trifluralin products (trifluralin) PRE 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 low rate on coarse soils with less than 2% organic matter. Not effective on muck or high organic matter soils REI: 12-hour. HRAC 03.

Mint – Horticulture

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

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 spearment (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. “Squirrely” mint, which occurs primarily on peppermint, is caused by the mint 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.

Topdress with 40 pounds N per acre on muck soils, or 80 pounds N per acre for mineral soils in early June.

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 on both 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 machines, but the collection into distillation tubs requires a specialized procedure and equipment.

Mint – Diseases

Reviewed by Dan Egel – Sept 2021

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 M05.
**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 M05.

*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 03.

*Rally 40WSP (myclobutanil) | 4-5 fl. oz. per acre. REI: 24-hour. PHI: 30-day. FRAC 03.

**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.

**Mint – Insects**

Reviewed by Laura Ingwell, Elizabeth Long – Sept 2021

**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.*

*Bt (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: 3-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 05. OMRI-listed.*

*Intrepid 2F (methoxyfenozide) | 10-16 fl. oz. per acre. For armyworms, cutworms, and loopers. Do not exceed 16 fl. oz. per acre 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 01A. 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 01B.*
**Mint – Weeds**

Reviewed by Stephen Meyers, Ben Phillips – Sept 2021

### Recommended Controls

#### All Weeds

Before establishing a mint planting, reduce perennial weeds in the area to be planted with systemic broad-spectrum herbicides and/or cultivation. For full-season weed control consider combinations of dormant, in-season, and post-harvest herbicide applications.

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

Because mint is grown as a short-lived perennial crop, weed management in preceding crops is important to reduce the amount of weed seeds in the soil, and good weed control in the planting year is especially important. Between-row cultivation can be used in the first year before stolons and rhizomes grow into fill in this space. Late winter or early spring cultivation can be used to control winter annual weeds.

#### Pesticide

**Aim EC (2) (carfentrazone)**

| POST | 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 HRAC 14.

**Assure II (0.88EC) (quizalofop)**

| POST | 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. HRAC 01.

**Basagran (4) (bentazon)**

| POST | 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.

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**Mint – Weeds**

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 05.

**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 04A.

Lannate LV (2.4L) (methomyl) | 2.25-3 pts. per acre. Do not exceed 6 pts. per acre per crop or 4 applications per crop. For best results, apply immediately after harvest on stubble. REI: 48-hour. PHI: 14-day. IRAC 01A.

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-hour. PHI: 7-day. IRAC 01B.

**Mites**

Squirrelly mint, which occurs primarily on peppermint, is caused by the mint bud mite, *Tarsonemus pipermenthae*.

**Pesticide**

Acracite 50WS (bifenthrate) | 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 0.7SC formulations at 1.75-2.5 fl. oz. 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-hour. PHI: 7-day. IRAC 01B.

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) (etofenprox) | 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.

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Mint – Weeds

Reviewed by Stephen Meyers, Ben Phillips – Sept 2021

### Recommended Controls

#### All Weeds

Before establishing a mint planting, reduce perennial weeds in the area to be planted with systemic broad-spectrum herbicides and/or cultivation. For full-season weed control consider combinations of dormant, in-season, and post-harvest herbicide applications.

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

Because mint is grown as a short-lived perennial crop, weed management in preceding crops is important to reduce the amount of weed seeds in the soil, and good weed control in the planting year is especially important. Between-row cultivation can be used in the first year before stolons and rhizomes grow into fill in this space. Late winter or early spring cultivation can be used to control winter annual weeds.

#### Pesticide

**Aim EC (2) (carfentrazone)**

| POST | 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 HRAC 14.

**Assure II (0.88EC) (quizalofop)**

| POST | 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. HRAC 01.

**Basagran (4) (bentazon)**

| POST | 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. HRAC 06.

**Chateau SW (51WDG) (flumioxazin)**

| POST | PRE |

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-hour to 12-hour. PHI: 7-day. HRAC 9.

**Command 3ME (clomazone)**

| PRE |

Apply in spring before mint starts to grow. Do not apply to emerged mint. Some whitening of tissue may occur as mint emerges. REI: 12-hour. PHI: 84-day. HRAC 13.

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

| PRE | 8 lb. |

**glyphosate products (glyphosate)**

| POST |

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-hour to 12-hour. PHI: 7-day. HRAC 9.

**GoalTender (4) (oxyfluorfen)**

| POST | PRE |

**Moxy 2E (bromoxynil)**

| POST | 1.0-1.5 pts. per acre |

**paraquat products (paraquat)**

| POST | 1.3-2 pt. per acre |

**pendimethalin products (pendimethalin)**

| PRE | 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. HRAC 03. |

**Poast (1.5EC) (sethoxydim)**

| POST | 1.0-2.5 pts. per acre. |

**Sinbar WDG (80) (terbacil)**

| POST | PRE | 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. HRAC 05. |

**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. HRAC 14.

**Midwest Veg Guide 2022**
Okra – Horticulture

**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.