

Cabbage

Copper Sulfate

Basicop 53 WP, 1 to 3 lb. (0 days)

Cuprofix Ultra, 3/4 to 1 1/4 lb. (0 days)

or

Cyprodinil/Fludioxonil

Switch 62.5 WG, 11 to 14 oz. (7 days)

or

Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 1 1/2 lb, 14-day intervals. (7 days) Maximum 4 applications.

or

Boscalid

Endura, 6 to 9 oz. (0 days)

DOWNY MILDEW (*Peronospora parasitica*): Apply when conditions favor disease development and repeat every 7 to 10 days.

* Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 1 1/2 lb, 14-day intervals. (7 days) Maximum 4 applications.

or

* Mefenoxam

Ridomil Gold SL, 0.125-0.25 pt. (7 days)

or

* Fosetyl-Aluminum

Aliette WDG, 2 to 5 lb, 7- to 21-day intervals. (3 days)

Note: Do not tank mix with copper fungicides.

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 2.5 to 5 pt every 7 - 21 days. (0 days)

Prophyt, 2 to 4 pt. (0 days)

or

Acibenzolar-S-methyl

Actigard, 1 oz per 20 gal (ground) or 10 gal (aerial) of water. (7 days) Do not apply more than 4 applications per crop per year.

or

Mono-, dibasic sodium salts of phosphorous acid

Fosphite, 1 to 3 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)

or

Mandipropamid

Revus, 8 fl oz. (1 day)

Note: Fungicides that protect against *Alternaria* also provide limited downy mildew protection.

Cabbage

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Sugar beet cyst, northern root-knot and root-lesion nematodes can reduce cabbage yields. Fields with soil or root problems of

undetermined cause should be tested for nematodes (see Appendix C). If the plant-parasitic nematodes are present in population densities above the economic threshold for cabbage, crop rotation or application of a nematicide is recommended. The following nematicides are suitable for control of sugar beet cyst, root-knot and lesion nematodes in cabbage production. It is best not to plant cabbage on land infested with sugar beet cyst nematodes.

FALL SOIL FUMIGATION (BROADCAST):

1,3-D

Telone II, 25 gal/A (muck soil), 9-18 gal/A (mineral soil).

Fumigate in the fall when soil temperatures at a 6-inch depth are above 50F. Inject the fumigant to a soil depth of 8 inches and lightly seal the soil immediately after application.

Use soil fumigants only as directed on the label. In some limited situations soil fumigants can be applied in the spring in Michigan. Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

PREPLANT SOIL TREATMENT:

Mocap 15 G. Apply 34 lb/A up to one week before planting and incorporate to a depth of 3 inches. (RUP)

SOIL TREATMENT AT PLANTING:

Fenamiphos

Nemacur 15 G, 7.3 to 18.4 oz per 1,000 row feet. Apply in 6-15 inch band width. Application may be made prior to planting, at planting or immediately following transplanting. Incorporate mechanically or with overhead irrigation. Do not treat more than 50% of total field area. DO NOT ALLOW BANDS TO OVERLAP. May be used on seeded or transplanted cabbage. (RUP)

Note: For hydrologic soil group A, soils that are excessively drained or predominantly sand or loamy sand with shallow water tables (less than 50 feet deep), *Nemacur* can no longer be used. For all other soil types, *Nemacur* can no longer be purchased, but stores of the product can be used until depleted.

or

Mocap 15 G (13 lb) or *Mocap* 6 EC (1.3 to 2 qt) (36 inch row spacing) Apply in a 12- to 15-inch band over the row. Do not allow material to contact the seed. (RUP)

INSECTS

SEEDBED TREATMENT:

Apply treatments to soil according to directions to protect young seedlings in the seedbed before transplanting in field.

CABBAGE MAGGOT: Apply to seedbed surface and incorporate to 3 to 4 inches.

Diazinon AG 500, 3 qt. Apply only as directed. (RUP)

SOIL TREATMENT:

APHIDS:

Venom, 5 to 6 oz. (21 days) See label for application methods. or

*Materials marked with an asterisk are particularly recommended for problem infestations.

Platinum, 5 to 11 fl oz. (30 days) See label for application methods.

FLEA BEETLE, THRIPS:

Platinum, 5 to 11 fl oz. (30 days) See label for application methods.

TRANSPLANT WATER TREATMENT:

Treatments are applied in water around roots at time plants are set in field. **Note:** Treatment rates are given in amount of formulation per 100 gallons of water. Apply at rate of 1 cup solution per plant. Frequent agitation is needed with wet-table powders.

CABBAGE MAGGOT:

Diazinon 50 WP (1 lb/100 gal) or *Diazinon* AG 500 (1/2 to 1 pt/100 gal) Use only as directed. (RUP)

PLANTING TREATMENT:

Treatments applied at seeding.

CABBAGE MAGGOT: Apply in a 4-inch band over row at time of seeding.

Lorsban 15 G (4.6 to 9.2 oz/1,000 ft of row) or *Lorsban* 4 E / *Lorsban* Advanced (1.6 to 2.75 fl oz / 1,000 ft of row) Use only as directed. (RUP)

or
Capture LFR, 3.4 to 6.8 oz. See label for application methods.

APHIDS, FLEA BEETLE: Apply as band on each side of seed row or transplant row at time of seeding or sidedressed after plants become established. Treatments applied at seeding or transplanting are translocated into foliage systemically.

Di-Syston 15 G (7.4 oz / 1,000 ft) or *Di-Syston* 8 E (1.1 fl oz/1,000 ft) (42 days) Use only as directed. (RUP)

or
Platinum, 5 to 11 fl oz. (30 days) See label for application methods.

SOIL TREATMENT AFTER TRANSPLANTING:

APHIDS: Apply as a post-seeding drench, transplant drench, or hill drench, or as a sidedress after plants are established.

Imidacloprid

Admire Pro, 4.4 - 10.5 fl oz. (21 days)

Nuprid 2 F, 10 to 24 oz. (21 days)

CABBAGE MAGGOT: Apply to the soil at base of plants after transplanting. Apply water to wet soil surface.

Lorsban 15 G (4.6 to 9.2 oz per 1,000 of row) or *Lorsban* 4 E / *Lorsban* Advanced (1.6 to 2.75 fl oz / 1,000 ft of row) Apply in a 4-inch band over row at time of seeding. Use only as directed. (RUP)

FOLIAR TREATMENT:

FLEA BEETLE: Apply as needed soon after plants emerge.

Cypermethrin

Ammo 2.5 EC (2 1/2 to 5 oz) or *Ammo* WSB (1 to 2 bags)

or *UP-Cyde* 2.5 EC (2 1/2 to 5 oz) (1 day) (RUP)

or
Asana XL, 5.8 oz. (3 days) (RUP)

or

Baythroid XL, 2.4 to 3.2 fl oz. (0 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz. (7 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin* XLR Plus (1/2 to 1 qt) (3 days)

or

Endosulfan 3 EC, 2 pt. (7 days) Consult label for rotation restrictions.

or

Thiodicarb

Larvin 3.2 EC, 16 to 32 oz. (7 days)

or

Lorsban 50 W, 2 lb. (21 days) (RUP)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Warrior with Zeon Technology, 2.6 to 3.8 fl oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (1 day) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Venom, 3 to 4 oz. (1 day)

or

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.8 fl oz. (7 days) Do not exceed 19.2 oz/Acre per season.

or

Actara, 1.5 to 3 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Permethrin

Perm-UP 3.2 EC, 2 to 8 oz. (1 day) (RUP)

CUTWORM, ARMYWORM: Apply when damage is first seen.

Repeat as needed

* Cypermethrin

Ammo 2.5 EC (2 1/2 to 5 oz) or *Ammo* WSB (1 to 2 bags)

or *UP-Cyde* 2.5 EC (2 1/2 to 5 oz) (1 day) (RUP)

or

* *Asana* XL, 9.6 oz. (3 days) (RUP)

or

* *Baythroid* XL, 2.4 to 3.2 fl oz. (0 days) (RUP)

or

* Bifenthrin (RUP)

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 6.4 oz. (7 days)

or

* *Mustang* Max, 3.2 to 4.0 oz. (1 day) (RUP)

or

* *Warrior* with Zeon Technology, 2.6 to 3.8 fl oz. (1 day) (RUP)

or

Endosulfan 3 EC, 2 2/3 pt. (7 days) Consult label for rotation restrictions.

or

Lannate LV (1 1/2 pt) or *Lannate* SP (1/2 lb) (1 day) (RUP)

or

Cabbage

SpinTor 2 SC, 4 to 8 oz. (1 day) Do not apply more than 3 times in 30 days.

or

Entrust, 1.3 to 3 oz. (1 day) Do not apply more than 3 times in 30 days.

or

Lambda-cyhalothrin

Lambda-Cy, Proaxis, 2.6 to 3.8 fl oz. (1 day) (RUP)

or

Rimon, 6 to 12 fl oz. (7 days)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Brigadier, 3.8 to 6.1 oz. (7 days)

IMPORTED CABBAGE WORM: Apply if 20% or more are infested with any cabbage "worm" before heading or if >10% are infested at or after heading.

Permethrin

Ambush 25 W, 3.2 to 6.4 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (2 to 8 oz) or *Pounce* 25 WP (3.2 to 6.4 oz) or *Pounce* 3.2 EC (2 to 4 oz) (1 day) (RUP)

or

Cypermethrin

Ammo 2.5 EC (2 1/2 to 5 oz) or *Ammo* WSB (1 to 2 bags) or *UP-Cyde* 2.5 EC (2 1/2 to 5 oz) (1 day) (RUP)

or

Asana XL, 2.9 to 5.8 oz. (3 days) (RUP)

or

Avaunt, 2.5 to 3.5 oz. (3 days) Do not exceed 14 oz/acre per crop.

or

Bacillus thuringiensis

Agree, Biobit, Dipel, Javelin, Lepinox, Xentari. (0 days)

or

Baythroid XL, 1.6 to 2.4 fl oz. (0 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz. (7 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/2 lb) or *Sevin* XLR Plus (1 to 2 qt) (3 days)

or

Danitol 2.4 EC, 10 2/3 to 16 fl oz. (7 days) (RUP)

or

Diazinon 50 WP (1 lb) or *Diazinon* AG 500 (1 pt) (7 days) (RUP)

or

Dibrom 8 EC, 1 pt. (1 day)

or

Endosulfan 3 EC, 2 pt. (7 days) Consult label for rotation restrictions.

or

Thiodicarb

Larvin 3.2 EC, 16 to 32 oz. (7 days)

or

Lannate LV (3/4 to 3 pt) or *Lannate* SP (1/4 lb) (1 day) (RUP)

or

Lorsban 50 W, 2 lb. (21 days) (RUP)

or

Malathion 57 EC, 2 pt. (7 days)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Proclaim, 2.4 to 4.8 oz. (7 days) (RUP)

or

SpinTor 2 SC, 3 to 6 oz. (1 day) Do not apply more than 3 times in 20 days.

or

Warrior with Zeon Technology, 1.9 to 3.2 fl oz. (1 day) (RUP)

or

Entrust, 1 to 2 oz. (1 day) Do not apply more than 3 times in 30 days.

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or

Lambda-cyhalothrin

Lambda-Cy, Proaxis, 1.9 to 3.2 fl oz. (1 day) (RUP)

or

Rimon, 6 to 12 fl oz. (7 days)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Brigadier, 3.8 to 6.1 oz. (7 days)

DIAMONDBACK MOTH: Apply if 20% or more are infested with any cabbage "worm" before heading or if >10% are infested at or after heading. Use *Bacillus thuringiensis* to avoid killing important natural enemies of diamondback moth.

* *Avaunt*, 3.5 oz. (3 days) Do not apply more than twice to one generation. Do not exceed 14 oz/acre per crop.

or

* *Bacillus thuringiensis*

Agree, Biobit, Dipel, Javelin, Lepinox, Xentari. (0 days)

or

* *SpinTor* 2 SC, 1.5 to 3 oz. (1 day) Do not apply more than 3 times in 30 days.

or

* *Entrust*, 0.5 to 1.3 oz. (1 day) Do not apply more than 3 times in 30 days.

or

Asana XL, 5.8 to 9.6 oz. (3 days) (RUP)

or

Baythroid XL, 2.4 to 3.2 fl oz. (0 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz. (7 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/2 lb) or *Sevin* XLR Plus (1 to 2 qt) (3 days)

or

Diazinon 50 WP (1 lb) or *Diazinon* AG 500 (1 pt) (7 days) (RUP)
 or
Dibrom 8 EC, 1 pt. (1 day)
 or
Endosulfan 3 EC, 2 pt. (7 days) Consult label for rotation restrictions.
 or
Lannate SP, 1 1/2 lb. (1 day) (RUP)
 or
 Thiodicarb
Larvin 3.2 EC, 24 to 40 oz. (7 days)
 or
Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)
 or
 Permethrin
Ambush 25 W, 3.2 to 12.8 oz. (1 day) (RUP)
 or
Perm-UP 3.2 EC (2 to 8 oz) or *Pounce* 25 WP (3.2 to 12.8 oz) or *Pounce* 3.2 EC (2 to 8 oz) (1 day) (RUP)
 or
Proclaim, 2.4 to 4.8 oz. (7 days) (RUP)
 or
Warrior with Zeon Technology, 2.6 to 3.8 fl oz. (1 day) (RUP)
 or
 Lambda-cyhalothrin
Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (1 day) (RUP)
 or
Rimon, 6 to 12 fl oz. (7 days)
 or
Hero, 4 to 10.3 oz. (7 days) (RUP)
 or
Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.
 or
Brigadier, 3.8 to 6.1 oz. (7 days)
CABBAGE LOOPERS: Apply if 20% or more are infested with any cabbage "worm" before heading or if >10% are infested at or after heading. Most controls are less effective on larger worms.
 Cypermethrin
Ammo 2.5 EC (3 3/4 to 5 oz) or *Ammo* WSB (1 to 2 bags) or *UP-Cyde* 2.5 EC (3 3/4 to 5 oz) (7 days) (RUP)
 or
Asana XL, 5.8 to 9.6 oz. (1 day) (RUP)
 or
Avaunt, 2.5 to 3.5 oz. (3 days) Do not exceed 14 oz/acre per crop.
 or
Bacillus thuringiensis
Agree, *Biobit*, *Dipel*, *Javelin*, *Lepinox*, *Xentari*. (0 days)
 or
Baythroid XL, 1.6 to 2.4 fl oz. (0 days) (RUP)
 or
 Bifenthrin
Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz. (7 days) (RUP)
 or
Danitol 2.4 EC, 10 2/3 to 16 fl oz. (7 days) (RUP)
 or
Dibrom 8 EC, 2 pt. (1 day)

or
Endosulfan 3 EC, 1 1/3 qt. (7 days) Consult label for rotation restrictions.
 or
Lannate LV (3 pt) or *Lannate* SP (1 lb) (1 day) (RUP)
 or
 Thiodicarb
Larvin 3.2 EC, 24 to 40 oz. (7 days)
 or
Mustang Max, 3.2 to 4.0 oz. (1 day) (RUP)
 or
 Permethrin
Perm-UP 3.2 EC (2 to 8 oz) or *Pounce* 25 WP (3.2 to 12.8 oz) or *Pounce* 3.2 EC (2 to 8 oz) (1 day) (RUP)
 or
Proclaim, 3.2 to 4.8 oz. (7 days) (RUP)
 or
Warrior with Zeon Technology, 1.9 to 3.2 fl oz. (1 day) (RUP)
 or
SpinTor 2 SC, 3 to 6 oz. (1 day) Do not apply more than 3 times in 30 days.
 or
Entrust, 1 to 2 oz. (1 day) Do not apply more than 3 times in 30 days.
 or
Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)
 or
 Lambda-cyhalothrin
Lambda-Cy, *Proaxis*, 1.9 to 3.2 fl oz. (1 day) (RUP)
 or
Rimon, 6 to 12 fl oz. (7 days)
 or
Hero, 4 to 10.3 oz. (7 days) (RUP)
 or
Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.
 or
Brigadier, 3.8 to 6.1 oz. (7 days)
APHIDS: Apply if there are >5 per plant.
Assail 30 SG, 1.9 to 2.8 oz. (7 days)
 or
Diazinon 50 WP (1 lb) or *Diazinon* AG 500 (1 pt) (7 days) (RUP)
 or
Dibrom 8 EC, 1 pt. (1 day)
 or
Endosulfan 3 EC, 2 pt. (1 day) Consult label for rotation restrictions.
 or
Fulfill, 2.75 oz. (7 days) May require 5 to 7 days for aphid mortality.
 or
Malathion 57 EC, 2 pt. (7 days)
 or
 Imidacloprid
Nuprid 1.6 F, *Provado* 1.6 F, 3.75 fl oz. (7 days) Do not use if Imidacloprid was used at planting. Do not exceed 19.2 oz/Acre per season.
 or

Cabbage

Venom, 1 to 4 oz. (1 day)

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Actara, 1.5 to 3 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Brigadier, 3.8 to 6.1 oz. (7 days)

THRIPS: Apply insecticide if thrips are present at cupping. Use resistant cabbage varieties.

* Cypermethrin

Ammo 2.5 EC (3 3/4 to 5 oz) or *Ammo* WSB (1 to 2 bags)

or *UP-Cyde* 2.5 EC (3 3/4 to 5 oz) (1 day) (RUP)

or

* Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz.

(7 days) (RUP)

or

Assail 30 SG, 4 oz. (7 days)

or

Entrust, 1.3 to 3 oz. (1 day) Do not apply more than 3 times in 30 days.

or

Hero, 10.3 oz. (7 days) (RUP)

or

Actara, 3 to 5.5 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Radiant SC, 6 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Brigadier, 3.8 to 6.1 oz. (7 days)

SLUGS

Deadline M-Ps 4% (20 to 40 lb) or *Metaldehyde* 3.5 G (30 to 40 lb) Apply between rows. Avoid contact to edible product.

DISEASES

SEED TREATMENT:

DAMPING OFF, WIRE STEM (*Pythium* spp., *Rhizoctonia solani*):

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Captan

Captan 30-DD, 1 1/4 oz/100 lb seed.

Captan 400, 1 to 2 oz/100 lb seed.

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed. Commercial seed treatment plants only (*Rhizoctonia*).

or

Thiram

42-S *Thiram*, *Thiram* 50 WP Dyed, 8 oz/100 lb seed.

BLACK LEG (*Phoma lingam*):

There are presently no chemicals registered for use on this disease.

SEEDBED TREATMENT:

Apply treatments to soil according to directions to protect young seedlings in the seedbed before transplanting in field.

CLUBROOT (*Plasmodiophora brassicae*):

PCNB. Sterilize seedbed before planting (Appendix A) or apply to soil surface as a drench.

Terraclor 10 G, 200 lb (row) or 300 lb (broadcast). Row application: Apply in a 12 to 15 inch band by means of a suitable applicator and rototill to a depth of 4 to 6 inches. Broadcast application: Apply and disc and cross disc to depth of 4 to 6 inches. May be used on direct seeded crops.

or

Terraclor 75 WP, 30 lb in 25 gal of water (band) or 40 lb in 35 gal of water (broadcast). Band application: Spray as a 12 to 15 inch band centered on the row and incorporate to a depth of 4 to 6 inches. Broadcast application: Apply and thoroughly incorporate to a depth of 4 to 6 inches. May be used on directly seeded crops.

or

Terraclor F, 5.6 gal in 25 gal of water (band) or 7.5 gal in 30 gal of water (broadcast). Band application: Spray as a 12- to 15-inch band centered on the row and incorporate to a depth of 4 to 6 inches prior to planting. Broadcast application: Apply as a preplant broadcast prior to planting. Incorporate to a depth of 4 to 6 inches. May be used on direct seeded crops.

DAMPING OFF (*Pythium* spp.), **BASAL STEM ROT**

(*Phytophthora* spp.):

Mefenoxam. Apply as a broadcast preplant incorporation or surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold SL, * 0.25-0.5 pt (*Pythium*) 1-2 pt (*Phytophthora*).

or

Ridomil Gold WSP, 1 to 2 lb (1/4 to 1/2 lb, surface application, *Pythium* only).

WIRE STEM or **BLACK ROOT** (*Corticium solani*):

PCNB

Terraclor 10 G, 110 to 150 lb. Row application (40 in. row spacing): Apply in an 8 in. band immediately prior to seeding.

or

Terraclor 75 WP, 10 to 15 lb in 35 gal of water (row) or 15 to 20 lb in 50 gal of water (broadcast). Row drench treatment: Apply 10 to 15 lb in 35 gal of water. Spray as an 8 inch band centered on the row.

or

Terraclor F, 1.9 to 2.8 gal in 35 gal of water (row) or 2.8 to 3.8 gal in 50 gal of water (broadcast). Row drench treatment: Spray as an 8 inch band centered on the row.

TRANSPLANT WATER TREATMENT:

CLUBROOT (*Plasmodiophora brassicae*):

PCNB. Apply in 100 gal of water using 1/2 pt per plant around roots at time plants are set in field. **Note:** Frequent agitation is needed.

Terraclor 75 WP, 2 lb.

Terraclor F, 3 pt.

*Materials marked with an asterisk are particularly recommended for problem infestations.

FOLIAR TREATMENT:

BLACK ROT (*Xanthomonas campestris*): Apply treatment (lowest rate) in the field as soon as transplants are established.

