre. REI: 24-hour. PHI: 7-day. FRAC M03, FRAC 11.

**Dexter Xcel (mancozeb, azoxystrobin, tebuconazole)** *Onion (Dry)* | 48-72 fl. oz. per acre. REI: See label. PHI: 7-day. FRAC M03, FRAC 11, FRAC 03.

**Endura (WG) (boscalid)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 6.8 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 07.

**Fontelis (1.67SC) (penthiopyrad)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 16-24 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 07.

**Gavel 75DF (zoxamide, mancozeb)** *Garlic, Onion (Dry), Shallot* | 1.5-2 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC 22, FRAC M03.

**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 03, FRAC 09.

**iprodione products (iprodione)** *Onion (Dry)* | Formulations of iprodione include Nevado and Rovral. REI: 24-hour. PHI: 14-day. FRAC 02.

**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 07, FRAC 03.

**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 07, FRAC 09.

**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 M03.

**ManKocide (DF) (copper hydroxide, mancozeb)** *Garlic, Onion (Dry), Shallot* | 1.5-2.25 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC M01, FRAC M03.

**Merivon (fluxapyroxad, pyraclostrobin)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 5.5-11 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 07, FRAC 11.

**Muscle ADV (chlorothalonil, tebuconazole)** *Garlic, Onion (Dry), Shallot* | 1.1-1.6 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC M05, FRAC 03.

**Omega 500F (4.17) (fluazinam)** *Garlic, Onion (Dry), Shallot* | 1 pt. per acre. REI: 12-hour. PHI: 7-day. FRAC 29.

**Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil)** *Garlic, Onion (Dry)* | 1.75-2.5 pt. per acre. REI: 12-hour. PHI: 7-day. FRAC 49, FRAC M05.

**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 07, 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 03.

**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 M05.

**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 03.

**Reason 500SC (4.13) (fenamidone)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 5.5 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 11.

**Ridomil Gold Bravo SC (mefenoxam, chlorothalonil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 2.5 pts. per acre. REI: 48-hour. PHI: 7-day for dry bulb onions, shallots, and garlic; 14-day for green bunching onions and leek. FRAC 04, FRAC M05.

**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 09.

**Switch 62.5WG (cyprodinil, fludioxonil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 11-14 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 09, FRAC 12.

**Tanos (DF) (famoxadone, cymoxanil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 8 oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 11, FRAC 27.

**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 03.

**Vanguard WG (75) (cyprodinil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 10 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 09.

**Viathon (potassium phosphite, tebuconazole)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 2-3 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC 33, FRAC 03.

**Zing! (zoxamide, chlorothalonil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 30 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 22, FRAC M05.

## 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 M01. *OMRI-listed*.

**ManKocide (DF) (copper hydroxide, mancozeb)** *Garlic, Onion (Dry), Shallot* | 1.5-2.25 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC M01, FRAC M03.

## 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 M03, FRAC M05.

**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 M03.

## White Rot of Alliums - Stromatinia Fungus

This highly destructive soil pathogen 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 03.

**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 07.

**iprodione products (iprodione)** *Garlic* | 4 pts. per acre. Formulations of iprodione include Nevado and Rovral. Use as in-furrow spray preplant. REI: 24-hour. PHI: 7-day. FRAC 02.

**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 07, FRAC 03.

**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 07, FRAC 09.

**Quadris Opti (SC) (azoxystrobin, chlorothalonil)** *Garlic, Onion (Dry)* | 1.6-3.2 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC 11, FRAC M05.

**Switch 62.5WG (cyprodinil, fludioxonil)** *Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | 11-14 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 09, 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 01.

## Onions and Related Crops – Insects

Reviewed by Laura Ingwell, Zsofia Szendrei – Sept 2021

### *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 01B. *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 03A. *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 03A. *RUP*.

**Seed treatments for insects (thiamethoxam, spinosad, abamectin)** *Leek, Onion (Dry), Onion (Green), Shallot* | Commercial seed treatments offered by seed companies include FarMore FI500 for dry bulb onions through Syngenta and CAPS (Coronet, Allegience, Pro Gro, and Sepresto) on dry bulb onions, green bunch onions and leeks through Nunhem's. IRAC 04A, IRAC 05, IRAC 06.

**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 03A. *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 06. *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 04A.