Copper Ammonium Carbonate

Copper Count N, 2 qt. (0 days) Flecking of wrapper leaves may occur.

or

Copper Hydroxide

Champ Formula 2 F, 1 1/3 pt. Flecking of wrapper leaves may occur.

or

Champion WP, *Kocide 101*, *Kocide DF*, *Nu-Cop 50 DF*, 2 lb. (0 days) Flecking of wrapper leaves may occur.

or

Kocide 2000, 3/4 to 1 1/2 lb. (0 days)

Kocide 4.5 LF, 2/3 to 1 1/3 pt. (0 days)

Nu-Cop 3 L, 1 1/3 to 2 2/3 pt. (0 days)

or

Acibenzolar-S-methyl

Actigard, 1 oz per 20 gal (ground) or 10 gal (aerial) of water. (7 days) Do not apply more than 4 applications / crop per year.

ALTERNARIA LEAF SPOT (*Alternaria brassicae*): Apply when conditions favor disease development and repeat every 7 to 10 days.

* Azoxystrobin

Amistar, 2 to 5 oz 7 - 14 days. (0 days) Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Quadris, 6.2 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Chlorothalonil

Bravo Ultrex, 1.4 lb. (7 days)

Bravo Weather Stik, *Equus 720 SST*, 1.5 pt. (7 days)

or

* Maneb

Maneb 75 DF, *Maneb 80 WP*, 1 1/2 to 2 lb. (7 days) Cabbage and tight-headed Chinese cabbage.

or

Maneb 75 DF, 1 to 1 1/2 lb. (10 days) Loose-headed Chinese cabbage only.

or

Manex, 1 1/5 to 1 3/5 qt (cabbage and tight-headed Chinese cabbage) or 4/5 to 1 1/5 qt.. (7 days) Cabbage and tight-headed Chinese cabbage.

or

Copper Ammonium Carbonate

Copper Count N, 2 qt. (0 days) Flecking of wrapper leaves may occur.

or

Copper Hydroxide

Champ Formula 2 F, 1 1/3 pt. (0 days) Flecking of wrapper leaves may occur.

or

Champ WP, *Kocide 101*, *Kocide DF*, *Nu-Cop 50 DF*, 2 lb. (0 days) Flecking of wrapper leaves may occur.

or

Kocide 2000, 3/4 to 1 1/2 lb. (0 days)

Kocide 4.5 LF, 2/3 to 1 1/3 pt. (0 days)

Nu-Cop 3 L, 1 1/3 to 2 2/3 pt. (0 days) Minimum of 25 GPA.

or

Copper Sulfate

Basicop 53 WP, 1 to 3 lb. (0 days)

Cuprofix Ultra, 3/4 to 1 1/4 lb. (0 days)

or

Cyprodinil/Fludioxonil

Switch 62.5 WG, 11 to 14 oz. (7 days)

or

Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 1 1/2 lb, 14-day intervals. (7 days) Cabbage and tight-headed Chinese cabbage. Maximum 4 applications. Do not tank mix with copper fungicides.

or

Boscalid

Endura, 6 to 9 oz. (0 days)

DOWNY MILDEW (*Peronospora parasitica*): Apply when conditions favor disease development and repeat every 7 to 10 days.

* Fosetyl-Aluminum

Aliette WDG, 2 to 5 lb, 7- to 21-day intervals. (3 days) Do not tank mix with copper fungicides.

or

* Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 1 1/2 lb, 14-day intervals. (7 days) Cabbage and tight-headed Chinese cabbage. Maximum 4 applications.

* Mefenoxam

Ridomil Gold SL, 0.125-0.25 pt. (7 days)

or

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 2.5 to 5 pt every 7 - 21 days.

Prophyt, 2 to 4 pt. (0 days)

or

Acibenzolar-S-methyl

Actigard, 1 oz per 20 gal (ground) or 10 gal (aerial) of water.

(7 days) Do not apply more than 4 applications / crop per year.

or

Mono-, dibasic sodium salts of phosphorous acid

Fosphite, 1 to 3 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)

or

Mandipropamid

Revus, 8 fl oz. (1 day)

Note: Fungicides that protect against Alternaria also provide limited downy mildew protection.

Carrots

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Northern root-knot, pin and carrot cyst nematodes severely reduce carrot quality and yields. Crop rotation is an essential part of nematode management in carrot production in Michigan. Fields with soil or root problems of undetermined cause should be tested for nematodes (see Appendix C). If the plant-parasitic nematodes are present, crop rotation or application of a nematicide will be recommended. The following nematicides are suitable for control of root-knot nematodes in carrot production. Nematicide failures have been observed with increasing frequency in sites with very high population densities, or where the carrot cyst nematode is the major problem.

FALL SOIL FUMIGATION (BROADCAST):

1,3-D

Telone II, 25 gal/A (muck soil), 9-18 gal/A (mineral soil).

Fumigate in the fall when soil temperatures at a 6-inch depth are above 50F. Inject the fumigant to a soil depth of 8 inches and lightly seal the soil immediately after application. Use soil fumigants only as directed on the label. In some limited situations, soil fumigants can be applied in the spring in Michigan.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

or

Metam Sodium

Vapam HL, 37.5 to 75 gal/A (use higher rate for muck soil).

Inject with shanks spaced 5 inches apart or to a depth of 4 to 10 inches in well prepared soil. If shanked, roll and irrigate treated surface to prevent escape of gas.

PREPLANT TREATMENT:

Vydate L, Broadcast. Apply 2 to 4 gal in a minimum of 20 gallons of water as a broadcast treatment. Apply within one week of planting and thoroughly incorporate to a depth of 4 to 6 inches. (RUP)

PLANTING TREATMENT:

Vydate L, in-row. Apply 1 to 2 gal in a minimum of 20 gallons of water in the seed furrow at planting. (RUP)

POST-PLANT TREATMENT:

Vydate L, Broadcast. Apply 2 gal/A in at least 20 gal water/A before emergence. Incorporate into the soil. (RUP)

INSECTS

PRE-PLANT TREATMENT:

WIREWORM: May be found in grassy or weedy fields. If wireworm are present, apply evenly to the soil surface and incorporate 4 to 6 inches deep prior to planting.

Diazinon AG 500, 4 qt. Preplant soil application only. (RUP)

APHIDS, EARLY SEASON LEAFHOPPERS: Apply preplant or in furrow.

Imidacloprid

Admire Pro, 4.4 - 10.5 fl oz. (21 days)

Nuprid 2 F, 10 to 24 fl oz. (21 days)

or

Platinum, 5 to 12 fl oz. (30 days) See label for application methods.

FOLIAR TREATMENT:

CUTWORM: Apply when cutworm are first seen.

* *Asana XL*, 5.8 to 9.6 oz. (1 day) Ground application only. (RUP)

or

* *Baythroid XL*, 1.6 fl oz. (0 days) (RUP)

or

Lannate LV (1 1/2 pt) or *Lannate SP* (1/2 lb) (1 day) (RUP)

CARROT WEEVIL ADULTS: Apply early in the spring when adults are first detected. Repeat weekly as needed.

* *Asana XL*, 9.6 oz. (7 days) Ground application only. (RUP)

or

* *Baythroid XL*, 2.8 fl oz. (0 days) (RUP)

CARROT WEEVIL LARVAE: Apply when larvae are first seen or 3 to 5 days after appearance of first eggs. Repeat in 2 to 3 weeks, up to 3 applications.

Vydate L, 4 pt. (14 days) Special Michigan SLN label. (RUP)

LEAFHOPPERS (*Aster yellows*): Treat fields if numbers exceed 20/100 sweeps. Repeat as needed (every 3 to 6 days) depending on the number of leafhoppers.

* *Asana XL*, 5.8 to 9.6 oz. (1 day) Ground application only. (RUP)

or

* *Baythroid XL*, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Actara, 1.5 to 3 oz. (7 days)

or

Carbaryl

Sevin 80 S, 1 1/4 lb. (0 days)

or

Endosulfan 3 EC, 2/3 to 1 1/3 qt. (7 days) Only 1 application per year.

or

Lannate LV (1 1/2 to 3 pt) or *Lannate SP* (1/2 to 1 lb) (1 day) (RUP)

or

Malathion 7 EC, 2 1/2 pt. (7 days)

APHIDS: Apply if needed.

Actara, 1.5 to 3 oz. (7 days)

or

Diazinon AG 500, 1 pt. (10 days) (RUP)

or

Endosulfan 3 EC, 2/3 to 1 1/3 qt. (7 days) Only 1 application per year.

or

Malathion 57 EC, 1 1/4 pt. (7 days)

or

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.5 fl oz. (7 days) Do not exceed 10.5 oz/Acre per season.

ASTER LEAFHOPPERS:

Carbaryl

Sevin XLR Plus, 1 qt. (7 days)

DISEASES

SEED TREATMENT:

DAMPING OFF (*Pythium* spp., *Rhizoctonia solani*): Use only as directed; overtreatment may cause injury.

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed. Commercial seed treatment plants only (*Rhizoctonia*).

or

Mefenoxam

Apron XL LS, 0.32 to 0.64 fl oz/100 lb seed (*Pythium*).

or

Metalaxyl

Allegiance-FL, 0.75 fl oz/100 lb seed.

or

Thiram

42-S Thiram, *Thiram* 50 WP Dyed, 8 oz/100 lb seed.

PREPLANT INCORPORATED:

CAVITY SPOT (*Pythium violae*):

* Mefenoxam

Ridomil Gold SL, 0.5-2 pt.

PREPLANT OR PLANTING TREATMENT:

CAVITY SPOT (*Pythium* spp. and *Phytophthora* spp.):

Mefenoxam

Ultra Flourish, 2 to 4 pt.

FOLIAR TREATMENT:

POWDERY MILDEW (*Sphaerotheca fuliginea* or *Erysiphe cichoracearum*): Apply at early leaf stage and repeat every 14 days.

* Pyraclostrobin/Boscalid

Pristine, 8 to 10.5 oz. (0 days)

or

* Trifloxystrobin

Flint, 2 to 3 oz. (7 days) Do not apply more than three sequential foliar applications of strobilurin fungicides before alternating with a fungicide that has a different mode of action.

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Sulfur

Kumulus DF, *Microthiol* Disperss, *Thiolux* Jet, 3 to 10 lb. (0 days)

or

Micro Sulf, 3 to 10 lb. (0 days)

or

Propiconazole

Propimax EC, 4 fl oz. (14 days)

Tilt, 4 fl oz. (14 days)

ALTERNARIA LEAF BLIGHT (*Alternaria dauci*): Apply every 7 to 14 days after emergence.

* Azoxystrobin

Amistar, 3 to 5 oz every 7-14 days. (0 days)

Quadris, 6.2 - 15.4 fl oz every 7 - 14 days. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Azoxystrobin/Chlorothalonil

Quadris Opti, 2.4 pt every 7-14 days. (0 days)

or

* Boscalid

Endura, 4.5 oz. (0 days)

or

* Chlorothalonil

Bravo Ultrex, *Equus* DF, 1.4 to 1.8 lb every 7 to 10 days. (0 days)

or

Bravo Weather Stik, *Echo* 720, *Equus* 720 SST, 1.5 to 2 pt. (0 days)

or

Echo 90 DF, 1.3 to 1.5 lb. (0 days)

or

* Iprodione

Iprodione 4L AG, *Rovral* 4 F, 1 to 2 pt. (0 days) Maximum 4 applications. See label for permissible rotation crops. Or 1 pt as a tank mix with another fungicide, maximum 10 applications.

or

Rovral, 1 to 2 lb. (0 days) Maximum 4 applications. See label for permissible rotation crops. Or 1 lb as a tank mix with another fungicide, maximum 10 applications.

or

* Pyraclostrobin

Cabrio, 8-12 oz. (0 days) No more than three sequential applications.

or

* Pyraclostrobin/Boscalid

Pristine, 8 to 10.5 oz. (0 days)

or

* Trifloxystrobin

Flint, 2 to 3 oz. (7 days) Do not apply more than three sequential foliar applications of strobilurin fungicides before alternating with a fungicide that has a different mode of action.

or

Copper Ammonium Carbonate

Copper Count N, 2 to 3 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, *Kocide* 4.5 LF, 1 1/3 pt. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

or

Cauliflower

Copper Sulfate

Basic Copper 53 (2 to 4 lb) or *Basicop* (3 to 4 lb) (0 days)
Cuprofix Ultra, 1.25 lb. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 to 4.5 pt. (0 days)

or

Cyprodinil/Fludioxonil

Switch 62.5 WG, 11 to 14 oz. (7 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Propiconazole

Propimax EC, 4 fl oz. (14 days)

or

Tilt, 4 fl oz. (14 days)

WHITE MOLD (*Sclerotinia sclerotiorum*): Apply when disease first appears and repeat every 7 to 10 days.

Neem Oil

Trilogy, 2 pt. (0 days)

CERCOSPORA LEAF SPOT (*Cercospora carotae*): Apply every 7 to 14 days after emergence.

* Azoxystrobin

Amistar, 3 to 5 oz. (0 days)

or

Quadris, 9.2 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Azoxystrobin/Chlorothalonil

Quadris Opti, 2.4 pt every 7-14 days. (0 days)

or

* Chlorothalonil

Bravo Ultrex, *Equus DF*, 1.4 to 1.8 lb. (0 days) May be applied through sprinkler irrigation equipment.

or

Bravo Weather Stik, *Echo 720*, *Equus 720 SST*, 1.5 to 2 pt. (0 days)

or

Echo 90 DF, 1.3 to 1.5 lb. (0 days)

or

* Pyraclostrobin

Cabrio, 8-12 oz. (0 days) No more than three sequential applications.

or

* Pyraclostrobin/Boscalid

Pristine, 8 to 10.5 oz. (0 days)

or

* Trifloxystrobin

Flint, 2 to 3 oz. (7 days) Do not apply more than three sequential foliar applications of strobilurin fungicides before alternating with a fungicide that has a different mode of action.

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, *Kocide 4.5 LF*, 1 1/3 pt. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 1/3 to 2 2/3 pt. (0 days)

or

Champion WP, *Kocide 101*, *Kocide DF*, *Nu-Cop 50 DF*, 2 lb. (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 2 to 3 qt. (0 days)

or

Copper Sulfate

Basic Copper 53, 2 to 4 lb. (0 days)

Basicop, 3 to 4 lb. (1 day)

Cuprofix Ultra, 1.25 lb. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 to 4.5 pt. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Propiconazole

Propimax EC, 4 fl oz. (14 days)

Tilt, 4 fl oz. (14 days)

BACTERIAL LEAF BLIGHT (*Xanthomonas campestris* pv. *carotae*): Apply every 7 to 10 days after first appearance.

Copper Hydroxide

Champ Formula 2 F, 2/3 to 2 pt. (0 days)

Champion WP, 1 to 3 lb. (0 days)

Kocide 101, 2 lb. (0 days)

CAVITY SPOT (*Pythium violae*): Apply 2 to 4 times at 14-day intervals beginning 40-50 days after Ridomil at-planting treatment. Maximum 4 applications.

* Mefenoxam

Ridomil Gold SL, 0.2 pt. (7 days)

or

Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 1 1/2 to 2 lb. (7 days)

or

Mefenoxam/Copper Hydroxide

Ridomil Gold Copper, 2 lb. (7 days)

Cauliflower

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

FALL SOIL FUMIGATION (BROADCAST): SUGAR BEET CYST, ROOT-KNOT and LESION NEMATODES:

Sugar beet cyst, root-knot and lesion nematodes can reduce cauliflower yields. Fields with soil or root problems of undetermined cause should be tested for nematodes (see Appendix C). If the plant-parasitic nematodes are present in population densities above the economic threshold for cauliflower, crop rotation or application of a nematicide is recommended. The following nematicides are suitable for control of sugar beet cyst, root-knot and lesion nematodes in cauliflower production.

1,3-D

Telone II, 25 gal/A (muck soil), 9-18 gal/A (mineral soil). Fumigate in the fall when soil temperatures at a 6-inch depth are above 50F. Inject the fumigant to a soil depth of 8 inches and lightly seal the soil immediately after application. Use soil fumigants only as directed on the label. In some situations soil fumigation can be applied in the spring in Michigan.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

INSECTS

SEEDBED TREATMENT:

Apply treatments to the soil according to directions to protect young seedlings in the seedbed before transplanting in field.

CABBAGE MAGGOT: Apply equivalent amount to seedbed surface and incorporate to 3 to 4 inches.

Diazinon AG 500, 3 qt. Apply only as directed. (RUP)

SOIL TREATMENT:

APHIDS:

Venom, 5 to 6 oz. (21 days) See label for application methods.

or
Platinum, 5 to 11 fl oz. (30 days) See label for application methods.

FLEA BEETLE:

Platinum, 5 to 11 fl oz. (30 days) See label for application methods.

TRANSPLANT WATER TREATMENT:

Treatments are applied in water around roots at time plants are being set in the field. **Note:** Treatment rates are given in the amount of formulation per 100 gals of water. Apply at rate of 1 cup solution/plant. Frequent agitation is needed with wettable powders.

CABBAGE MAGGOT:

Diazinon 50 WP (1 lb/100 gal) or *Diazinon AG 500* (1/2 to 1 pt/100 gal) Use only as directed. (RUP)

PLANTING TREATMENT:

Treatments applied at seeding.

CABBAGE MAGGOT: Apply in a 4 inch band over row at time of seeding.

Lorsban 15 G (4.6 to 9.2 oz/1,000 ft of row) or *Lorsban 4 E / Lorsban Advanced* (1.6 to 2.4 fl oz/1,000 ft of row) (RUP)

or
Capture LFR, 3.4 to 6.8 oz. See label for application methods.

APHIDS and FLEA BEETLE: Apply as a band on each side of seed row or transplant row at the time of planting or sidedressed after plants are established. Treatments applied at seeding or transplanting are translocated into foliage systemically.

Di-Syston 15 G (7.4 oz / 1,000 ft) or *Di-Syston 8 E* (1.1 fl oz/1,000 ft) (40 days) Use only as directed. (RUP)

or

Platinum, 5 to 11 fl oz. (30 days) See label for application methods.

SOIL TREATMENT AFTER TRANSPLANTING:

APHIDS: Apply as a post-seeding drench, transplant drench, or hill drench, or as a sidedress after plants are established.

Imidacloprid

Admire Pro, 4.4 - 10.5 fl oz. (21 days)

Nuprid 2 F, 10 to 24 fl oz. (21 days)

CABBAGE MAGGOT: Apply to the soil at base of plants after transplanting. Apply water to wet soil surface.

Lorsban 4 E / Lorsban Advanced, 1.6 to 2.4 fl oz/1,000 ft of row. (RUP)

FOLIAR TREATMENT:

FLEA BEETLE: Apply as needed soon after plants emerge.

Cypermethrin

Ammo 2.5 EC (2.5 to 5 oz) or *Ammo WSB* (1 to 2 bags) or

UP-Cyde 2.5 EC (2.5 to 5 oz) (1 day) (RUP)

or

Asana XL, 5.8 oz. (3 days) (RUP)

or

Baythroid XL, 2.4 to 3.2 fl oz. (0 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade 2EC*, *Capture 2 EC*, 2.1 to 6.4 oz. (7 days) (RUP)

or

Endosulfan 3 EC, 2 pt. (14 days) Consult label for rotation restrictions.

or

Thiodicarb

Larvin 3.2 EC, 24 to 40 oz. (7 days)

or

Lorsban 50 W, 2 lb. (21 days) (RUP)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Venom, 3 to 4 oz. (1 day)

or

Cauliflower

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.8 fl oz. (7 days) Do not exceed 19.2 oz/Acre per season.

or

Actara, 1.5 to 3 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Permethrin

Perm-UP 3.2 EC, 2 to 4 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (RUP)

CUTWORM, ARMYWORM: Apply when damage is first seen.

Repeat as needed.

* Cypermethrin

Ammo 2.5 EC (2.5 to 5 oz) or *Ammo* WSB (1 to 2 bags) or *UP-Cyde* 2.5 EC (2.5 to 5 oz) (1 day) (RUP)

or

* *Asana* XL, 9.6 oz. (3 days) (RUP)

or

* *Baythroid* XL, 2.4 to 3.2 fl oz. (0 days) (RUP)

or

* Bifenthrin (RUP)

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 6.4 oz. (7 days)

or

* *Mustang* Max, 3.2 to 4.0 oz. (1 day) (RUP)

or

* Permethrin

Ambush 25 W, 6.4 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 oz) or *Pounce* 25 WP (6.4 oz) or *Pounce* 3.2 EC (4 oz) (1 day) (RUP)

or

Endosulfan 3 EC, 2 2/3 pt. (14 days) Consult label for rotation restrictions.

or

Lannate LV (1 1/2 pt) or *Lannate* SP (1/2 lb) (3 days) (RUP)

or

Lorsban 50 W, 2 lb. (21 days) (RUP)

or

SpinTor 2 SC, 4 to 8 oz. (1 day) Do not apply more than 3 times in 30 days.

or

Entrust, 1.3 to 3 oz. (1 day) Do not apply more than 3 times in 30 days.

or

Rimon, 6 to 12 fl oz. (7 days)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Brigadier, 3.8 to 6.1 oz. (7 days)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (RUP)

IMPORTED CABBAGE WORM: Apply if: 1) >10% of transplants are infested with any type of cabbage "worm", 2) >50% of plants are infested before flowering, or 3) >10% of plants are infested at or after 1st flowering.

Acephate

Acephate 97 UP, *Orthene* 97, 1 lb. (14 days) Do not apply more than 2-1/8 lb per season.

or

Cypermethrin

Ammo 2.5 EC (2.5 to 5 oz) or *Ammo* WSB (1 to 2 bags) or *UP-Cyde* 2.5 EC (2.5 to 5 oz) (1 day) (RUP)

or

Asana XL, 2.9 to 5.8 oz. (3 days) (RUP)

or

Avaunt, 2.5 to 3.5 oz. (3 days) Do not exceed 14 oz/acre per crop.

or

Bacillus thuringiensis

Agree, *Biobit*, *Dipel*, *Javelin*, *Lepinox*, *Xentari*. (0 days)

or

Baythroid XL, 1.6 to 2.4 fl oz. (0 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz. (7 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/2 lb) or *Sevin* XLR Plus (1 to 2 qt) (3 days)

or

Danitol 2.4 EC, 2.4 EC, 10 2/3 to 16 fl oz. (7 days) (RUP)

or

Dibrom 8 EC, 1 pt. (1 day)

or

Endosulfan 3 EC, 2 pt. (14 days) Consult label for rotation restrictions.

or

Lannate LV (3/4 to 3 pt) or *Lannate* SP (1/4 to 1 lb) (3 days) (RUP)

or

Thiodicarb

Larvin 3.2 EC, 24 to 40 oz. (7 days)

or

Lorsban 50 W, 2 lb. (21 days) (RUP)

or

Malathion 57 EC, 1 to 2 pt. (7 days)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Permethrin

Ambush 25 W, 3.2 to 6.4 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (2 to 8 oz) or *Pounce* 25 WP (3.2 to 6.4 oz) or *Pounce* 3.2 EC (2 to 4 oz) (1 day) (RUP)

or

Proclaim, 2.4 to 4.8 oz. (7 days) (RUP)

or

SpinTor 2 SC, 3 to 6 oz. (1 day) Do not apply more than 3 times in 30 days.

or

Entrust, 1 to 2 oz. (1 day) Do not apply more than 3 times in 30 days.

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or

Rimon, 6 to 12 fl oz. (7 days)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Brigadier, 3.8 to 6.1 oz. (7 days)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 1.9 to 3.2 fl oz. (RUP)

DIAMONDBACK MOTH: Apply if: 1) >10% of transplants are infested with any type of cabbage "worm", 2) >50% of plants are infested before flowering, or 3) >10% of plants are infested at or after 1st flowering. Use *Bacillus thuringiensis* to avoid killing important natural enemies of diamondback moth.

* *Avaunt*, 3.5 oz. (3 days) Do not apply more than twice to one generation. Do not exceed 14 oz/acre per crop.

or

* *Bacillus thuringiensis*

Agree, *Biobit*, *Dipel*, *Javelin*, *Lepinox*, *Xentari*. (0 days)

or

* *SpinTor* 2 SC, 1.5 to 3 oz. (1 day) Do not apply more than 3 times in 30 days.

or

* *Entrust*, 0.5 to 1.3 oz. (1 day)

or

Acephate

Acephate 97 UP, *Orthene* 97, 1 lb. (14 days) Do not apply more than 2-1/8 lb per season.

or

Baythroid XL, 2.4 to 3.2 fl oz. (0 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz. (7 days) (RUP)

or

Dibrom 8 EC, 1 pt. (1 day)

or

Endosulfan 3 EC, 2 pt. (14 days) Consult label for rotation restrictions.

or

Fulfill, 2.75 oz. (7 days) May require 5 to 7 days for aphid mortality.

or

Lannate LV (1 1/2 to 3 pt) or *Lannate* SP (1/2 to 1 lb) (3 days) (RUP)

or

Thiodicarb

Larvin 3.2 EC, 24 to 40 oz. (7 days)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Permethrin

Ambush 25 W, 3.2 to 6.4 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (2 to 8 oz) or *Pounce* 25 WP (3.2 to 6.4 oz) or *Pounce* 3.2 EC (2 to 4 oz) (1 day) (RUP)

or

Proclaim, 2.4 to 4.8 oz. (7 days) (RUP)

or

Cryolite

Kryocide, 8 to 16 lb. (14 days) Apply with maximum tank agitation. Allow at least 14 days between applications. Do not irrigate within 48 to 72 hrs after treatment (14 days).

or

Rimon, 6 to 12 fl oz. (7 days)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Brigadier, 3.8 to 6.1 oz. (7 days)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (RUP)

CABBAGE LOOPERS: Apply if: 1) >10% of transplants are infested with any type of cabbage "worm", 2) >50% of plants are infested before flowering, or 3) >10% of plants are infested at or after 1st flowering. Most controls are less effective on larger worms.

Acephate

Acephate 97 UP, *Orthene* 97, 1 lb. (14 days) Do not apply more than 2-1/8 lb per season.

or

Cypermethrin

Ammo 2.5 EC (3.75 to 5 oz) or *Ammo* WSB (1 to 2 bags) or *UP-Cyde* 2.5 EC (3.75 to 5 oz) (1 day) (RUP)

or

Asana XL, 5.8 to 9.6 oz. (3 days) (RUP)

or

Avaunt, 2.5 to 3.5 oz. (3 days) Do not exceed 14 oz/acre per crop.

or

Bacillus thuringiensis

Agree, *Biobit*, *Dipel*, *Javelin*, *Lepinox*, *Xentari*.

or

Baythroid XL, 1.6 to 2.4 fl oz. (0 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz. (7 days) (RUP)

or

Danitrol 2.4 EC, 2.4 EC, 10 2/3 to 16 fl oz. (7 days) (RUP)

or

Dibrom 8 EC, 2 pt. (1 day)

or

Endosulfan 3 EC, 1 1/3 qt. (14 days) Consult label for rotation restrictions.

or

Lannate LV (3 pt) or *Lannate* SP (1 lb) (3 days) (RUP)

Cauliflower

or
Thiodicarb
 Larvin 3.2 EC, 24 to 40 oz. (7 days)

or
Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or
Permethrin
 Perm-UP 3.2 EC (4 oz) or *Pounce* 25 WP (6.4 oz) or *Pounce* 3.2 EC (4 oz) (1 day) (RUP)

or
Proclaim, 3.2 to 4.8 oz. (7 days) (RUP)

or
SpinTor 2 SC, 3 to 6 oz. (1 day) Do not apply more than 3 times in 30 days.

or
Entrust, 1 to 2 oz. (1 day) Do not apply more than 3 times in 30 days.

or
Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or
Rimon, 6 to 12 fl oz. (7 days)

or
Hero, 4 to 10.3 oz. (7 days) (RUP)

or
Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or
Brigadier, 3.8 to 6.1 oz. (7 days)

or
Lambda-cyhalothrin
 Lambda-Cy, *Proaxis*, 1.9 to 3.2 fl oz. (RUP)

APHIDS: Apply if there are >100 aphids per plant before flowering or >5/plant at flowering or beyond.

Acephate
 Acephate 97 UP, *Orthene* 97, 1/2 to 1 lb. (14 days) Do not apply more than 2-1/8 lb per season.

or
Assail 30 SG, 1.9 to 2.8 oz. (7 days)

or
Dibrom 8 EC, 1 pt. (1 day)

or
Dimethoate 2.67 EC, 3/4 to 1 1/2 pt. (7 days)

or
Endosulfan 3 EC, 2 pt (14 days) See label for rotation restrictions.

or
Imidacloprid
 Nuprid 1.6 F, *Provado* 1.6 F, 3.75 fl oz. (7 days) Do not use if Imidacloprid was used at planting. Do not exceed 19.2 oz/Acre per season.

or
Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or
Venom, 1 to 4 oz. (1 day)

or
Actara, 1.5 to 3 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or
Brigadier, 3.8 to 6.1 oz. (7 days)

DISEASES

SEED TREATMENT:

DAMPING OFF, WIRE STEM (*Pythium* spp., *Rhizoctonia solani*):
Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or
Captan

Captan 30-DD, 1 1/4 oz/100 lb seed.

Captan 400, 1 to 2 oz/100 lb seed.

or
Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia*).

 Commercial seed treatment plants only.

or
Thiram

 42-S Thiram, *Thiram* 50 WP Dyed, 8 oz/100 lb seed.

BLACK LEG (*Phoma lingam*): There are presently no chemicals registered for use on this disease.

SEEDBED TREATMENT:

Apply treatments to the soil according to directions to protect young seedlings in the seedbed before transplanting in field.

CLUBROOT (*Plasmodiophora brassicae*): Sterilize seedbed before planting (Appendix A) or apply to soil surface as a drench.

PCNB

Terraclor 10 G, 200 lb (row) or 300 lb (broadcast). Row application: Apply in a 12- to 15-inch band by means of a suitable applicator and rototill to a depth of 4 to 6 inches.

 Broadcast application: Apply and disc and cross disc to depth of 4 to 6 inches. May be used on direct seeded crops.

or

Terraclor 75 WP, 30 lb in 25 gal of water (band) or 40 lb in 35 gal of water (broadcast). Band application: Spray as 12- to 15-inch band centered on the row and incorporate to a depth of 4 to 6 inches. Broadcast application: Apply and thoroughly incorporate to a depth of 4 to 6 inches. May be used on direct seeded crops.

or

Terraclor F, 5.6 gal in 25 gal of water (band) or 7.5 gal in 30 gal of water (broadcast). Band application: Spray as a 12- to 15-inch band centered on the row and incorporate to a depth of 4 to 6 inches prior to planting. Broadcast application: Apply as preplant broadcast. Incorporate to a depth of 4 to 6 inches. May be used on direct seeded crops.

WIRE STEM or BLACK ROOT (*Corticium solani*):

PCNB

Terraclor 10 G, 110 to 150 lb. Row application in an 8 in. band prior to seeding.

or

Terraclor 75 WP, 10 to 15 lb in 35 gal of water (row) or 15 to 20 lb in 50 gal of water (broadcast). Row drench treatment: Spray as an 8 inch band centered on the row.

or

Terraclor F, 1.9 to 2.8 gal in 35 gal of water (row) or 2.8 to 3.8 gal in 50 gal of water (broadcast). Row drench treatment: Apply as an 8-inch band centered on the row.

DAMPING OFF (*Pythium* spp.):

* Mefenoxam. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold SL, 0.25-0.5 pt.

Ridomil Gold WSP, 1 to 2 lb (1/4 to 1/2 lb, surface application).

TRANSPLANT WATER TREATMENT:

Apply in 100 gal of water using 1/2 pt per plant around roots at time plants are being set in the field. **Note:** Frequent agitation is needed.

CLUBROOT (*Plasmodiophora brassicae*):PCNB

Terraclor 75 WP, 2 lb.

Terraclor F, 3 pt.

For best results, use with disease free (clubroot) seedlings.

FOLIAR TREATMENT:

BLACK ROT (*Xanthomonas campestris*): Apply treatment (lowest rates) in the field as soon as transplants are established.

Copper Ammonium Carbonate

Copper Count N, 2 qt. (0 days)

or

Copper Hydroxide

Champ 2FL, 1/3 to 2/3 pt. (0 days)

Champ DP, 1/3 to 2/3 lb. (0 days)

Champ WP, 1 to 2 lb. (0 days)

Kocide 101, *Kocide* DF, 1 to 2 lb. (0 days)

Kocide 2000, 3/4 to 1 1/2 lb. (0 days)

Kocide 4.5 LF, 2/3 to 1 1/3 pt. (0 days)

or

Copper Sulfate

Cuprofix Ultra, 3/4 to 1 1/4 lb. (0 days)

or

Acibenzolar-S-methyl

Actigard, 1 oz per 20 gal (ground) or 10 gal (aerial) of water.

(7 days) Do not apply more than 4 applications / crop per year.

ALTERNARIA LEAF SPOT (*Alternaria brassicae*): Apply when conditions favor disease and repeat every 7 to 10 days.

* Azoxystrobin

Amistar, 2 to 5 oz every 7 - 14 days. (0 days)

Quadris, 6.2 to 15.4 fl oz.

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Chlorothalonil

Bravo Ultrex, 1.4 lb. (7 days)

Bravo Weather Stik, *Equus* 720 SST, 1.5 pt. (7 days)

or

* Maneb

Maneb 75 DF, *Maneb* 80 WP, 1.5 to 2 lb. (7 days)

Manex, 1 1/5 to 1 3/5 qt. (7 days)

or

* Boscalid

Endura, 6 to 9 oz. (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 2 qt. (0 days)

or

Copper Hydroxide

Kocide 101, *Kocide* DF, 1 to 2 lb. (0 days)

Kocide 2000, 3/4 to 1 1/2 lb. (0 days)

Kocide 4.5 LF, 2/3 to 1 1/3 pt. (0 days)

or

Copper Sulfate

Basicop 53 WP, 1 to 3 lb. (0 days)

Cuprofix Ultra, 3/4 to 1 1/4 lb. (0 days)

or

Cyprodinil/Fludioxonil

Switch 62.5 WG, 11 to 14 oz. (7 days)

or

Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 1 1/2 lb. (7 days) Apply at 14-day intervals.

Maximum 4 applications.

DOWNY MILDEW (*Peronospora parasitica*): Apply when conditions favor disease.

* Fosetyl-Aluminum

Aliette WDG, 2 to 5 lb, 7- to 21-day intervals. (3 days)

Note: Do not tank mix with copper fungicides.

or

* Mefenoxam

Ridomil Gold SL, 0.125-0.25 pt. (7 days)

or

* Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 1 1/2 lb. (7 days) Apply at 14-day intervals.

Maximum 4 applications.

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 2.5 to 5 pt every 7 - 21 days.

Prophyt, 2 to 4 pt. (0 days)

or

Acibenzolar-S-methyl

Actigard, 1 oz per 20 gal (ground) or 10 gal (aerial) of water.

(7 days) Do not apply more than 4 applications / crop per year.

or

Mandipropamid

Revus, 8 fl oz. (1 day)

Note: Fungicides that protect against Alternaria also provide limited downy mildew protection.

Celery

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Root-knot, pin, needle and root-lesion nematodes can reduce celery yields. Fields with root problems of undetermined cause should be tested for nematodes (see Appendix C). If the plant-parasitic nematodes are present in population densities above the economic threshold for celery, crop rotation or application of a nematicide is recommended. The following nematicides are suitable for control of root-knot, pin, needle and lesion nematodes in celery production. Nematode-free transplants must be used to prevent serious losses.

FALL SOIL FUMIGATION (BROADCAST):

1,3-D

Telone II, 25 gal/A (muck soil), 9-18 gal/A (mineral soil).

Fumigate in the fall when soil temperatures at a 6-inch depth are above 50F. Inject the fumigant to a soil depth of 8 inches and lightly seal the soil immediately after application. Use soil fumigants only as directed on the label. In some limited situations soil fumigants can be applied in the spring in Michigan.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

or

Metam Sodium

Vapam HL, 37.5 to 75 gal/A. Use higher rate for muck soil.

Inject with shanks spaced 5 inches apart or to a depth of 4-10 inches in well prepared soil. If shanked, roll and irrigate treated surface to prevent escape of gas.

PREPLANT TREATMENT:

Vydate L, Apply 2 gal/acre in 20 gal of water in 8- to 16-inch band. Incorporate to a depth of 4 inches. (RUP)

PLANTING TREATMENT:

Vydate L, apply 0.5 to 1 gal/acre in at least 100 gal of water immediately after transplanting seedlings in the field. (RUP)

POST-PLANT TREATMENT:

Vydate L, apply 1 gal/acre in at least 100 gal of water as a foliar spray 3 weeks after transplanting. Apply again 3 weeks after first treatment. (RUP)

INSECTS

SOIL TREATMENT:

APHIDS: Apply to soil in narrow band 14 or fewer days before planting, as an in-furrow spray at planting, as a post-seeding drench, transplant drench or hill drench, as a sidedress after plants are established, or in drip or trickle irrigation water.

Imidacloprid

Admire Pro, 4.4 - 10.5 fl oz. (45 days)

Nuprid 2 F, 10 to 24 fl oz. (45 days)

or

Venom, 5 to 6 oz. (21 days) See label for application methods.

APHIDS, LEAF MINERS, LEAFHOPPER:

Platinum, 5 to 11 oz. (30 days) See label for application methods.

FOLIAR TREATMENT:

CUTWORM, ARMYWORM: Apply preventive treatments within 4 weeks of harvest.

* *Baythroid XL*, 2.4 to 3.2 fl oz. (0 days) (RUP)

or

* *Mustang Max*, 2.4 to 4.3 oz. (1 day) (RUP)

or

* Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce 25 WP* (6.4 to 12.8 oz)

or *Pounce 3.2 EC* (4 to 8 oz) (1 day) (RUP)

or

Lannate LV (1 1/2 pt) or *Lannate SP* (1/2 lb) (7 days) (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

CARROT WEEVIL LARVAE: Apply as a directed spray. Start when eggs or larvae are first seen and repeat in 2 to 3 weeks.

Vydate L, 4 pt. (21 days) May also be used for nematode control at same time. (Special Michigan SLN label.) (RUP)

CARROT WEEVIL ADULTS: Apply when adults are first caught in traps or eggs are first seen. No materials are labeled specifically for this area, however, permethrin at the rates given below will give some control of carrot weevil adults.

No materials are labeled for this area, however Permethrin at the rates given below will give some control of carrot weevil adults.

ASTER LEAFHOPPER (*Aster yellows*): Apply if numbers exceed 14/100 sweeps. Repeat as needed, depending on number of leafhoppers. Over-treatment with permethrin or Guthion may cause increased aphid problems.

* *Mustang Max*, 2.4 to 4.3 oz. (1 day) (RUP)

or

* Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce 25 WP* (6.4 to 12.8 oz)

or *Pounce 3.2 EC* (4 to 8 oz) (1 day) (RUP)

or

Lannate LV (1 1/2 to 3 pt) or *Lannate SP* (1/2 to 1 lb) (7 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 to 1 7/8 lb) or *Sevin XLR Plus* (1 to 2 qt) (14 days)

or

Venom, 1 to 3 oz. (7 days)

or

Actara, 1.5 to 3 oz. (7 days) Do not exceed 11.0 oz/Acre per season

Do not exceed 11.0 oz/Acre per season.

TARNISHED PLANT BUG: Apply if numbers exceed 2 to 4 per 20 plants.

Baythroid XL, 2.4 to 3.2 fl oz. (0 days) (RUP)

or

Mustang Max, 3.4 to 4.3 oz. (1 day) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 to 2 1/2 lb) or *Sevin* XLR Plus (1 to 2 qt)
(14 days)

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

APHIDS: Apply if more than 3% of plants are infested or if there are more than 6/100 sweeps. Over-treatment with pyrethroids or Guthion may cause increased aphid problems.

* *Assail* 30 SG, 1.9 to 2.8 oz. (7 days)

or

Acephate

Acephate 97 UP, *Orthene* 97, 1/2 to 1 lb. (21 days) Do not apply more than 2-1/8 lb per season.

or

Lannate LV (1 1/2 to 3 pt) or *Lannate* SP (1/2 to 1 lb) (7 days) Not labeled for aphids; follow directions for loopers. (RUP)

or

Endosulfan 3 EC, 1 1/3 to 2 2/3 pt. (4 days) Limited to 1 application per year.

or

Malathion 57 EC, 1 1/2 pt. (7 days)

or

Pyrellin EC, 1 to 2 pt. (0 days)

or

Pyrenone, 2 to 12 oz. (0 days)

or

Venom, 1 to 3 oz. (7 days)

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Actara, 1.5 to 3 oz. (7 days) Do not exceed 11.0 oz/Acre per season.

or

Fulfill, 2.75 oz. (7 days) Do not exceed 5.5 oz/acre per season. May require 5 to 7 days for aphid mortality.

LOOPERS (CELERY and CABBAGE): Apply if needed to protect plants within 4 weeks of harvest.

* *Baythroid* XL, 1.6 to 2.4 fl oz. (0 days) (RUP)

or

* Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz) or *Pounce* 3.2 EC (4 to 8 oz) (1 day) (RUP)

or

Acephate

Acephate 97 UP, *Orthene* 97, 1 lb. (21 days) Do not apply more than 2-1/8 lb per season.

or

Bacillus thuringiensis

Agree, *Biobit*, *Dipel*, *Javelin*, *Lepinox*, *Xentari*. (0 days)

or

Endosulfan 3 EC, 2 2/3 pt. (4 days) Limited to one application per year.

or

Lannate LV (3 pt) or *Lannate* SP (1 lb) (7 days) (RUP)

or

Mustang Max, 3.4 to 4.3 oz. (1 day) (RUP)

or

Proclaim, 3.2 to 4.8 oz. (RUP)

or

Pyrellin EC, 1 to 2 pt. (0 days)

or

Pyrenone, 2 to 12 oz. (0 days)

or

SpinTor 2 SC, 4 to 8 oz. (1 day) Do not apply more than 3 times in 21 days.

or

Entrust, 1 to 2 oz. (1 day)

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or

Avant, 3.5 oz. (3 days) Do not exceed 14 oz/acre per crop.