**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-

## Onions and Related Crops – Weeds

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 05. *OMRI-listed.*

**Exirel (0.83SE) (cyantraniliprole)** *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 01A. *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 06. *RUP.*

**Movento (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. REI: 12-hour. PHI: 1-day. IRAC 03A. *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 05.

**Torac (1.29SC) (tolfenpyrad)** *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 03A. *RUP.*

## Onions and Related Crops – Weeds

Reviewed by Stephen Meyers, Ben Phillips – Sept 2021

### *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, flame weeder, or very shallow cultivation.

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

Rates provided in the recommendations below are given for overall coverage. For a banded 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. A stale seedbed can be prepared prior to transplanting with flame weeding or very shallow cultivation to control emerged weeds, 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 postemergence 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. For this reason, many growers prefer white-on-black plastic with the white side up.

## Pesticide

**Aim EC (2) (carfentrazone)** POST  *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 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. Do not allow spray to contact crop. REI: 12-hour. HRAC 14.

**Chateau SW (51WDG) (flumioxazin)** PRE  *Garlic,*

*Onion (Dry)* | For **garlic**: apply 6 oz. per acre within 3 days after planting and before garlic emerges. Do not exceed 6 oz. per acre per growing season. For **onion in Michigan only**: apply 2 oz. per acre to transplanted onions between the 2- and 6-leaf stage or to direct-seeded onions between the 3- and 6-leaf stage and prior to weed emergence. Do not exceed 2 oz. per acre per application or 3 oz. per acre per growing season. Will not control emerged weeds. Wait at least 14 days between repeat applications. Do not tank mix with adjuvants or other herbicides. REI: 12-hour. PHI: 45-day for dry bulb onion. HRAC 14.

**clethodim products (clethodim)** POST  *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. HRAC 01.

**Dacthal Flowable (6F) (DCPA)** PRE  *Leek, Onion*

*(Dry), Onion (Green), Shallot* | 6-14 pts. per acre. Apply at seeding, transplanting, and/or layby. Preplant incorporation

not recommended. May be sprayed over transplants. REI: 12-hour. HRAC 03.

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

*Garlic, Leek, Onion (Dry), Onion (Green), Shallot* | *Illinois, Indiana, Kansas, Michigan, Minnesota, and Ohio only. IL 24c exp. 12/31/24. KS & MI 24c exp. 12/31/21. MN 24c exp. 12/31/25. OH 24c exp. 12/31/22.* For **dry onion**: apply 0.67-1.33 pts. per acre prior to weed emergence and when the crop has at least 2 true leaves. A second application may be applied 21 or more days after the first. Do not exceed 1.3 pts. per acre per application and 2.6 pts. per acre per crop and two applications per crop. For **all else except in Kansas**: Apply 0.67-1.33 pts. per acre postemergence starting when the crop has 2 true leaves. Do not exceed 1.3 pts. per acre per season. REI: 24-hour. PHI: 60-day for dry bulb onion; 21-day for all else. HRAC 15.

**Fusilade DX (2EC) (fluazifop-P)** POST  *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. HRAC 01.

**glyphosate products (glyphosate)** POST   *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: 4-hour to 12-hour. PHI: 14-day. HRAC 9.

**GoalTender (4) (oxyfluorfen)** POST PRE  *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. Also works preemergent weeds, and on actively growing postemergent weeds with 2-4 leaves. 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. HRAC 14.

**Moxy 2E (bromoxynil)** POST  *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. HRAC 06.

**Nortron SC (4) (ethofumesate)** POST PRE  

*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. HRAC 15.

**Outlook (6) (dimethenamid-p)** PRE   *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. HRAC 15.

**paraquat products (paraquat)** POST   *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-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. PHI: 60-day HRAC 22. RUP.

**pendimethalin products (pendimethalin)** PRE  

*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. HRAC 03.

**Poast (1.5EC) (sethoxydim)** POST  *Garlic, Leek,*

*Onion (Dry), Onion (Green), Shallot* | 1-1.5 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 pts. per acre per growing season. REI: 12-hour. PHI: 30-day. HRAC 01.

**Prefar 4E (bensulide)** PRE   *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. HRAC NC.

**Starane Ultra (2.8) (fluroxypyr)** POST  *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. HRAC 04.

**trifluralin products (trifluralin)** PRE   *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. HRAC 03.