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

VEGETABLE LEAFMINER: Apply as soon as visible mines appear and repeat every 7 days as needed.

Agri-Mek 0.15 EC, 8 to 16 fl oz. (7 days) (RUP)

or

SpinTor 2 SC, 4 to 8 oz. (1 day) Do not apply more than 3 times in 21 days.

or

Trigard 75 WP, 1/6 lb. (7 days)

or

Entrust, 2 to 3 oz. (1 day) Do not apply more than 3 times in 30 days.

or

Venom, 1 to 3 oz. (7 days)

or

Radiant SC, 6 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

MITES

Agri-Mek 0.15 EC, 8 to 16 fl oz. (7 days) (RUP)

SLUGS

Deadline M-Ps 4% (20 to 40 lb) or *Metaldehyde* 3.5 G (30 to 40 lb) Apply between rows. Avoid contact to edible product.

DISEASES

PREPLANT TREATMENT:

DAMPING OFF:

* *Mefenoxam*

Ridomil Gold SL, 1-2 pt.

PLANTING TREATMENT:

DAMPING OFF (*Pythium* spp.):

Mefenoxam. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold GR, 20 to 40 lb.

Ultra Flourish, 2 to 4 pt.

Celery

FOLIAR TREATMENT:

CRATER ROT (*Rhizoctonia solani*): Apply as a basal spray after each cultivation.

* Azoxystrobin

Amistar, 0.125 to 0.25 oz per 1000 row feet (see label) (0 days)

Quadris, 0.4 to 0.8 fl oz per 1000 row feet (see label) (0 days)

or

* Azoxystrobin/Chlorothalonil

Quadris Opti, 2.4 - 3.7 pts every 7-14 days. (7 days)

or

* Chlorothalonil

Bravo Ultrex, *Equus DF*, 1.8 to 2.7 lb every 7 days.

or

Bravo Weather Stik, *Equus 720 SST*, 2 to 3 pt every 7 days. (7 days)

or

Echo 720, 1 to 1 1/2 pt every 3-5 days. (7 days)

or

Echo 720, 2 to 3 pt every 7 days. (7 days)

or

Echo 90 DF, 1 5/8 to 2 1/2 lb every 7 days. (7 days)

or

Echo 90 DF, 7/8 to 1 1/4 lb every 3 - 5 days. (7 days)

or

Echo Zn, 3 to 4 1/4 pt every 7 days. (7 days)

or

Echo Zn, 1 1/2 to 2 1/8 pt every 3 - 5 days. (7 days)

PINK ROT (*Sclerotinia sclerotiorum*):

DCNA

Botran 75 W (5 1/3 lb (single application)) or *Botran 75 W* (2 lb every 7 - 14 days) (7 days)

or

Chlorothalonil

Bravo Ultrex, *Equus DF*, 2.7 lb every 7 days (pink rot suppression). (7 days)

or

Bravo Weather Stik, *Equus 720 SST*, 3 pt every 7 days (pink rot suppression). (7 days)

or

Echo 90 DF, 1.7 to 2.4 lb. (7 days)

Equus DF, 1.8 to 2.7 lb. (7 days)

or

Cyprodinil/Fludioxonil

Switch 62.5 WG, 11 to 14 oz. (0 days)

EARLY BLIGHT (*Cercospora apii*), **LATE BLIGHT** (*Septoria apiicola*): Treat every 7 to 10 days beginning after transplanting.

* Azoxystrobin. Do not apply more than one foliar application of *Amistar* and *Quadris* or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

Amistar, 3 to 5 oz every 7 - 14 days. (0 days)

Quadris, 9.2 to 15.4 fl oz every 7 - 14 days. (0 days)

or

* Azoxystrobin/Chlorothalonil

Quadris Opti, 2.4 - 3.7 pt every 7-14 days. (7 days)

or

* Chlorothalonil

Bravo Ultrex, *Equus DF*, 1.8 to 2.7 lb every 7 days. (7 days)

or

Bravo Weather Stik, *Equus 720 SST*, 2 to 3 pt every 7 days. (7 days)

or

Echo 720, 1 to 1 1/2 pt every 3-5 days. (7 days)

Echo 720, 2 to 3 pt every 7 days. (7 days)

Echo 90 DF, 1 5/8 to 2 1/2 lb every 7 days. (7 days)

Echo 90 DF, 7/8 to 1 1/4 lb every 3 - 5 days. (7 days)

Echo Zn, 3 to 4 1/4 pt every 7 days. (7 days)

Echo Zn, 1 1/2 to 2 1/8 pt every 3 - 5 days. (7 days)

or

* Propiconazole

Propimax EC, *Tilt*, 4 fl oz. (14 days) Maximum of four applications per season.

or

* Trifloxystrobin

Flint, 2 to 3 oz. (7 days) Do not apply more than three sequential foliar application of strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, *Kocide 4.5 LF*, 1 1/3 pt. (0 days)

Champion WP, *Kocide 101*, *Kocide DF*, 2 lb. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 1/3 to 2 2/3 pt. (0 days)

Nu-Cop 50 DF, 1 to 2 lb, 5- to 7-day intervals. (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 2 to 3 qt. (0 days)

or

Copper Oxychloride / Copper Sulfate

C-O-C-S WDG, 2 to 4 lb, 7 days. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt (*Cercospora apii*). (0 days) (*Cercospora apii*)

or

Copper Sulfate

Basic Copper 53, *Basicop*, 3 to 4 lb. (0 days)

Cuprofix Ultra, 1.25 lb. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

BACTERIAL LEAF SPOT (*Pseudomonas syringae* pv. *apii*): Treat every 7 to 10 days, beginning after transplanting.

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, *Kocide 4.5 LF*, 1 1/3 pt. (0 days)

Champion WP, *Kocide 101*, *Kocide DF*, 2 lb. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 1/3 to 2 2/3 pt. (0 days)

Nu-Cop 50 DF, 1 to 2 lb, 5- to 7-day intervals. (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 2 to 3 qt. (0 days)

or

Copper Oxychloride / Copper Sulfate

C-O-C-S WDG, 2 to 4 lb, 7 days. (0 days)

or
Copper Sulfate
Cuprofix Ultra, 1.25 lb. (0 days)
 or
Copper Resinate
Tenn-Cop 5 E, 3 pt. (0 days)

Corn (Sweet)

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

FALL SOIL FUMIGATION:

1,3-D

Telone II (3 gal in-row for mineral soil) or *Telone II* (9-12 gal/A broadcast for mineral soil)

Fumigate in the fall when soil temperatures at a 6-inch depth are above 50F. Inject the fumigant to a soil depth of 8 inches and lightly seal the soil immediately after application. Use soil fumigants only as directed on the label. In some limited situations, soil fumigants can be applied in the spring in Michigan.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

SOIL TREATMENT:

Root-lesion, stunt, stubby-root, lance and dagger nematodes can reduce sweet corn yields. Fields with soil or root problems of undetermined cause should be tested for nematodes (see Appendix C). If the above plant-parasitic nematodes are present in population densities above the economic threshold for sweet corn, crop rotation or application of a nematicide is recommended. The following nematicides are suitable for control of root-lesion, lance, stunt, dagger and stubby-root nematodes in sweet corn production.

PREPLANT TREATMENT:

Mocap 15 G, broadcast. Apply 40 lb/A 3 days before planting to at-planting. Mix with the top 2-4 inches of soil. (RUP)

or
Mocap 15 G, band. Add 3/4 to 1 lb per 1,000 row ft in a band 12-15 inches on the row 3 days before planting to at-planting. Mix with the top 2-4 inches of soil. Rate per acre is dependent on row spacing. Rate would be 10-13.3 lb/A at 40-inch row spacings. (RUP)

INSECTS

SEED TREATMENT:

Treatments applied to seed prior to planting. Insecticide and fungicide treatments can be combined according to directions.

CORN FLEA BEETLE, WIRE WORM, SEED CORN MAGGOT:

Cruiser 5 FS, Purchase seed treated at 1.28 to 5.1 fl oz / 100 lb seed.

CORN ROOTWORM, FLEA BEETLE, SEED CORN MAGGOT, WIREWORM:

Poncho 600, purchase seed treated commercially at 1.13 to 5.64 fl oz/80,000.

SEED CORN MAGGOT:

Lorsban 50 SL, 2 oz/100 lb seed. Use as a slurry treatment. (RUP)

PLANTING TREATMENT:

WIREWORM: Broadcast evenly on soil surface and incorporate to 4 to 6 inches or band over the row at planting at reduced rate.

Note: Consult the labels for other uses of these materials.

Aztec 2.1 G, 6.7 oz/1000 row ft. (RUP)

or

Capture 1.15 G, 3.2 to 8.0 oz. (RUP)

or

Counter CR, 6 oz/1,000 row ft, banded. (RUP)

or

Mocap 15 G, 10.5 oz/1,000 row ft, banded. (RUP)

or

Diazinon 4 EC, 4 qt. (RUP)

or

Capture LFR, 3.4 to 6.8 oz. See label for application methods.

SEED CORN MAGGOT:

Aztec 2.1 G, 6.7 oz/1,000 ft of row. (RUP)

or

Capture 1.15 G, 3.2 to 8.0 oz banded or in furrow. (RUP)

or

Counter CR, 6 oz/1,000 row ft, banded. Also controls wireworm and white grubs. May help control flea beetle. (RUP)

or

Phorate

Thimet 15 G (8 oz/1000 row ft) or *Thimet 20 G* (6 oz / 1000 row ft) Do not apply in-furrow. (RUP)

or

Capture LFR, 3.4 to 6.8 oz. See label for application methods.

CORN ROOTWORM: Corn rootworms are a problem only when rotation of crops is not practiced. Apply treatments in a band above seed at time of planting. Use special equipment for correct placement of granules. Consult label for other uses and directions.

Aztec 2.1 G, 6.7 oz/1,000 ft of row. (RUP)

or

Capture 1.15 G, 3.2 to 8.0 oz banded or in furrow. (RUP)

or

Counter CR, 6 oz/1,000 row ft. May help control flea beetle. (RUP)

or

Force 1.5G, 8 to 10 oz/1,000 ft of row. (RUP)

or

Corn (Sweet)

Furadan 4 F, 2.5 oz/1,000 row ft. May help control flea beetle. (RUP)

or

Lorsban 15 G, 6 to 8 oz/1,000 ft of row. (35 days) (RUP)

or

Mocap 15 G, 10.5 oz/1,000 row ft. (RUP)

or

Phorate

Thimet 15 G (8 oz/1000 row ft) or *Thimet* 20 G (6 oz / 1000 row ft) Do not apply in-furrow. (RUP)

or

Capture LFR, 6.8 to 8.5 oz. See label for application methods.

EUROPEAN CORN BORER:

Capture 1.15 G, 3.2 to 8.0 oz banded or in furrow. (RUP)

FOLIAR TREATMENT:

CUTWORM, ARMYWORM: Apply when they appear. Repeat as needed.

* *Asana* XL, 5.8 to 9.6 oz. (1 day) (RUP)

or

* Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz. (1 day) (RUP)

or

* *Mustang* Max, 2.8 to 4.0 oz. (3 days) (RUP)

or

* Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz) or *Pounce* 3.2 EC (4 to 8 oz) (1 day) (RUP)

or

Avaunt, 3.5 oz (fall army worm). (3 days)

or

Carbaryl

Sevin 80 S (2 lb) or *Sevin* XLR Plus (2 qt) (2 days) See label for pre-harvest intervals for forage and fodder.

or

Lannate LV (1 1/2 pt) or *Lannate* SP (1/2 lb) (0 days; 3 days if forage is fed to livestock) (RUP)

or

Thiodicarb

Larvin 3.2 EC, 20 to 30 oz. (0 days)

or

Penncap-M 2 F, 4 pt. (3 days) Do not apply during pollination. (RUP)

or

Entrust, 1 to 2 oz. (1 day) Do not apply more than 3 times in 30 days.

or

Hero, 4 to 10.3 oz. (3 days) (RUP)

or

Radiant SC, 3 to 6 fl oz. (1 day) Do not make more than 6 applications or exceed 36 fl oz/acre per season.

CORN FLEA BEETLE: Apply when damage is first seen, especially if Stewart's disease has been a problem. Plant a variety low in susceptibility to Stewart's wilt for best disease control. Some corn rootworm insecticides may give some early-season flea beetle control (see corn rootworm section).

Asana XL, 5.8 to 9.6 oz. (1 day) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz. (3 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin* XLR Plus (1 to 2 qt) (2 days)

See label for pre-harvest intervals for forage and fodder.

or

Diazinon AG 500, 1 pt. (0 days) (RUP)

or

Mustang Max, 2.4 to 4.3 oz. (3 days) (RUP)

or

Permethrin

Ambush 25 W, 6.4 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 oz) or *Pounce* 25 WP (6.4 oz) or *Pounce* 3.2 EC (4 oz) (1 day) (RUP)

or

Hero, 4 to 10.3 oz. (3 days) (RUP)

EUROPEAN CORN BORER: For early season control, prior to tasseling. Treat if >15% of plants are infested. Direct granules into corn whorls.

Avaunt, 2.5 to 3.5 oz. (3 days) Whorl application only.

or

Bacillus thuringiensis

Dipel 10 G, 5 to 10 lb.

or

Lorsban 15 G, 6 to 8 oz/1,000 ft of row. (35 days) (RUP)

or

Pounce 1.5 G, 6.7 to 13.5 lb. (1 day) (RUP)

EUROPEAN CORN BORER: If pheromone trap catch is >5 moths per week. Apply every 5-7 days, beginning at tassel stage.

Asana XL, 5.8 to 9.6 oz. (1 day) (RUP)

or

Avaunt, 2.5 to 3.5 oz. (3 days)

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz. (3 days) (RUP)

or

Carbaryl

Sevin 80 S (1 7/8 to 2 1/2 lb) or *Sevin* XLR Plus (1 1/2 to 2 qt)

(2 days) See label for pre-harvest intervals for forage and fodder.

or

Furadan 4 F, 1 pt. (14 days) Machine harvest corn only. Do not make more than 4 applications in 1 season. (RUP)

or

Lannate LV (3/4 to 1 1/2 pt) or *Lannate* SP (1/4 to 1/2 lb) (0 days; 3 days if forage is fed to livestock) (RUP)

or

Thiodicarb

Larvin 3.2 EC, 20 to 30 oz. (0 days)

or

Mustang Max, 2.8 to 4.0 oz. (3 days) (RUP)
 or
Penncap-M 2 F, 2 to 4 pt. (3 days) Do not apply during
 pollination. (RUP)
 or
 Permethrin
Ambush 25 W, 6.4 to 12.8 oz. (1 day) (RUP)
 or
Perm-UP 3.2 EC (4 to 8 oz) or *Pounce 25 WP* (6.4 to 12.8 oz)
 or *Pounce 3.2 EC* (4 to 8 oz) (1 day) (RUP)
 or
SpinTor 2 SC, 3 to 6 oz. (1 day)
 or
Warrior with Zeon Technology, 2.6 to 3.8 fl oz. (1 day) (RUP)
 or
Entrust, 0.5 to 2 oz. (1 day)
 or
 Lambda-cyhalothrin
Lambda-Cy, Proaxis, 2.6 to 3.8 fl oz. (1 day) (RUP)
 or
Hero, 4 to 10.3 oz. (3 days) (RUP)
 or
Radiant SC, 3 to 6 fl oz. (1 day) Do not make more than 6
 applications or exceed 36 fl oz/acre per season.
CORN EARWORM: Apply to silks when moths are active to
 prevent ear damage. Treat every 5 days if 2-6 moths per week are
 caught in pheromone traps, every 4 to 5 days if catch is 7 to 90
 moths per week, and every 3 to 4 days if catch is >90 moths per
 week. Use the shorter intervals listed above if temperatures are
 >85.
 * *Asana XL*, 5.8 to 9.6 oz. (1 day) (RUP)
 or
 * *Baythroid XL*, 1.6 to 2.8 fl oz. (0 days) (RUP)
 or
 * Bifenthrin
Bifenture EC, Brigade 2EC, Capture 2 EC, 2.1 to 6.4 oz.
 (3 days) (RUP)
 or
 * Thiodicarb
Larvin 3.2 EC, 20 to 30 oz. (0 days)
 or
 * *Mustang Max*, 2.8 to 4.0 oz. (3 days) (RUP)
 or
 * Permethrin
Ambush 25 W, 6.4 to 12.8 oz. (1 day) (RUP)
 or
Perm-UP 3.2 EC (4 to 8 oz) or *Pounce 25 WP* (6.4 to 12.8 oz)
 or *Pounce 3.2 EC* (4 to 8 oz) (1 day) (RUP)
 or
 * *Warrior* with Zeon Technology, 2.6 to 3.8 fl oz. (1 day) (RUP)
 or
 Carbaryl
Sevin 80 S (1 1/4 to 2 1/2 lb) or *Sevin XLR Plus* (1 to 2 qt)
 (2 days) See label for pre-harvest intervals for forage and
 fodder.
 or
Diazinon AG 500, 1 to 1 1/2 qt. (7 days) (RUP)
 or

Endosulfan 3 EC (4 pt) or *Endosulfan 50 WP* (3 lb) (1
 day) Maximum of 3 applications. **Note:** Do not use for processing
 corn. Do not feed forage to livestock.
 or
 Lambda-cyhalothrin
Lambda-Cy, Proaxis, 2.6 to 3.8 fl oz. (1 day) (RUP)
 or
Lannate SP, 1/2 lb. (0 days; 3 days if forage is fed to livestock)
 (RUP)
 or
SpinTor 2 SC, 3 to 6 oz. (3 days)
 or
Entrust, 1 to 2 oz. (1 day) Do not apply more than 3 times in 30
 days.
 or
Hero, 4 to 10.3 oz. (3 days) (RUP)
 or
Radiant SC, 3 to 6 fl oz. (1 day) Do not make more than 6
 applications or exceed 36 fl oz/acre per season.
CORN ROOTWORM ADULTS: Apply as needed to protect silks,
 when beetle are active and feeding on silks.
Asana XL, 5.8 to 9.6 oz. (1 day) (RUP)
 or
Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)
 or
 Bifenthrin
Bifenture EC, Brigade 2EC, Capture 2 EC, 2.1 to 6.4 oz.
 (1 day) (RUP)
 or
 Carbaryl
Sevin 80 S (1 1/4 lb, 1 to 2 qt) or *Sevin XLR Plus* (1 to 2 qt)
 (2 days) See label for pre-harvest intervals for forage and
 fodder.
 or
Diazinon AG 500, 1 pt. (0 days) (RUP)
 or
Mustang Max, 2.2 to 4.0 oz. (3 days) (RUP)
 or
Penncap-M 2 F, 1 to 2 pt. (3 days) (RUP)
 or
 Permethrin
Ambush 25 W, 6.4 to 12.8 oz. (1 day) (RUP)
 or
Perm-UP 3.2 EC (4 to 8 oz) or *Pounce 25 WP* (6.4 to 12.8 oz)
 or *Pounce 3.2 EC* (4 to 8 oz) (1 day) (RUP)
 or
Hero, 4 to 10.3 oz. (3 days) (RUP)
CORN LEAF APHIDS: Apply when populations start to build,
 prevents sooty mold on ears at harvest.
Diazinon AG 500, 1 pt. (0 days) (RUP)
 or
Endosulfan 3 EC, 2 2/3 pt. (1 day) Maximum of 3 applications.
Note: Do not use for processing corn. Do not feed forage to
 livestock.
 or
Malathion 57 EC, 1 1/2 pt. (5 days)
 or
Penncap-M 2 F, 2 pt. (15 days) Do not apply during pollination.
 (RUP)

Corn (Sweet)

SAP BEETLE: These usually come in following damage by other insects or birds. Controlling damage will be the most effective solution. For short-term control, apply as needed.

Asana XL, 5.8 to 9.6 oz. (1 day) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz. (1 day) (RUP)

Or

Carbaryl

Sevin 80 S (1 7/8 to 2 1/2 lb) or *Sevin* XLR Plus (1 1/2 to 2 qt) (2 days) See label for pre-harvest intervals for forage and fodder.

or

Mustang Max, 2.2 to 4.0 oz. (3 days) (RUP)

or

Warrior with Zeon Technology, 2.6 to 3.8 fl oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (1 day) (RUP)

or

Hero, 4 to 10.3 oz. (3 days) (RUP)

MITES

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 5.1 to 6.4 oz. (1 day) (RUP)

or

Hero, 10.3 oz. (3 days) (RUP)

DISEASES

SEED TREATMENT:

DAMPING OFF (*Pythium* spp., *Rhizoctonia solani*): Treatments applied to seed prior to planting. Insecticide and fungicide treatments can be combined according to directions.

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Captan

Captan 30-DD, 3 1/4 oz/100 lb seed.

Captan 400, 2 to 4 oz/100 lb seed.

or

Fludioxinil

Maxim 4 FS, 0.08 fl oz/100 lb seed (*Rhizoctonia*). Commercial seed treatment plants only.

or

Mefenoxam

Apron XL LS, 0.32 to 0.64 oz/100 lb seed (*Pythium*).

or

Metalaxyl

Allegiance-FL (0.75 fl oz/100 lb seed (*Pythium*)) or *Apron* 50 W (1/2 to 1 oz/100 lb seed (*Pythium*)) or *Apron* FS (3/4 to 1 1/2 oz/100 lb seed (*Pythium*))

or

Thiram

42-S Thiram, 5 oz/100 lb seed.

or

Thiram 50 WP Dyed, 3 oz/100 lb seed. Use as a slurry treatment.

SYSTEMIC DOWNY MILDEW:

Mefenoxam

Apron XL LS, 1.28 oz/100 lb seed.

or

Metalaxyl

Apron 50 W (2 oz/100 lb seed) or *Apron* FS (3 oz/100 lb seed)

FOLIAR TREATMENT:

CORN RUST (*Puccinia sorghi*): Apply when conditions favor disease. **Note:** Do not feed treated forage to livestock.

* Tebuconazole

Folicur 3.6F, 4-6 fl oz. (7 days) 19 days REI.

or

Azoxystrobin

Amistar, 2 to 3 oz. (7 days)

Quadris, 6.2 to 9.2 fl oz. (7 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Azoxystrobin/Propiconazole

Quilt, 10.5 - 14 fl oz every 14 days. (14 days)

or

Chlorothalonil

Bravo Ultrex, 0.7 to 1.8 lb. (14 days)

Note: Do not apply to sweet corn to be processed.

or

Bravo Weather Stik, *Equus* 720 SST, 3/4 to 2 pt.

(14 days) Sweet corn and seed corn only, not field corn.

Do not apply to sweet corn to be processed.

or

Echo 720, 1.5 to 2 pt. (14 days)

or

Maneb

Maneb 75 DF, *Maneb* 80 WP, 1 1/2 lb, 3- to 10-day intervals. (7 days)

or

Manex, 1 1/5 qt, 3- to 10-day intervals. (7 days)

or

Mancozeb

Dithane DF Rainshield, *Dithane* M-45, *Dithane* WSP, 1 1/2 lb. (7 days)

or

Dithane F-45 Rainshield, 1 1/5 qt. (7 days)

Manzate 75 DF, 1 1/2 lb. (7 days)

Penncozeb 4 F, 1.6 qt. (7 days)

Penncozeb 75 DF, *Penncozeb* 80 WP, 1 1/2 lb. (7 days)

or

Propiconazole

Tilt, 4 fl oz. (14 days) Apply at 7 to 14 day intervals. Maximum 16 fl oz per season.

Cucumber

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Root-knot and root-lesion nematodes can reduce cucumber yields. Fields with soil or root problems of undetermined cause should be tested for nematodes (see Appendix C). If the plant-parasitic nematodes are present in population densities above the economic threshold for cucumber, crop rotation or application of a nematicide is recommended. The following nematicides are suitable for control of root-knot and root-lesion nematodes in cucumber production. Recent observations indicate that cucumber planting the year following a chemigated (metham) potato crop may provide benefits to the cucumber crop.

FALL SOIL FUMIGATION (BROADCAST):

1,3-D
Telone II, 9-18 gal/A (mineral soil).

Fumigate in the fall when soil temperatures at a 6-inch depth are above 50F. Inject the fumigant to a soil depth of 8 inches and lightly seal the soil immediately after application. Use soil fumigants only as directed on the label. In some limited situations soil fumigants can be applied in the spring in Michigan.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

PREPLANT NEMATICIDE TREATMENT (IN-ROW):

Mocap 15 G, at 13 lb/A (7-foot row spacing) or 2.1 lb/1000 row feet in a band 12 to 15 inches wide on top of the row at or just before planting. Mix with top 2 to 4 inches of soil immediately after application. Do not use as a seed furrow treatment or allow granules to contact seed. (RUP)

or
Vydate L, apply 2 gal (broadcast) or 1 gal (band) per acre. Apply before planting, incorporate 2-4 in into the soil. (RUP)

INSECTS

SEED TREATMENT:

SEED CORN MAGGOT:

Lorsban 50 SL, 2 oz/100 lb seed as slurry treatment only. (RUP)

SOIL TREATMENT:

CUCUMBER BEETLE (STRIPED and SPOTTED), APHIDS, THRIPS: Apply to soil in a narrow band 14 or less days before planting, as an in-furrow spray at planting, as a post-seeding drench, as a sidedress after plants are established or in drip or

trickle irrigation water. Do not make more than 1 application per year.

* Imidacloprid

Admire Pro, 7.0 - 10.5 fl oz. (21 days)

Nuprid 2 F, 16 to 24 fl oz. (21 days)

CUCUMBER BEETLE: Use in areas with high cucumber beetle pressure.

* *Furadan 4 F*, 2.4 oz/1000 ft of row. Apply at planting or transplanting in a 7-inch band, incorporate into the top 3 inches of soil, or apply in furrow and mix with the covering soil. (Special Michigan SLN label.) (RUP)

APHIDS, FLEA BEETLE, CUCUMBER BEETLE, LEAFHOPPER, THRIPS:

Platinum, 5 to 11 oz. (30 days) See label for application methods.

APHIDS, THRIPS:

Venom, 5 to 6 oz. (21 days) See label for application methods.

FOLIAR TREATMENT:

Cucumber plants may be sensitive to certain insecticide formulations. Make certain a problem exists before treatment. Read and observe restrictions on the label. To avoid killing bees, do not treat cucumbers during bloom. If treatment is necessary, see the Insecticide Effectiveness for bee toxicity.

CUTWORM: Apply if needed to prevent >1-5% stand loss.

Asana XL, 5.8 to 9.6 oz. (1 day) (RUP)

or

Baythroid XL, 0.8 to 1.6 fl oz. (0 days) (RUP)

or

Bifenthrin (RUP)

Bifenture EC, *Brigade 2EC*, *Capture 2 EC*, 6.4 oz. (3 days)

or

Lannate LV (1 1/2 to 3 pt) or *Lannate SP* (1/2 to 1 lb) (3 days) (RUP)

or

Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (0 days) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce 25 WP* (6.4 to 12.8 oz)

or *Pounce 3.2 EC* (4 to 8 oz) (0 days) (RUP)

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

STRIPED and SPOTTED CUCUMBER BEETLE: Apply as soon as possible if numbers exceed 0.1 to 1 per plant. Repeat as needed. Use preplant *Furadan* treatment (above) in fields with severe problems.

Asana XL, 5.8 to 9.6 oz. (3 days) (RUP)

or

Baythroid XL, 2.4 to 2.8 fl oz. (0 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade 2EC*, *Capture 2 EC*, 2.6 to 6.4 oz. (3 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin XLR Plus* (1 qt) (3 days)

or

Cucumber

Endosulfan 3 EC (1 1/3 pt) or *Endosulfan* 50 WP (1 lb) (2 days)
or
Lannate LV (1 1/2 (1 day) or 3 pt (3 days)) or *Lannate* SP (1/2 lb (1 day) or 1 lb (3 days)) (RUP)

or
Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (0 days) (RUP)
or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz)
or *Pounce* 3.2 EC (4 to 8 oz) (0 days) (RUP)

or

Danitol 2.4 EC, 10 2/3 to 16 fl oz. (7 days) (RUP)

or

Venom, 3 to 4 oz. (1 day)

or

Actara, 3 to 5.5 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)
Do not exceed 23 fl oz/acre per season. (RUP)

or

Assail 30 SG, 2.5 to 5.3 oz. (0 days)

FLEA BEETLE: Apply when damage is present.

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin* XLR Plus (1 qt) (3 days)

or

Endosulfan 3 EC (1 1/3 pt) or *Endosulfan* 50 WP (1 lb) (2 days)

or

Lannate LV (1 1/2 pt) or *Lannate* SP (1/2 lb) (1 day) (RUP)

or

Actara, 1.5 to 3 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)
Do not exceed 23 fl oz/acre per season. (RUP)

APHIDS: Apply if needed.

Endosulfan 3 EC, 1 1/3 pt. (2 days)

or

Fulfill, 2.75 oz. (0 days) Do not exceed 5.5 oz/acre per season.
May require 5 to 7 days for aphid mortality.

or

Lannate LV (1 1/2 pt) or *Lannate* SP (1/2 lb) (1 day) (RUP)

or

Malathion 57 EC, 1 1/2 pt. (1 day)

or

Venom, 1 to 4 oz. (1 day)

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Actara, 1.5 to 3 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Assail 30 SG, 2.5 to 4 oz. (0 days)

THRIPS: Apply when damage is seen. Repeat as needed.

SpinTor 2 SC, 6 to 8 oz. (3 days)

or

Venom, 1 to 4 oz. (1 day)

or

Entrust, 2 to 2.5 oz. (3 days) Do not apply more than 3 times in 30 days.

or

Radiant SC, 6 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)
Do not exceed 23 fl oz/acre per season. (RUP)

SQUASH BUG:

Venom, 3 to 4 oz. (1 day)

MITES

Apply when needed. Usually a problem only in hot, dry weather.

Agri-Mek 0.15 EC, 8 to 16 fl oz. (7 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 5.1 to 6.4 oz. (3 days) (RUP)

or

Danitol 2.4 EC, 10 2/3 fl oz. (7 days) (RUP)

or

Kelthane 35 (1 2/3 lb) or *Kelthane* 50 WSP (1 1/4 lb) (2 days)

or

Oberon 2 SC, 7 to 8.5 fl oz. (7 days)

DISEASES

SEED TREATMENT:

DAMPING OFF (*Pythium* spp., *Rhizoctonia solani*): Use only as directed; over-treatment may cause injury.

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only.

or

Metalaxyl

Allegiance-FL, 0.75 fl oz/100 lb seed.

or

Captan

Captan 30-DD, 2 1/3 fl oz/100 lb seed.

Captan 400, 2 1/2 to 3 fl oz/100 lb seed.

or

Thiram

42-S Thiram, *Thiram* 50 WP Dyed, 4 1/2 oz/100 lb seed.

SEEDBED PREPARATION:

ROOT ROTTS (*Fusarium solani*, *Fusarium cucurbitae*, *Pythium* spp., *Rhizoctonia solani*): Grow transplants in disease free soil (sterilized) and fumigate fields before planting. To sterilize soil, use steam or fumigate with Chemicals suggested for seedbed sterilization in Appendix A. Follow manufacturer's recommendations for use with particular crops. Avoid planting until the soil is free of fumigant.

PREPLANT SOIL FUMIGATION:

DAMPING OFF, ROOT ROT (*Phytophthora* spp., *Pythium* spp. *Rhizoctonia solani*): This method protects plants grown from seed or transplanted in the field. See Bulletin E-2099.

Soil sterilization by fumigation is best achieved by proper application of material. Correct soil moisture, temperature, and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or immediate tarping.

1,3 Dichloropropene/chloropicrin

Telone C35, 13-35 gal. (RUP)

or

Metam Sodium

Sectagon 42, *Vapam HL*, 37.5-75 gal.

or

Potassium N-methylidithiocarbamate

Sectagon-K54, 30-60 gal.

PREPLANT TREATMENT:

PYTHIUM DAMPING OFF and COTTONY LEAK (*Pythium* spp):

* Mefenoxam. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold SL, 1-2 pt.

Ultra Flourish, 2 to 4 pt.

FOLIAR TREATMENT:

POWDERY MILDEW (*Sphaerotheca fuliginea* or *Erysiphe cichoracearum*):

* Myclobutanil

Rally 40 WSP, 2.5 to 5 oz. (0 days) Do not apply more than 1.5 lb per acre per crop.

or

* Pyraclostrobin

Cabrio, 12-16 oz. (0 days) Alternate one-to-one with fungicides having a different mode of action.

or

* Pyraclostrobin/Boscalid

Pristine, 12.5 to 18.5 oz. (0 days)

or

* Thiophanate-Methyl

Topsin 4.5 FL, 10 fl oz. (1 day)

or

Topsin M 70 WP, *Topsin M WSB*, 1/4 to 1/2 lb. (0 days)

Apply at 7 to 14-day intervals.

or

* Trifloxystrobin

Flint, 1 1/2 to 2 oz, 7- to 14-day intervals. (0 days) Maximum 2 consecutive applications, 4 applications/year and 16 oz/season.

or

Azoxystrobin

Amistar, 3.5 to 5 oz every 7 - 14 days. (1 day)

Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

Bacillus subtilis

Serenade, 6 to 8 lb every 7 days. (0 days)

Serenade Max, 1 - 3 lb every 7 to 10 days. (0 days)

Biological control product that needs to be applied before disease development. Control will be limited under heavy disease pressure.

or

Chlorothalonil

Bravo Ultrex, *Equus DF*, 1.8 to 2.7 lb. (0 days) *Sphaerotheca* only.

or

Bravo Weather Stik, *Echo 720*, *Equus 720 SST*, 2 to 3 pt. (0 days) *Sphaerotheca* only.

or

Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 1 to 2 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb, 5- to 7-day intervals. (0 days)

Champ Formula 2 F, *Kocide 4.5 LF*, 1 1/3 pt. (0 days)

Champion WP, 1.5 to 3 lb. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 to 4 pt, 5- to 10-day intervals. (0 days)

or

Copper Sulfate

Cuprofix Ultra, 1.25 lb. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Potassium Bicarbonate

Armcarb 100, 2.5 to 5 lb. (0 days)

or

Sulfur

Kumulus DF, 2 to 6 lb. (0 days)

Micro Sulf, 3 to 10 lb. (0 days)

Microthiol Disperss, 2 to 4 lb. (0 days)

Thiolux Jet, 4 to 6 lb. (0 days)

or

Triflumizole

Procure 480 SC, 4 to 8 fl oz every 7-14 days. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

or

Tebuconazole

Folicur 3.6F, 4-6 fl oz. (7 days) 12 hr REI.

Cucumber

SCAB (*Cladosporium cucumerinum*): Treat every 7 days after plants are 2 to 3 inches tall.

* **Chlorothalonil**

Bravo Ultrex, Equus DF, 1.8 to 2.7 lb. (0 days)

or

Bravo Weather Stik, Echo 720, Equus 720 SST, 2 to 3 pt. (0 days)

or

Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or

* **Mancozeb**

Dithane DF Rainshield, Dithane M-45, 2 to 3 lb. (5 days)

Dithane F-45 Rainshield, 1 3/5 to 2 2/5 qt. (5 days)

Penncozeb 4 F, 1.2 to 2.4 qt. (5 days)

or

Manzate 75 DF, 2 to 3 lb, 7- to 10-day intervals. (5 days) Maximum 24 In/year.

or

Copper Ammonium Carbonate

Copper Count N, 2 to 3 qt. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

ALTERNARIA LEAF BLIGHT (*Alternaria cucumerin*): Treat plants after vine tip when conditions favor disease and continue at 7 to 10 day intervals.

* **Azoxystrobin**

Amistar, 3.5 to 5 oz every 7-14 days. (1 day)

Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* **Azoxystrobin/Chlorothalonil**

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

* **Chlorothalonil**

Bravo Ultrex, Equus DF, 1.8 to 2.7 lb every 7 days. (0 days)

Echo 90 DF, 1.6 to 2.4 lb. (0 days)

or

Bravo Weather Stik, Echo 720, Equus 720 SST, 2 to 3 pt. (0 days)

or

* **Maneb**

Maneb 75 DF, Maneb 80 WP, 1 1/2 to 2 lb. (5 days)

Manex, 1 1/5 to 1 3/5 qt. (5 days)

or

* **Mancozeb**

Penncozeb 4 F, 1.2 to 2.4 qt. (5 days)

Penncozeb 75 DF, Penncozeb 80 WP, 1 1/2 to 3 lb. (5 days)

or

* **Pyraclostrobin**

Cabrio, 8-12 oz. (0 days) No more than 2 consecutive applications before alternating with a fungicide having a different mode of action.

or

* **Pyraclostrobin/Boscalid**

Pristine, 12.5 to 18.5 oz. (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 1 to 2 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, Kocide 4.5 LF, 1 1/3 pt. (0 days)

Champion WP, 1.5 to 3 lb. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 to 4 pt. (0 days)

or

Copper Sulfate

Cuprofix Ultra, 1.25 lb. (0 days)

or

Famoxadone/Cymoxanil

Tanos, 8 oz. (3 days)

or

Mancozeb/Copper Sulfate

Cuprofix MZ Disperss, 4-7.25 lb. (5 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Potassium Bicarbonate

Armicarb 100, 2.5 to 5 lb. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

ANTHRACNOSE (*Colletotrichum lagenarium*): Treat after flowering when conditions are favorable for disease development.

* **Azoxystrobin**

Amistar, 3.5 to 5 oz every 7 - 14 days. (1 day)

Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* **Azoxystrobin/Chlorothalonil**

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

* **Chlorothalonil**

Bravo Ultrex, Equus DF, 1.4 to 1.8 lb. (0 days)

Echo 90 DF, 1.3 to 1.6 lb every 7 days. (0 days)

or

Bravo Weather Stik, Echo 720, Equus 720 SST, 1.5 to 2 pt. (0 days)

or

* **Mancozeb**

Dithane DF Rainshield, Dithane M-45, 2 to 3 lb, 7- to 10-day intervals. (5 days)

or

Dithane F-45 Rainshield, 1 3/5 to 2 2/5 qt, 7- to 10-day intervals. (5 days)

or

Manzate 75 DF, 2 to 3 lb, 7- to 10-day intervals. (5 days)

or

Penncozeb 4 F, 1.2 to 2.4 qt. (5 days)
or
Penncozeb 75 DF, *Penncozeb* 80 WP, 1 1/2 to 3 lb, 7- to 10-day intervals. (5 days)
or
* Maneb
Maneb 75 DF, *Maneb* 80 WP, 1 1/2 to 2 lb, 7- to 10-day intervals. (5 days)
or
Manex, 1 1/5 to 1 3/5 qt, 7- to 10-day intervals. (5 days)
or
* Pyraclostrobin
Cabrio, 12-16 oz. (0 days) No more than 2 consecutive applications before alternating with a fungicide having a different mode of action.
or
* Pyraclostrobin/Boscalid
Pristine, 18.5 oz. (0 days)
or
* Thiophanate-Methyl
Topsin 4.5 FL, 10 fl oz. (1 day)
or
Topsin M 70 WP, *Topsin* M WSB, 1/4 to 1/2 lb, 7- to 14-day intervals. (1 day)
or
Copper Ammonium Carbonate
Copper Count N, 1 to 2 qt. (0 days)
or
Copper Hydroxide
Champ DP, 1 1/3 lb. (0 days)
Champ Formula 2 F, *Kocide* 4.5 LF, 1 1/3 pt. (0 days)
Champion WP, 1.5 to 3 lb. (0 days)
Kocide 2000, 1 1/2 lb. (0 days)
Nu-Cop 3 L, 1 to 4 pt, 5- to 10-day intervals. (0 days)
or
Mancozeb/Copper Hydroxide
ManKocide, 2 to 2.5 lb. (5 days)
or
Copper Oxychloride / Copper Sulfate
C-O-C-S WDG, 2 to 4 lb every 7 days. (0 days)
or
Copper Sulfate
Basic Copper 53, *Basicop*, 2 lb. (0 days)
Cuprofix Ultra, 1.25 lb. (0 days)
or
Famoxadone/Cymoxanil
Tanos, 8 oz. (3 days)
or
Mancozeb/Copper Sulfate
Cuprofix MZ Disperss, 4-7.25 lb. (5 days)
or
Neem Oil
Trilogy, 2 pt. (0 days)
ANGULAR LEAF SPOT (*Pseudomonas lachrymans*): Spray every 7 days, starting before the first fruit form. The disease is likely to be more serious in high-population plantings (40,000 plants/A or more). Under these conditions spray every 3 or 4 days to protect fruit at all stages of development.

Copper Ammonium Carbonate
Copper Count N, 1 to 2 qt. (0 days)
or
Mancozeb/Copper Hydroxide
ManKocide, 2 to 2.5 lb. (5 days)
or
Copper Hydroxide
Champ DP, 1 1/3 lb. (0 days)
Champ Formula 2 F, *Kocide* 4.5 LF, 1 1/3 pt. (0 days)
Kocide 2000, 1 1/2 lb. (0 days)
Champion WP (1 1/2 to 3 lb) (0 days)
Kocide 101 or *Kocide* DF(1 1/2 to 2 lb) (0 days)
Nu-Cop 50 DF (1 1/2 to 2 lb) (0 days)

or
Copper Sulfate
Basic Copper 53, *Basicop*, 2 lb. (0 days)
Cuprofix Ultra, 1.25 lb. (0 days)

or
Neem Oil
Trilogy, 2 pt. (0 days)

or
Copper Resinate
Tenn-Cop 5 E, 3 pt. (0 days)

BELLY ROT (*Rhizoctonia solani*):

* Thiophanate-Methyl
Topsin 4.5 FL, 10 fl oz. (1 day)
Topsin M 70 WP, *Topsin* M WSB, 1/2 lb. (0 days)

or
Azoxystrobin
Amistar, 3.5 to 5 oz. (1 day)
Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or
Azoxystrobin/Chlorothalonil
Quadris Opti, 3.2 pt see label for interval. (1 day)

DOWNY MILDEW (*Pseudoperonospora cubensis*): Treat plants at first sign of disease and repeat at 14-day intervals.

* Famoxadone/Cymoxanil
Tanos, 8 oz. (3 days)

or
* Propamocarb
Previcur Flex, 1.2 pt every 7 - 14 days. (2 days)

or
* Cyazofamid
Ranman, 2.1 to 2.75 fl oz every 7 to 10 days. (0 days)

or
* Cymoxanil
Curzate 60 DF, 3.2 oz every 5 - 7 days. (3 days)

or
* Chlorothalonil
Bravo Ultrex, *Equus* DF, 1.8 to 2.7 lb. (0 days)
Equus 720 SST (2 to 3 pt every 7 days) (0 days)
Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)
or
Bravo Weather Stik or *Echo* 720 (2 to 3 pt, 7-day intervals) (0 days)

Cucumber

or

* Fluopicolide

Presidio, 3-4 fl oz. (2 days)

or

* Mancozeb

Dithane DF Rainshield, *Dithane M-45*, 2 to 3 lb, 7- to 10-day intervals. (5 days)

or

Dithane F-45 Rainshield, 1 3/5 to 2 2/5 qt, 7- to 10-day intervals. (5 days)

or

Manzate 75 DF, 2 to 3 lb, 7- to 10-day intervals. (5 days) Maximum 24 lb/season.

or

Penncozeb 4 F, 1.2 to 2.4 qt. (5 days)

or

Penncozeb 75 DF, 1.2 to 2.4 qt. (5 days)

or

* Mancozeb/Zoxamide

Gavel 75 DF, 2.0 lb. (5 days)

or

Azoxystrobin

Amistar, 3.5 to 5 oz. (1 day)

Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

Dimethomorph

Acrobat 50 WP, 6.4 oz. (0 days) Must be tank-mixed with another fungicide.

or

Forum, 6 fl oz. (0 days)

or

Fenamidone

Reason 500 SC, 5.5 fl oz every 5 to 10 days. (14 days)

or

Fosetyl-Aluminum

Aliette WDG, 2 to 5 lb, 7 to 14 day intervals. (0 days) Do not tank mix with copper fungicides.

or

Mancozeb/Copper Sulfate

Cuprofix MZ Disperss, 4-7.25 lb. (5 days)

or

Mefenoxam/Chlorothalonil

Flouronil, *Ridomil Gold Bravo*, 2 lb. (7 days) Maximum 4 applications. Do not apply to mature or senescent plants.

or

Mefenoxam/Copper Hydroxide

Ridomil Gold Copper, 2 lb. (5 days) Maximum 4 applications.

or

Mefenoxam/Mancozeb

Ridomil Gold MZ, 2 1/2 lb. (5 days) Maximum 4 applications.

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 2.5 to 5 pt every 7 - 14 days. (0 days)

Prophyt, 2 to 4 pt. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Potassium Bicarbonate

Armicarb 100, 2.5 to 5 lb. (0 days)

or

Pyraclostrobin

Cabrio, 8-12 oz. (0 days) Alternate one-to-one with fungicides having a different mode of action.

or

Pyraclostrobin/Boscalid

Pristine, 12.5 to 18.5 oz. (0 days)

or

Trifloxystrobin

Flint, 4 oz, 7- to 14-day intervals. (0 days) Maximum 2 consecutive applications, 4 applications/year and 16 oz/season. Alternate with Ridomil Gold Bravo.

or

Mono-, dibasic sodium salts of phosphorous acid

Fosphite, 1 to 3 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)

or

Mandipropamid

Revus, 8 fl oz. (0 day)

Note: Most fungicides that protect against Alternaria and gummy stem blight may also provide limited downy mildew protection.

GUMMY STEM BLIGHT or BLACK ROT (*Didymella bryoniae* also called *Mycosphaerella melonis*): Begin treatment at the 2-leaf stage.

* Azoxystrobin

Amistar, 3.5 to 5 oz every 7 - 14 days. (1 day)

Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

* Chlorothalonil

Bravo Ultrex, *Equus DF*, 1.8 to 2.7 lb. (0 days)

Equus 720 SST (2 to 3 pt every 7 days) (0 days)

Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or

Bravo Weather Stik or *Echo 720* (2 to 3 pt, 7-day intervals) (0 days)

or

* Mancozeb

Dithane DF Rainshield, *Dithane M-45*, 2 to 3 lb, 7- to 10-day intervals. (5 days)

or

Dithane F-45 Rainshield, 1 3/5 to 2 2/5 qt, 7- to 10-day intervals. (5 days)

or

Manzate 75 DF, 2 to 3 lb, 7- to 10-day intervals.
(5 days) Maximum 24 lb/season. or
Penncozeb 4 F, 1.2 to 2.4 qt. (5 days)
Penncozeb 75 DF, 1.2 to 2.4 qt. (5 days)

or

* Pyraclostrobin
Cabrio, 12-16 oz. (0 days) No more than 2 consecutive applications before alternating with a fungicide having a different mode of action.

or

* Pyraclostrobin/Boscalid
Pristine, 12.5 to 18.5 oz. (0 days)

or

* Thiophanate-Methyl
Topsin 4.5 FL, 10 fl oz. (1 day)
or
Topsin M 70 WP, *Topsin M* WSB, 1/4 to 1/2 lb, 7- to 14-day intervals. (1 day)

or

Copper Ammonium Carbonate
Copper Count N, 1 to 2 qt. (0 days)

or

Copper Hydroxide
Champ DP, 1 1/3 lb. (0 days)
Champ Formula 2 F, *Kocide* 4.5 LF, 1 1/3 pt. (0 days)
Champion WP, 1.5 to 3 lb. (0 days)
Kocide 2000, 1 1/2 lb. (0 days)
Nu-Cop 3 L, 1 to 4 pt, 5- to 10-day intervals. (0 days)

or

Mancozeb/Copper Hydroxide
ManKocide, 2 to 2.5 lb. (5 days)

or

Copper Sulfate
Cuprofix Ultra, 1.25 lb. (0 days)

or

Fenamidon
Reason 500 SC, 5.5 fl oz every 5 to 10 days. (14 days)

or

Mancozeb/Copper Sulfate
Cuprofix MZ Disperss, 4-7.25 lb. (5 days)

or

Tebuconazole
Folicur 3.6F, 8 fl oz. (7 days) Approved for gummy stem blight. Suppression only.

FRUIT ROT (*Phytophthora* spp., *Pythium* spp.): Initiate treatment at flowering. If possible, tank-mix products with a labeled copper product.

* Dimethomorph
Acrobat 50 WP, 6.4 oz every 7 days. (0 days)
Forum, 6 fl oz. (0 days)

or

* Famoxadone/Cymoxanil
Tanos, 8 - 10 oz every 5 - 7 days. (3 days)

or

* Mancozeb/Zoxamide
Gavel 75 DF, 1.5 - 2.0 lb. (5 days)

or

* Mandipropamid
Revus, 8 fl oz. (0 day)

or

Cyazofamid
Ranman, 2.75 fl oz every 7 to 10 days. (0 days)

or

Fosetyl-Aluminum
Aliette WDG, 2 to 5 lb, 7- to 14-day intervals (*Phytophthora*). (0 days) Do not tank mix with copper fungicides.

or

Maneb
Maneb 75 DF, *Maneb* 80 WP, 1 1/2 to 2 lb, 7- to 10-day intervals (*Pythium*). (5 days)
or
Manex, 1.2 to 1.6 qt (*Pythium*). (5 days) Maximum 12.8 qt/season.

or

Mancozeb
Penncozeb 4 F, 1.2 to 2.4 qt. (5 days)
or
Penncozeb 75 DF (1 1/2 to 3 lb, 7- to 10-intervals (*Pythium*)) or *Penncozeb* 80 WP (1 1/2 to 3 lb, 7- to 10-day intervals (*Pythium*)) (5 days)

or

Mono-, dibasic sodium, potassium and ammonium phosphites
Phostrol, 2.5 to 5 pt every 7 - 14 days. (0 days)
Prophyt, 6 pt. (0 days)

or

Mono-, dibasic sodium salts of phosphorous acid
Fosphite, 1 to 3 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)

Note: Fungicides applied to control downy mildew may have limited efficacy against *Phytophthora* crown and fruit rot.

PHYTOPHTHORA CROWN and FRUIT ROT (*Phytophthora* spp.):

* Fluopicolide
Presidio, 3-4 fl oz. (2 days)

Eggplant

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

SOIL TREATMENT AT PLANTING:

Fenamiphos
Nemacur 15 G, 13.4 lb/A on 36-in rows. Apply in 12-in band over the row at transplanting and incorporate immediately. (RUP)
or

Eggplant

Nemacur 3 S, 5.9 fl oz/1000 row feet (or 2 2/3 qt/A on 36 inch rows) in a 12-inch band over the row at transplanting.

Incorporate immediately into the soil. **Note:** on narrow row crops, do not allow bands to overlap. (RUP)

Note: For hydrologic soil group A, soils that are excessively drained or predominantly sand or loamy sand with shallow water tables (less than 50 feet deep), *Nemacur* cannot be used. For all other soil types, *Nemacur* can no longer be purchased but stores of the product can be used until depleted.

or
Vydate L. Apply 1 gal/A in a band 2 to 3 weeks after transplanting and again 4 weeks later. Make 2 foliar treatments of 2 qt 2-4 weeks after the soil treatments at 1 to 2 week intervals. (RUP)

INSECTS

SOIL TREATMENT:

COLORADO POTATO BEETLE, APHIDS, FLEA BEETLE: Apply where high potato beetle, aphid, or flea beetle numbers are expected. Apply in a band prior to transplanting or in a drench at transplanting.

* Imidacloprid
Admire Pro, 7.0 - 10.5 fl oz. (21 days) Consult label for rotation restrictions and application methods.

or
Nuprid 2 F, 16 to 24 fl oz.

or
* *Platinum*, 5 to 11 fl oz. (30 days) Apply as in-furrow spray or narrow surface band, as a post seeding, transplant or hill drench, in trickle or drip irrigation, or shanked into root zone after establishment or transplanting.

or
Venom, 5 to 6 oz. (21 days) See label for application methods.

FOLIAR TREATMENT:

CUTWORM: Apply when damage is first seen, usually soon after transplanting.

* *Baythroid* XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or
* Permethrin
Perm-UP 3.2 EC, 4 to 8 oz. (3 days) (RUP)

or
* *Warrior* with Zeon Technology, 2.6 to 3.8 fl oz. (5 days) (RUP)

or
Carbaryl
Sevin 80 S (2 1/2 lb) or *Sevin* XLR Plus (2 qt) (3 days)

or
Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or
Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or
Lambda-cyhalothrin
Lambda-Cy, *Proaxis*, 1.9 to 3.2 fl oz. (5 days) (RUP)

or
Hero, 4 to 10.3 oz. (7 days) (RUP)

or
Brigadier, 5.1 to 9.85 oz. (7 days)

COLORADO POTATO BEETLE:

* *Actara*, 2 to 3 oz. (0 days) Do not apply if a neonicotinoid was used at planting. Do not exceed 11 oz/acre per season.

or
* *Assail* 30 SG, 1.4 to 2.5 oz. (7 days) Do not use if Imidacloprid or Platinum was used at planting.

or
* Imidacloprid
Nuprid 1.6 F, *Provado* 1.6 F, 3.8-6.2 fl oz. (0 days) Do not use if neonicotinoids were used at planting. Do not apply more than 19.2 oz/acre per season.

or
* *SpinTor* 2 SC, 2.25 to 4.5 oz (for larvae). (1 day) Do not apply more than 3 times in 21 days.

or
* *Venom*, 1 to 4 oz. (1 day) Do not use if neonicotinoids were used at planting.

or
Asana XL, 5.8 to 9.6 oz. (7 days) (RUP)

or
Bacillus thuringiensis tenebrionis
Novodor. (0 days) Small larvae only.

or
Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or
Bifenthrin
Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz. (7 days) (RUP)

or
Carbaryl
Sevin 80 S (2/3 to 1 1/4 lb) or *Sevin* XLR Plus (1 to 2 qt) (3 days)

or
Permethrin
Ambush 25 W, 12.8 oz. (3 days) (RUP)
or
Perm-UP 3.2 EC (8 oz) or *Pounce* 25 WP (12.8 oz) or *Pounce* 3.2 EC (8 oz) (3 days) (RUP)

or
Vydate L, 1 to 2 qt. (1 day) Repeat in 1 to 3 weeks if needed. (RUP)

or
Warrior with Zeon Technology, 1.3 to 3.8 fl oz. (5 days) (RUP)

or
Entrust, 1 to 2 oz. (1 day)

or
Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or
Lambda-cyhalothrin
Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (5 days) (RUP)

or
Hero, 4 to 10.3 oz. (7 days) (RUP)

or
Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or
Brigadier, 5.1 to 9.85 oz. (7 days)

FLEA BEETLE: Apply when damage is first seen.

Actara, 2 to 3 oz. (0 days) Do not apply if a neonicitinoid was used at planting. Do not exceed 11 oz/acre per season.

or

Asana XL, 5.8 to 9.6 oz. (1 day) (RUP)

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade 2EC*, *Capture 2 EC*, 2.1 to 6.4 oz. (7 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin XLR Plus* (1 qt) (3 days)

or

Dibrom 8 EC, 1 pt. (1 day)

or

Endosulfan 3 EC, 1 1/3 pt. (1 day) Consult label for rotation limitations.

or

Permethrin

Ambush 25 W, 12.8 oz. (3 days) (RUP)

or

Perm-UP 3.2 EC (8 oz) or *Pounce 25 WP* (12.8 oz) or *Pounce 3.2 EC* (8 oz) (3 days) (RUP)

or

Imidacloprid

Nuprid 1.6 F, *Provado 1.6 F*, 3.8-6.2 fl oz. (0 days) Do not use if neonicitinoids were used at planting. Do not apply more than 19.2 oz/acre per season.

or

Venom, 1 to 4 oz. (1 day) Do not use if neonicitinoids were used at planting.

or

Warrior with Zeon Technology, 1.3 to 3.8 fl oz. (5 days) (RUP)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (5 days) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Brigadier, 5.1 to 9.85 oz. (7 days)

APHIDS: Apply when needed.

* *Assail 30 SG*, 1.9 to 2.8 oz. (7 days)

or

* *Actara*, 2 to 3 oz. (0 days) Do not apply if a neonicitinoid was used at planting. Do not exceed 11 oz/acre per season.

or

* Imidacloprid

Nuprid 1.6 F, *Provado 1.6 F*, 3.8-6.2 fl oz. (0 days) Do not use if neonicitinoids were used at planting. Do not apply more than 19.2 oz/acre per season.

or

Dibrom 8 EC, 1 pt. (1 day)

or

Endosulfan 3 EC, 1 1/3 pt. (1 day) Consult label for rotation limitations.

or

Fulfill, 2.75 oz. (0 days) May require 5 to 7 days for aphid mortality

or

Malathion 57 EC, 1 pt. (3 days)

or

Venom, 1 to 4 oz. (1 day) Do not use if neonicitinoids were used at planting.

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Brigadier, 3.8 to 9.85 oz. (7 days)

MITES

Apply if needed to avoid foliar injury.

Bifenthrin

Bifenture EC, *Brigade 2EC*, *Capture 2 EC*, 5.1 to 6.4 oz. (7 days) (RUP)

or

Oberon 2 SC, 7 to 8.5 fl oz. (7 days)

or

Trithion 8 EC, 1/2 to 1 pt. (7 days)

or

Vydate L, 1 to 2 qt. (1 day) Repeat in 1 to 3 weeks if needed. (RUP)

or

Hero, 10.3 oz. (7 days) (RUP)

or

Agri-Mek 0.15 EC, 8 to 16 fl oz. (7 days) (RUP)

DISEASES**SEED TREATMENT:**

DAMPING OFF (*Pythium* spp., *Phytophthora* spp., *Rhizoctonia solani*): Apply to seed as slurry or dust. Use only as directed; overtreatment may cause injury.

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Thiram

42-S Thiram, 6 1/2 oz/100 lb seed.

Thiram 50 WP Dyed, 6 oz/100 lb seed.

or

Thiram

Thiram 50 WP Dyed, 6 oz/100 lb seed.

SEEDBED TREATMENT:

DAMPING OFF (*Pythium* spp.), **CROWN ROT** (*Phytophthora capsici*): Ridomil must be applied to the soil before the plants are infected with *Phytophthora* to obtain satisfactory disease control.

* Mefenoxam

Ridomil Gold SL, 1 pt. (7 days)

Ridomil Gold WSP, 1 lb. (7 days)

Ultra Flourish, 2 pt. (7 days)

Incorporate mechanically before planting or move into root zone after planting with 1/2 to 1 inch sprinkler water. For banded applications, use 12 to 16 inch band.

Garden Greens

After initial application, 2 supplemental post-directed applications at 1 lb (Ridomil Gold WSP) or 1 pt (Ridomil Gold EC) should be made at 30-day intervals. Spray should be directed at the base of the plants and cover 6 to 8 inches of soil on either side of the plants. Ridomil Gold must be moved into the root zone mechanically or by sprinkler irrigation. Spray may be applied with liquid fertilizer shanked in as a band treatment to either side of the plant. The foliar blight phase of *Phytophthora* cannot be controlled with foliar applications of Ridomil Gold.

Note: Observe limit of active ingredient/crop on label.

PREPLANT SOIL FUMIGATION:

FUSARIUM, VERTICILLIUM WILT, *PHYTOPHTHORA* spp:

Preplant treatment (production fields). Most fumigants applied to the soil to control disease organisms will also control soil insects, nematodes and weed seeds.

Soil sterilization by fumigation is best achieved by proper application of material. Correct soil moisture, temperature, and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or immediate tarping.

1,3 Dichloropropene/chloropicrin

Telone C35, 13-35 gal. (RUP)

or

Metam Sodium

Sectagon 42, *Vapam HL*, 37.5-75 gal.

or

Potassium N-methylidithiocarbamate

Sectagon-K54, 30-60 gal.

FOLIAR TREATMENT:

ALTERNARIA BLIGHT (*Alternaria melongenae*),

ANTHRACNOSE (*Colletotrichum melongenae*): Treat every 7 to 10 days after disease first appears.

* Azoxystrobin

Amistar, 2 to 5 oz every 7-14 days (*Anthracnose* only) (0 days)

Quadris, 6.2 to 15.4 fl oz (*Anthracnose* only). (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Boscalid

Endura, 2.5 to 3.5 oz. (0 days)

or

* Maneb

Maneb 75 DF, *Maneb 80 WP*, 1 1/2 to 2 lb. (5 days)

Manex, 1 1/5 to 1 3/5 qt. (5 days)

or

* Trifloxystrobin

Flint, 2 to 3 oz. (3 days) Do not apply more than three sequential foliar applications of strobilurin fungicides before alternating with a fungicide that has a different mode of action.

or

Copper Ammonium Carbonate

Copper Count N, 2 qt. (0 days)

or

Copper Hydroxide

Champ Formula 2 F, *Kocide 4.5 LF*, *Nu-Cop 3 L*, 1 1/3 pt (0 days)

or

Champion WP, *Kocide 101*, *Kocide DF*, *Nu-Cop 50 DF*, 2 lb. (0 days)

or

Kocide 2000, 1 1/2 lb. (0 days)

or

Copper Sulfate

Basicop 53 WP, 3 to 4 lb. (0 days)

Cuprofix Ultra, 1.25 lb. (0 days)

or

Pyraclostrobin

Cabrio, 8 to 12 oz. (0 days)

PHOMOPSIS BLIGHT (*Phomopsis vexans*): Treat every 7 to 10 days after disease first appears.

Copper Ammonium Carbonate

Copper Count N, 2 qt. (0 days)

or

Copper Hydroxide

Champ Formula 2 F, *Kocide 4.5 LF*, *Nu-Cop 3 L*, 1 1/3 pt. (0 days)

or

Champion WP, *Kocide 101*, *Kocide DF*, *Nu-Cop 50 DF*, 2 lb. (0 days)

or

Kocide 2000, 1 1/2 lb. (0 days)

or

Copper Sulfate

Basicop 53 WP, 3 to 4 lb. (0 days)

Cuprofix Ultra, 1.25 lb. (0 days)

Garden Greens

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

INSECTS

PLANTING TREATMENT:

APHIDS:

Imidacloprid. See label for application methods.

Admire Pro, 4.4 - 10.5 fl oz. (21 days; 45 days for Swiss Chard)

Nuprid 2 F, 10 to 24 oz. (21 days)

or

Venom, 5 to 6 oz. (21 days) Non-Brassica greens.

or

Platinum, 5 to 11 fl oz. (30 days) See label for application methods.

CABBAGE MAGGOT:

Lorsban 15 G (4.6 to 9.2 oz per 1,000 ft of row) or *Lorsban 4 E / Lorsban Advanced* (1.6 to 2.75 fl oz / 1,000 ft of row) Apply in a 4-inch band over row at time of seeding. Use only as directed. Brassica greens only. (RUP)

FLEA BEETLE, THRIPS:

Platinum, 5 to 11 fl oz. (30 days)

FOLIAR TREATMENT:

FLEA BEETLE: Apply when damage is first seen on young plants. Repeat as needed.

Cypermethrin

Ammo 2.5 EC (2.5 to 5 oz) or *Ammo WSB* (1 to 2 bags) or *UP-Cyde 2.5 EC* (2.5 to 5 oz) (1 day) (RUP)

or

Asana XL, 5.8 to 9.6 oz. (7 days) Collards only. (RUP)

or

Baythroid XL, 1.6 to 2.4 fl oz. (0 days) Mustard greens only. (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin XLR Plus* (1 qt) (14 days)

or

Lorsban 50 W, 2 lb. (21 days) Collards, kale and kohlrabi only. (RUP)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Imidacloprid

Nuprid 1.6 F, *Provado 1.6 F*, 3.75 fl oz. (7 days) Do not use if Imidacloprid was used at planting. Do not exceed 19.2 oz/Acre per season.

or

Pyrellin EC, 1 to 2 pt. (0 days)

or

Pyrenone, 2 to 12 oz. (0 days)

or

Actara, 1.5 to 3 oz. (7 days) Do not exceed 11.0 oz/Acre per season.

or

Bifenthrin (RUP)

Bifenture EC, 2.1 to 6.4 oz. (7 days) Brassica greens only.

CUTWORM, LOOPERS: Apply as needed.

* Cypermethrin (RUP)

Ammo 2.5 EC (2.5 to 5 oz) or *Ammo WSB* (1 to 2 bags) or *UP-Cyde 2.5 EC* (2.5 to 5 oz) (1 day) Brassica greens only.

or

* *Asana XL*, 9.6 oz. (7 days) Collards and mustard greens only. (RUP)

or

* *Baythroid XL*, 1.6 to 2.4 fl oz. (0 days) Mustard greens only. (RUP)

or

* Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (1 day) Non-Brassica greens only. (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce 25 WP* (6.4 to 12.8 oz) or *Pounce 3.2 EC* (4 to 8 oz) (1 day) Chard and non-Brassica greens only. (RUP)

or

Endosulfan 3 EC, 1 qt. (21 days) Collards, kale and mustard greens only.

or

Thiodicarb

Larvin 3.2 EC, 16 to 30 oz. (14 days) Cress, dandelion, endive, parsley and Swiss chard (consult label for a complete list).

or

Lorsban 50 W, 2 lb. (21 days) Collards, kale and kohlrabi only. (RUP)

or

Mustang Max, 3.2 to 4.0 oz. (1 day) (RUP)

or

SpinTor 2 SC, 3 to 6 oz. (1 day)

or

Entrust, 1 to 2 oz. (1 day)

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or

Avaunt, 2.5 to 3.5 oz. (3 days)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Brigadier, 4.2 to 6.1 oz. (7 days) Brassica greens only.

CABBAGE "WORM": Apply when feeding damage is seen. Repeat as needed.

Cypermethrin (RUP)

Ammo 2.5 EC (2.5 to 5 oz) or *Ammo WSB* (1 to 2 bags) or *UP-Cyde 2.5 EC* (2.5 to 5 oz) (1 day) Brassica greens only.

or

Asana XL, 9.6 oz. (7 days) Collards and mustard greens only. (RUP)

or

Avaunt, 2.5 to 3.5 oz. (3 days)

or

Bacillus thuringiensis

Agree, *Biobit*, *Dipel*, *Javelin*, *Lepinox*, *Xentari*. (0 days)

or

Baythroid XL, 1.6 to 2.4 fl oz. (0 days) Mustard greens only. (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin XLR Plus* (1 to 2 qt) (14 days)

or

Dibrom 8 EC, 1 pt. (1 day) Collards and kale only.

or

Endosulfan 3 EC, 1 qt. (21 days) Collards, kale and mustard greens only.

or

Lannate LV (1 1/2 to 3 pt) or *Lannate SP* (1/2 to 1 lb) (3 days) (RUP)

or

Garden Greens

Thiodicarb

Larvin 3.2 EC, 16 to 30 oz. (14 days) Cress, dandelion, endive, parsley and swiss chard (consult label for a complete list).

or

Lorsban 50 W, 2 lb. (21 days) Collards, kale and kohlrabi only. (RUP)

or

Malathion 57 EC, 1 qt. (7 days)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (1 day) Non-Brassica greens only. (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz) or *Pounce* 3.2 EC (4 to 8 oz) (1 day) Chard and non-Brassica greens only. (RUP)

or

SpinTor 2 SC, 3 to 6 oz. (1 day)

or

Entrust, 1 to 2 oz. (1 day)

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Brigadier, 4.2 to 6.1 oz. (7 days) Brassica greens only.

APHIDS: Apply as needed to avoid infestations on leaves at harvest.

* *Assail* 30 SG, 1.9 to 2.8 oz. (7 days) Do not use if Imidacloprid was used at planting.

or

* *Fulfill*, 2.75 oz (7 days) May require 5-7 days for aphid mortality.

or

* Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.75 fl oz. (7 days) Do not use if Imidacloprid was used at planting. Do not exceed 19.2 oz/Acre per season.

or

Dibrom 8 EC, 1 pt. (1 day) Collards and kale only.

or

Dimethoate 2.67 EC, 3/4 pt. (14 days)

or

Endosulfan 3 EC, 1 qt. (21 days) Collards, kale and mustard greens only.

or

Malathion 57 EC, 1 qt. (7 days) Collards, kale and mustard greens only.

or

Pyrellin EC, 1 to 2 pt. (0 days)

or

Pyrenone, 2 to 12 oz. (0 days)

or

Venom, 1 to 3 oz. Non-Brassica greens.

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Actara, 1.5 to 3 oz. (7 days) Do not exceed 11.0 oz/Acre per season.

or

Brigadier, 4.2 to 6.1 oz. (7 days) Brassica greens only.

CUTWORM, EUROPEAN CORN BORER:

Bifenthrin (RUP)

Bifenture EC, 2.1 to 6.4 oz. (7 days) Brassica greens only.

MITES

May be a problem in hot, dry weather.

Dibrom 8 EC, 1 pt. (1 day) Collards and kale.

or

Bifenthrin (RUP)

Bifenture EC, 5.1 to 6.4 oz. (7 days) Brassica greens only.

SLUGS

Deadline M-Ps 4% (20 to 40 lb) or *Metaldehyde* 3.5 G (30 to 40 lb) Apply between rows. Avoid contact to edible product.

DISEASES

SEED TREATMENT:

DAMPING OFF (*Rhizoctonia* spp., *Pythium* spp.):

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only. Collards, endive, kale, swiss chard.

or

Captan

Captan 30-DD, 1 1/4 oz/100 lb seed. Collards, kale, mustard.

Captan 30-DD, 9 1/2 oz/100 lb seed. Swiss chard.

Captan 400, 1 to 2 oz/100 lb seed. Mustard.

Captan 400, 10 to 12 oz/100 lb seed. Swiss chard.

or

Thiram

42-S Thiram, *Thiram* 50 WP Dyed, 8 oz/100 lb seed.

PREPLANT INCORPORATED:

DAMPING OFF (*Pythium* spp.):

Mefenoxam. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into seed zone after planting with 1/2 to 1 in. of sprinkler irrigation. Endive and Swiss chard only).

Ridomil Gold GR, 20 to 40 lb.

Ridomil Gold WSP, 1 to 2 lb.

FOLIAR TREATMENT:

BOTRYTIS GRAY MOLD (*Botrytis* spp.): Apply 7 days following transplanting. Repeat applications when plants are half, mature. Do not apply to wilted plants or seedlings.

* *DCNA*

Botran 75 W, 2 2/3 lb (endive, escarole). (14 days)

DOWNY MILDEW (*Peronospora parasitica*): Apply as needed to maintain control.

* Fosetyl-Aluminum

Aliette WDG, 2 to 5 lb at 7- to 21-day intervals.
(3 days) Collards, kale, mustard greens, endive, escarole, Swiss chard. **Note:** Do not tank mix with copper fungicides.

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 2.5 to 5 pt every 7 - 21 days. (0 days)

or

Dimethomorph

Forum, 6 fl oz. (0 days)

or

Acibenzolar-S-methyl

Actigard, 1 oz per 20 gal (ground) or 10 gal (aerial) of water.
(7 days) Do not apply more than 4 applications / crop per year.

or

Mono-, dibasic sodium salts of phosphorous acid

Fosphite, 1 to 3 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)

or

Mandipropamid

Revus, 8 fl oz. (1 day)

Note: Fungicides that protect against *Alternaria* also provide limited downy mildew protection.

CERCOSPORA LEAF SPOT (*Cercospora beticola*):

* Azoxystrobin

Amistar, 2 to 5 oz. (0 days)
Quadris, 6.2 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Trifloxystrobin

Flint, 2 to 3 oz. (7 days) Swiss chard only.

Do not apply more than three sequential foliar applications of strobilurin fungicides before alternating with a fungicide that has a different mode of action.

or

Tebuconazole

Folicur 3.6F, 3-4 fl oz. (7 days) Maximum 16 fl oz/acre/season.
12 hr REI.

ALTERNARIA LEAF SPOT (*Alternaria cucumerina*):

* Azoxystrobin

Amistar, 2 to 5 oz. (0 days)
Quadris, 6.2 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Maneb

Maneb 75 DF, *Maneb* 80 WP, 1 1/2 to 2 lb. (10 days) Kale only.
Manex, 1.2 to 1.6 qt. (10 days) Kale only.

or

Copper Hydroxide

Kocide 101, *Kocide* DF, 1 to 2 lb. (0 days) Collards only.
Kocide 4.5 LF, 1 1/3 pt. (0 days)

or

Kocide 2000, 3/4 to 1 1/2 lb. (0 days) Mustard greens and Collards only.

or

Cyprodinil/Fludioxonil

Switch 62.5 WG, 11 to 14 oz. (7 days)

or

Tebuconazole

Folicur 3.6F, 3-4 fl oz. (7 days) Maximum 16 fl oz/acre/season.
12 hr REI.

Garlic

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

SOIL TREATMENT:

BULB and STEM NEMATODE:

Fenamiphos

Nemacur 15 G, 9.2 to 18.4 oz/1,000 ft in furrow with seed. For best results, plant the crop within 7 to 10 days after cracking (seed preparation). (RUP)

Note: For hydrologic soil group A, soils that are excessively drained or predominantly sand or loamy sand with shallow water tables (less than 50 feet deep), Nemacur cannot be used. For all other soil types, Nemacur can no longer be purchased but stores of the product can be used until depleted.

INSECTS

FOLIAR TREATMENT:

LOOPERS, ARMYWORM: Apply as needed.

* Cypermethrin

Ammo 2.5 EC (2 to 5 oz) or *Ammo* WSB (1 to 2 bags) or *UP-Cyde* 2.5 EC (2 to 5 oz) (7 days) (RUP)

or

* *Mustang* Max, 2.2 to 4.0 oz. (7 days) (RUP)

or

* Permethrin

Ambush 25 W, 9.6 to 19.2 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (6 to 12 oz) or *Pounce* 25 WP (9.6 to 19.2 oz) or *Pounce* 3.2 EC (6 to 12 oz) (1 day) (RUP)

or

Bacillus thuringiensis

Agree, *Biobit*, *Dipel*, *Javelin*, *Lepinox*, *Xentari*. (0 days)

or

Lannate SP, 1/2 lb. (7 days) (RUP)

or

Entrust, 1 to 2 oz. (1 day) Do not apply more than 9 oz per acre per crop. Do not make more than 5 applications per year.

or

Garlic

SpinTor 2 SC, 3 to 6 oz. (1 day) Do not apply more than 29 oz per acre per crop. Do not make more than 5 applications per year.

or
Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 5 applications or exceed 30 fl oz/acre per season.

APHIDS: Apply as needed.

Malathion 57 EC, 1 1/2 to 2 pt. (3 days)

THRIPS: Apply as needed.

* Cypermethrin

Ammo 2.5 EC (4 to 5 oz) or *Ammo* WSB (1 to 2 bags) or
UP-Cyde 2.5 EC (4 to 5 oz) (7 days) (RUP)

or

* *Mustang* Max, 2.9 to 4.0 oz. (7 days) (RUP)

or

Malathion 57 EC, 1 1/2 to 2 pt. (3 days)

or

Permethrin

Ambush 25 W, 9.6 to 19.2 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (6 to 12 oz) or *Pounce* 25 WP (9.6 to 19.2 oz)
or *Pounce* 3.2 EC (6 to 12 oz) (1 day) (RUP)

or

Pyrellin EC, 1 to 2 pt. (0 days)

or

Pyrenone, 2 to 12 oz. (0 days)

or

Entrust, 1.25 to 2.5 oz. (1 day)

or

SpinTor 2 SC, 4 to 8 oz. (1 day) Suppression only. Do not apply more than 29 oz per acre per crop. Do not make more than 5 applications per year.

or

Radiant SC, 6 to 10 fl oz. (1 day) Do not make more than 5 applications or exceed 30 fl oz/acre per season.

DISEASES

SEED TREATMENT:

WHITE ROT (*Sclerotium cepivorum*): Apply a uniform mist spray. For best results use a commercial sticker to the spray solution.

PCNB

Terraclor 75 WP, 13 1/2 lb/1000 lb of "seed" cloves.

Terraclor F, 2.5 gal/1000 lb of "seed" cloves.

PLANTING TREATMENT:

DAMPING OFF (*Pythium* spp.):

* Mefenoxam. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. or sprinkler irrigation.

Ridomil Gold SL, 0.5-1 pt.

Ultra Flourish, 1 to 2 pt.

WHITE ROT (*Sclerotium cepivorum*): Apply as an in-furrow spray at planting.

Iprodione

Iprodione 4L AG, *Rovral* 4 F, 4 pt. **Note:** See label for permissible crop rotation.

or

DCNA

Botran 75 W, 2 2/3 to 5 1/3 lb. The use of a spreader/sticker is not recommended. Do not make more than one application per season.

or

PCNB

Blocker 4 F, 29 oz/1000 row feet.

Terraclor 2 E, 10 gal.

Terraclor 75 WP, 27.5 lb.

Terraclor F, 5 gal.

or

Thiophanate-Methyl

Topsin 4.5 FL, 40 fl oz.

FOLIAR TREATMENT:

BOTRYTIS LEAF BLIGHT (*Botrytis* spp.), **PURPLE BLOTCH**

(*Alternaria porri*):

* Azoxystrobin

Amistar, 2 to 5 oz every 7 - 14 days. (0 days)

Quadris, 6.2 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Chlorothalonil

Bravo Ultrex, 0.9 to 2.7 lb. (7 days)

Echo 90 DF, 1.2 to 2.4 lb every 7 days. (7 days)

Equus DF, 0.9 to 2.7 lb. (7 days)

or

Bravo Weather Stik, *Bravo* Weather Stik Zn, *Echo* 720, *Equus* 720 SST, 1 to 3 pt. (7 days)

or

* Mancozeb

Dithane DF Rainshield, *Dithane* M-45, 3 lb. (7 days)

Dithane F-45 Rainshield, 2.4 qt. (7 days)

Manzate 75 DF, 3 lb. (7 days) Do not apply to exposed bulbs.

Penncozeb 4 F, 1.6 to 2.4 qt. (7 days)

Penncozeb 75 DF, *Penncozeb* 80 WP, 2 to 3 lb. (7 days)

or

* Maneb

Maneb 75 DF, *Maneb* 80 WP, 2 to 3 lb. (7 days)

Manex, 3.2 to 4.8 pt. (7 days)

or

* Pyraclostrobin

Cabrio, 8-12 oz. (7 days) Do not apply more than three sequential applications

or

* Pyraclostrobin/Boscalid

Pristine, 14.5 to 18.5 oz for *Botrytis*, 10.5 to 18.5 oz for *Alternaria*. (7 days)

or

* Boscalid

Endura, 6.8 oz. (7 days)

or

DCNA

Botran 75 W, 2 2/3 to 5 1/3 lb. (14 days) The use of a spreader/sticker is not recommended. Do not make more than one application per season.

or

Fenamidone

Reason 500 SC, 5.5 fl oz every 5 to 10 days. (7 days) Purple blotch only.

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Pyrimethanil

Scala, 9 to 18 fl oz. (7 days)

or

Propiconazole

Propimax EC, 4 fl oz. (14 days)

Tilt, 4-8 fl oz. (14 days)

BACTERIAL BLIGHT (*Erwinia carotovora* subsp. *carotovora*, *Pseudomonas* spp.): Apply at 7 to 10 day intervals when plants are 4-6 in. tall. Can cause foliar phytotoxicity.

Copper Hydroxide

Champ DP, 2/3 to 1 lb. (0 days)

Champ Formula 2 F, 2/3 to 1 pt. (0 days)

Kocide 4.5 LF, 1 1/3 pt. (0 days)

or

Copper Sulfate

Cuprofix Ultra, 1.25 to 3 lb. (0 days)

DOWNY MILDEW (*Peronospora destructor*): Apply after the 4-leaf stage.

* Dimethomorph

Acrobat 50 WP, 6.4 oz. (0 days) Must be tank-mixed with another fungicide.

or

Forum, 6 fl oz. (0 days)

or

* Mancozeb

Dithane DF Rainshield, *Dithane* M-45, 3 lb. (7 days)

Dithane F-45 Rainshield, 2.4 qt. (7 days)

Manzate 75 DF, 3 lb. (7 days) Do not apply to exposed bulbs.

Penncozeb 4 F, 1.6 to 2.4 qt. (7 days)

Penncozeb 75 DF, *Penncozeb* 80 WP, 2 to 3 lb. (7 days)

or

* Maneb

Manex, 3.2 to 4.8 pt. (7 days)

or

* Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 2 lb. (7 days) Maximum 4 applications.

or

* Mefenoxam/Mancozeb

Ridomil Gold MZ, 2 1/2 lb. (7 days) Maximum 4 applications.

or

* Mefenoxam/Copper Hydroxide

Ridomil Gold Copper, 2 lb. (10 days) Maximum 4 applications.

or

Azoxystrobin

Amistar, 3 to 5 oz every 5 - 7 days. (0 days)

or

Quadris, 6.2 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Chlorothalonil. Downy mildew suppression.

Bravo Ultrex, 0.9 - 2.7 lb every 7 to 10 days. (7 days)

Bravo Weather Stik Zn, 1.5 to 3 pt every 7 to 10 days. (7 days)

Echo 90 DF, 1.2 to 2.4 lb every 7 days. (7 days)

Echo 720, *Equus* 720 SST, 1 to 3 pt. (7 days)

or

Fenamidone

Reason 500 SC, 5.5 fl oz every 5 to 10 days. (14 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Pyraclostrobin

Cabrio, 12 oz. (7 days) Do not apply more than one application before alternating with another chemical.

or

Pyraclostrobin/Boscalid

Pristine, 18.5 oz. (7 days)

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Prophyt, 4 pt. (0 days)

or

Mandipropamid

Revus, 8 fl oz. (7 day)

Note: Most fungicides that protect against purple blotch or Botrytis leaf blight may also provide limited downy mildew protection.

WHITE ROT (*Sclerotium cepivorum*):Tebuconazole

Folicur 3.6F, 20.5 fl oz in 4-6 inch band. 12 hr REI.

PURPLE BLOTCH (*Alternaria porri*):Tebuconazole

Folicur 3.6F, 4-6 fl oz. (7 days) Maximum 12 fl oz/acre/season. 12 hr REI.

Leeks

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Leeks are hosts for root-knot nematodes. Fields with soil or root problems of undetermined cause should be tested for nematodes (see Appendix C). Management of root-knot nematodes can be accomplished by using crop rotation. The benefits of utilizing nematicides for leeks grown in Michigan are undetermined at this time.

INSECTS

SEED TREATMENT:

None presently registered.

SOIL TREATMENT:

ONION MAGGOT: No insecticides are registered for this use.

Onion maggots are not as serious in leeks as they are in onions. Avoid planting leeks near onions that had onion maggot problems the previous year. Plant as late as is practical to reduce early-season problems.

FOLIAR TREATMENT:

CUTWORM, ARMYWORM: Apply banded over the row.

Bacillus thuringiensis

Agree, Biobit, Dipel, Javelin, Lepinox, Match, MVP II, Vault, Xentari. (0 days)

or

Mustang Max, 2.2 to 4.0 oz. (7 days) (RUP)

or

Pyrellin EC, 1 to 2 pt. (0 days)

or

Pyrenone, 2 to 12 oz. (0 days)

or

Entrust, 1 to 2 oz. (1 day) Do not apply more than 9 oz per acre per crop. Do not make more than 5 applications per year.

or

SpinTor 2 SC, 3 to 6 oz. (1 day) Do not apply more than 29 oz per acre per crop. Do not make more than 5 applications per year.

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 5 applications or exceed 30 fl oz/acre per season.

THRIPS:

Mustang Max, 1.9 to 4.0 oz. (7 days) (RUP)

or

Pyrellin EC, 1 to 2 pt. (0 days)

or

Pyrenone, 2 to 12 oz. (0 days)

or

Entrust, 1 to 2 oz. (1 day) Suppression only. Do not apply more than 9 oz per acre per crop. Do not make more than 5 applications per year.

or

SpinTor 2 SC, 4 to 8 oz. (1 day) Suppression only. Do not apply more than 29 oz per acre per crop. Do not make more than 5 applications per year.

or

Radiant SC, 6 to 10 fl oz. (1 day) Do not make more than 5 applications or exceed 30 fl oz/acre per season.

DISEASES

SOIL TREATMENT:

DAMPING OFF (*Pythium* spp.):

* **Mefenoxam.** Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate,

incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold SL, 0.5-1 pt.

Ultra Flourish, 1 to 2 pt.

GREENHOUSE PREPLANT INCORPORATION:

DAMPING OFF (*Pythium* spp.), **ROOT ROT** (*Rhizoctonia* spp.):

Gliocladium virens GL-21

SoilGard 12 G, 1 to 1.5 lb per cubic yard.

Biological control product that needs to be applied before disease development. Control may be limited under heavy disease pressure.

FOLIAR TREATMENT:

BACTERIAL BLIGHT (*Erwinia carotovora* subsp. *carotovora*, *Pseudomonas* spp.): Apply at 7 to 10 day intervals when plants are 4-6 in. tall. Can cause foliar phytotoxicity.

Copper Hydroxide

Champ DP, 2/3 to 1 lb. (0 days)

Champ Formula 2 F, 2/3 to 1 pt. (0 days)

Kocide 4.5 LF, 1 1/3 pt. (0 days)

BOTRYTIS LEAF BLIGHT (*Botrytis squamosa*), **PURPLE BLOTCH** (*Alternaria porri*): Apply every 7 to 10 days after the 4 leaf stage.

* **Azoxystrobin**

Amistar, 2 to 5 oz every 7 - 14 days. (0 days)

Quadris, 6.2 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* **Chlorothalonil**

Bravo Ultrex, 1.4 to 2.7 lb every 7 - 10 days. (14 days)

Bravo Weather Stik Zn, 1.5 to 3 pt. (14 days)

Echo 90 DF, 1.2 to 2.4 lb. (14 days)

or

Echo 720, *Equus* 720 SST, 1.5 to 3 pt every 7-10 days. (14 days)

or

* **Pyraclostrobin**

Cabrio, 8-12 oz. (7 days) Do not apply more than three sequential applications

or

* **Pyraclostrobin/Boscalid**

Pristine, 14.5 to 18.5 oz for *Botrytis*, 10.5 to 18.5 oz for *Alternaria*. (7 days)

or

Boscalid

Endura, 6.8 oz. (7 days)

or

Fenamidone

Reason 500 SC, 5.5 fl oz every 5 to 10 days. (7 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Pyrimethanil

Scala, 9 to 18 fl oz. (7 days)

or

Propiconazole

Propimax EC, 4 fl oz. (14 days)

or

Tilt, 4-8 fl oz. (14 days)

DOWNY MILDEW (*Peronospora destructor*): Apply every 7 to 10 days after the 4 leaf stage.

* Dimethomorph

Acrobat 50 WP, 6.4 oz. (0 days)

Forum, 6 fl oz. (0 days)

or

* Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 2 lb. (21 days) Maximum 3 applications.

or

* Mefenoxam/Copper Hydroxide

Ridomil Gold Copper, 2 lb. (7 days) Maximum 3 applications.

or

Azoxystrobin

Amistar, 3 to 5 oz every 5 - 7 days. (0 days)

Quadris, 9.2 to 15.4 fl oz every 5 to 7 days. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Azoxystrobin/Chlorothalonil

Quadris Opti, 2.4 - 3.7 pt every 7 - 14 days. (14 days)

or

Chlorothalonil. Downy mildew suppression.

Bravo Ultrex, 1.4 to 2.7 lb every 7 - 10 days. (14 days)

Echo 720, Equus 720 SST, 1.5 to 3 pt every 7 days. (14 days)

Bravo Weather Stik Zn, 1.5 to 3 pt every 7 to 10 days. (14 days)

Echo 90 DF, 1.2 to 2.4 lb every 7 days. (14 days)

or

Fenamidone

Reason 500 SC, 5.5 fl oz every 5 to 10 days. (7 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Pyraclostrobin

Cabrio, 12 oz. (7 days) Do not apply more than application before alternating with another chemical.

or

Pyraclostrobin/Boscalid

Pristine, 18.5 oz. (7 days)

or

Mandipropamid

Revus, 8 fl oz. (7 day)

Note: Most fungicides that protect against purple blotch or Botrytis leaf blight may also provide limited downy mildew protection.

Lettuce

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Root-knot and root-lesion can reduce lettuce yields. Fields with soil or root problems of undetermined cause should be tested for nematodes (see Appendix C). If the plant-parasitic nematodes are present in population densities above the economic threshold for lettuce, crop rotation or application of a nematicide is recommended. The following nematicides are suitable for control of root-knot and root-lesion nematodes in lettuce production.

FALL SOIL FUMIGATION (BROADCAST):

Fumigate in the fall when soil temperatures at a 6 inch depth are above 50F. Inject the fumigant to a soil depth of 8 inches and lightly seal the soil immediately after application. Use soil fumigants only as directed on the label. In some limited situations, soil fumigants can be applied in the spring in Michigan.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

1,3-D

Telone II, 25 gal/A (muck soil), 9-18 gal/A (mineral soil).

or

Metam Sodium

Vapam HL, 37.5 to 75 gal/A. Use higher rate for muck soil injected with shanks spaced 5 inches apart or to a depth of 4 to 10 inches in well prepared soil. Follow immediately with a roller to smooth and compact surface. Light watering to the treated surface helps to prevent escape of gas.

INSECTS

PLANTING TREATMENT:

APHIDS:

Venom, 5 to 6 oz. (21 days) See label for application methods.

APHIDS, LEAF MINERS, LEAFHOPPER, FLEA BEETLE:

Platinum, 5 to 11 oz. (30 days) See label for application methods.

FOLIAR TREATMENT:

CUTWORM, ARMYWORM: Apply when damage is first seen and repeat as needed.

* Cypermethrin

Ammo 2.5 EC (2.5 to 5 oz) or Ammo WSB (1 to 2 bags) or UP-Cyde 2.5 EC (2.5 to 5 oz) (5 days) Head lettuce only. (RUP)

or

* Baythroid XL, 2.4 to 3.2 fl oz. (0 days) (RUP)

or

* Mustang Max, 3.2 to 4.0 oz. (5 days) (RUP)

Lettuce

or

* Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz)
or *Pounce* 3.2 EC (4 to 8 oz) (1 day) (RUP)

or

* *Warrior* with Zeon Technology, 1.3 to 3.8 fl oz. (5 days) (RUP)

or

Lannate LV (1 1/2 pt) or *Lannate* SP (1/2 lb) (7 days) (RUP)

or

SpinTor 2 SC, 4 to 8 oz. (1 day) Do not apply more than 3 times
in 21 days.

or

Entrust, 1.3 to 2.5 oz. (1 day)

or

Lambda-cyhalothrin

Lambda-Cy, Proaxis, 2.6 to 3.8 fl oz. (1 day) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) Head lettuce only. (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6
applications or exceed 34 fl oz/acre per season.

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (7 days) Head lettuce only. (RUP)

or

Brigadier, 5.1 to 6.1 oz. (7 days) Head lettuce only.

ASTER LEAFHOPPERS:

* Cypermethrin

Ammo 2.5 EC (2.5 to 5 oz) or *Ammo* WSB (1 to 2 bags) or
UP-Cyde 2.5 EC (2.5 to 5 oz) (5 days) Head lettuce only. (RUP)

or

* *Mustang* Max, 2.2 to 4.0 oz. (5 days) Head lettuce only. (RUP)

or

* Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz)
or *Pounce* 3.2 EC (4 to 8 oz) (1 day) (RUP)

or

* *Warrior* with Zeon Technology, 1.3 to 3.8 fl oz. (1 day)

Head lettuce only. (RUP)

or

Acephate. Crisphead type only.

Acephate 97 UP, *Orthene* 97, 1/2 to 1 lb. (21 days) Do not
apply more than 2-1/8 lb per season.

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin* XLR Plus (1 to 2 qt) (14 days)

or

Dimethoate 4 EC, 1/2 pt. (7 days for head lettuce; 14 days for leaf
lettuce)

or

Endosulfan 3 EC, 2 pt. (14 days) Consult label for number of
applications and other limitations.

or

Lannate LV (1 1/2 pt (7 days) to 3 pt (10 days)) or *Lannate*
SP (1/2 lb (7 days) to 1 lb (10 days)) (RUP)

or

Malathion 57 EC, 2 pt (7 days for head lettuce; 14 days for leaf
lettuce)

or

Venom, 1 to 3 oz. (7 days)

or

Lambda-cyhalothrin

Lambda-Cy, Proaxis, 2.6 to 3.8 fl oz. (1 day) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) Head lettuce only. (RUP)

or

Actara, 1.5 to 3 oz. (7 days) Do not exceed 11.0 oz/Acre per
season. Do not exceed 11.0 oz/Acre per season.

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (7 days) Head lettuce only. (RUP)

or

Brigadier, 3.8 to 6.1 oz. (7 days) Head lettuce only.

APHIDS:

* *Assail* 30 SG, 1.9 to 2.8 oz. (7 days)

or

* *Fulfill*, 2.75 oz. (7 days) Do not exceed 5.5 oz/acre per season.
May require 5 to 7 days for aphid mortality.

or

* Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.75 fl oz. (7 days) Do not use if
Imidacloprid was used at planting. Do not exceed 19.2 oz/Acre
per season.

or

Acephate. Crisphead only.

Acephate 97 UP, *Orthene* 97, 1/2 to 1 lb. (21 days) Do not
apply more than 2-1/8 lb per season.

or

Diazinon 50 WP (1 lb) or *Diazinon* AG 500 (1 pt) (14 days) (RUP)

or

Dimethoate 2.67 EC, 3/4 pt. (14 days) Leaf lettuce only.

or

Endosulfan 3 EC, 2 pt. (14 days) Consult label for number of
applications and other limitations.

or

Lannate LV (1 1/2 pt (7 days) to 3 pt (10 days)) or *Lannate*
SP (1/2 lb (7 days) to 1 lb (10 days)) (RUP)

or

Malathion 57 EC, 2 pt. (7 days for head lettuce; 14 days for leaf
lettuce)

or

Pyrenone, 2 to 12 oz. (0 days)

or

Venom, 1 to 3 oz. (7 days)

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Actara, 1.5 to 3 oz. (7 days) Do not exceed 11.0 oz/acre per
season.

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (7 days) Head lettuce only. (RUP)

or

Brigadier, 3.8 to 6.1 oz. (7 days) Head lettuce only.

TARNISHED PLANT BUG:

* Cypermethrin

Ammo 2.5 EC, *UP-Cyde* 2.5 EC, 2.5 to 5 oz. (5 days) Head lettuce only. (RUP)

or

* *Baythroid* XL, 2.4 to 3.2 fl oz. (0 days) (RUP)

or

* *Mustang* Max, 3.2 to 4.0 oz. (5 days) (RUP)

or

* *Warrior* with Zeon Technology, 1.3 to 3.8 fl oz. (1 day) Head lettuce only. (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 to 2 1/2 lb) or *Sevin* XLR Plus (1 to 2 qt) (14 days)

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Hero, 10.3 oz. (7 days) Head lettuce only. (RUP)

or

Bifenthrin

Bifenture EC, 5.1 to 6.4 oz. (7 days) Head lettuce only. (RUP)

or

Brigadier, 3.8 to 6.1 oz. (7 days) Head lettuce only.

CATERPILLARS: Caterpillars (mainly cabbage loopers), are usually controlled with aster leafhopper program, but damage potential may require additional treatments.

* Cypermethrin

Ammo 2.5 EC (2.5 to 5 oz) or *Ammo* WSB (1 to 2 bags) or *UP-Cyde* 2.5 EC (2.5 to 5 oz) (5 days) Head lettuce only. (RUP)

or

* *Baythroid* XL, 1.6 to 2.4 fl oz. (0 days) (RUP)

or

* Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz) or *Pounce* 3.2 EC (4 to 8 oz) (1 day) (RUP)

or

Acephate. Crisphead type only.

Acephate 97 UP, *Orthene* 97, 1 lb. (21 days) Do not apply more than 2-1/8 lb per season.

or

Avaunt, 2.5 to 3.5 oz. (3 days)

or

Bacillus thuringiensis

Agree, *Biobit*, *Dipel*, *Javelin*, *Lepinox*. (0 days)

or

Carbaryl

Sevin 80 S (1 1/4 to 2 1/2 lb) or *Sevin* XLR Plus (1 to 2 qt) (14 days)

or

Endosulfan 3 EC, 2 pt. (14 days) Consult label for numbers of applications and other restrictions.

or

Lannate LV (1 1/2 pt (7 days) to 3 pt (10 days)) or *Lannate* SP (1/2 lb (7 days) to 1 lb (10 days)) (7 days) (RUP)

or

Thiodicarb

Larvin 3.2 EC, 16 to 30 oz. (14 days)

or

Proclaim, 3.2 to 4.8 oz. (7 days) Head Lettuce only. (RUP)

or

Entrust, 1 to 2 oz. (1 day)

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or

Hero, 4 to 10.3 oz. (7 days) Head lettuce only. (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (7 days) Head lettuce only. (RUP)

or

Brigadier, 5.1 to 6.1 oz. (7 days) Head lettuce only.

VEGETABLE LEAFMINER: Apply as soon as visible mines appear and repeat every 7 days as needed.

Agri-Mek 0.15 EC, 8 to 16 fl oz. (7 days) (RUP)

or

SpinTor 2 SC, 6 to 10 oz. (1 day) Do not apply more than 3 times in 21 days.

or

Trigard 75 WP, 1/6 lb. (7 days)

or

Venom, 1 to 3 oz. (7 days)

or

Entrust, 2 to 3 oz. (1 day)

or

Radiant SC, 6 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.**SLUGS**

Deadline M-Ps 4% (20 to 40 lb) or *Metaldehyde* 3.5 G (30 to 40 lb) Apply between rows. Avoid contact to edible product.

DISEASES**SEED TREATMENT:**

DAMPING OFF (*Rhizoctonia* spp., *Pythium* spp. *Botrytis* spp.):

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only.

or

Thiram

42-S *Thiram*, *Thiram* 50 WP Dyed, 8 oz/100 lb seed.

SEEDBED TREATMENT:

DAMPING OFF SEED and CROWN ROTTS (*Rhizoctonia* spp., *Pythium* spp., *Botrytis* spp., *Sclerotinia sclerotiorum*):

Note: For seedbed protection programs, sterilize seedbed with steam or Chemicals (see Appendix A). Follow recommended procedures carefully.

Melons

PLANTING TREATMENT:

PYTHIUM DAMPING OFF:

Mefenoxam. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold GR, 20 to 40 lb.

Ridomil Gold WSP, 1 to 2 lb.

Ultra Flourish, 2-4 pt.

FOLIAR TREATMENT:

DROP (*Sclerotinia sclerotiorum* or *Sclerotinia minor*):

Boscalid

Endura, 8 to 11 oz. (14 days)

or

DCNA

Botran 75 W, 2 to 3 1/3 lb. (14 days) Apply at 2 lb preemergence in a 4- to 6-inch band over the transplanted or seeded row. Make a second application of 3 1/3 lb immediately after thinning. Do not use more than 5 1/3 lb per acre per season. For a single application, apply 5 1/3 lb immediately after thinning.

or

Iprodione

Rovral 4 F, 1 1/2 to 2 pt. (14 days) Apply at 3-leaf stage to just after thinning and again in 10 days. Make a third application 10 days later if conditions for disease remain favorable.

Note: See label for permissible crop rotations.

BOTTOM ROT (*Rhizoctonia solani*):

Boscalid

Endura, 8 to 11 oz (bottom rot suppression). (14 days)

or

Iprodione

Rovral 4 F, 1 1/2 to 2 pt. (14 days) Apply at 3-leaf stage to just after thinning and again in 10 days. Make a third application 10 days later if conditions for disease remain favorable.

Note: See label for permissible crop rotations.

DOWNY MILDEW (*Bremia lactucae*):

* Dimethomorph

Acrobat 50 WP, 6.4 oz. (0 days)

Forum, 6 fl oz. (0 days)

or

* Famoxadone/Cymoxanil

Tanos, 8 oz. (3 days) Head Lettuce only.

or

* Fluopicolide

Presidio, 3-4 fl oz. (2 days)

or

* Fosetyl-Aluminum

Aliette WDG, 2 to 5 lb at 7- to 21-day intervals. (3 days) Do not make more than 7 applications per season. Do not tank mix with copper fungicides.

or

* Mefenoxam

Ridomil Gold SL, 0.125-0.25 pt. (7 days)

or

Azoxystrobin

Amistar, 4 to 5 oz every 7 - 14 days. (0 days)

Quadris, 12.3 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Copper Hydroxide

Champ Formula 2 F, 2/3 to 1 1/3 pt. (0 days)

Champion WP, *Kocide DF*, *Nu-Cop 50 DF*, 1 to 2 lb. (0 days)

Nu-Cop 3 L, 2/3 to 2 2/3 pt. (0 days)

or

Fenamidone

Reason 500 SC, 5.5 to 8.2 fl oz every 5 to 10 days. (2 days)

or

Maneb

Maneb 75 DF, *Maneb 80 WP*, 1 1/2 to 2 lb. (10 days)

Do not apply more than 9.6 qt per season

or

Manex 4 F, 1 1/5 to 1 3/5 qt. (10 days)

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 2.5 to 5 pt every 7 - 21 days. (0 days)

Prophyt, 2 to 4 pt. (0 days)

or

Propamocarb

Previcur Flex, 2 pt every 5 to 10 days. (2 days)

or

Cymoxanil

Curzate 60 DF, 3.2 to 5 oz. (30 days) Do not apply more than 30 oz/acre/season.

or

Mandipropamid

Revus, 8 fl oz. (1 day)

Melons

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Muskmelons and watermelons are hosts for root-knot and lesion nematodes. These nematodes can reduce melon yields but yield losses in Michigan have not been documented. If you suspect nematodes are reducing melon yields collect root and soil samples for analyses as described in Appendix C. If the numbers of nematodes recovered from those samples exceed damage thresholds; control options will be suggested. Vydate 2L is labeled for use in melons.

INSECTS**SEED TREATMENT:**

If possible, buy treated seed.

SEED CORN MAGGOT: There is no chemical control currently available.

SOIL TREATMENT:

CUCUMBER BEETLE, APHIDS, THRIPS: Apply to soil in a narrow band 14 or less days before planting, as an in-furrow spray at planting, as a post-seeding drench, as a sidedress after plants are established or in drip or trickle irrigation water. Do not make more than 1 application per year.

* Imidacloprid

Admire Pro, 7.0 - 10.5 fl oz. (21 days)

Nuprid 2 F, 16 to 24 oz. (21 days)

CUCUMBER BEETLE: Apply in areas with high beetle populations.

* *Furadan 4 F*, 2.4 oz/1000 ft of row. Apply at planting or transplanting in a 7-inch band, incorporated into the top 3 inches of soil, or apply into the furrow and mix with the covering soil. (Special Michigan SLN registration.) (RUP)

APHIDS, FLEA BEETLE, CUCUMBER BEETLE, LEAFHOPPER, THRIPS:

Platinum, 5 to 11 oz. (30 days) See label for application methods.

APHIDS, THRIPS:

Venom, 5 to 6 oz. (21 days) See label for application methods.

FOLIAR TREATMENT:

Melon plants may be sensitive to certain insecticide formulations. Make certain a problem exists before treatment. Read and observe restrictions on the label. To avoid killing bees, do not treat melons during bloom.

CUTWORM: Apply if >1% of plants are injured.

* *Asana XL*, 5.8 to 9.6 oz. (3 days) (RUP)

or

* *Baythroid XL*, 0.8 to 1.6 fl oz. (0 days) (RUP)

or

* Bifenthrin (RUP)

Bifenture EC, *Brigade 2EC*, *Capture 2 EC*, 6.4 oz. (3 days)

or

* Permethrin

Ambush 25 W, 12.8 oz. (0 days) (RUP)

or

Perm-UP 3.2 EC (8 oz) or *Pounce 25 WP* (12.8 oz) or *Pounce 3.2 EC* (8 oz) (0 days) (RUP)

or

Lannate LV (1 1/2 pt (1 day) or 3 pt (3 days)) or *Lannate SP* (1/2 lb (1 day) or 1 lb (3 days)) (1 day) (RUP)

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

STRIPED and SPOTTED CUCUMBER BEETLE: Apply if numbers exceed 0.1 to 1/plant. Repeat as needed. Use preplant Furadan treatment in fields with severe problems.

Asana XL, 5.8 to 9.6 oz. (3 days) (RUP)

or

Baythroid XL, 2.4 to 2.8 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin XLR Plus* (1 qt) (3 days)

or

Bifenthrin

Bifenture EC, *Brigade 2EC*, *Capture 2 EC*, 2.6 to 6.4 oz. (3 days) (RUP)

or

Endosulfan 3 EC, 2 pt. (2 days)

or

Lannate LV (1 1/2 pt (1 day) or 3 pt (3 days)) or *Lannate SP* (1/2 lb (1 day) or 1 lb (3 days)) (RUP)

or

Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (0 days) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce 25 WP* (6.4 to 12.8 oz) or *Pounce 3.2 EC* (4 to 8 oz) (0 days) (RUP)

or

Danitol 2.4 EC, 10 2/3 to 16 fl oz. (7 days) (RUP)

or

Venom, 3 to 4 oz. (1 day)

or

Actara, 3 to 5.5 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

or

Assail 30 SG, 2.5 to 5.3 oz. (0 days)

FLEA BEETLE: Apply if needed.

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin XLR Plus* (1 qt) (3 days)

or

Endosulfan 3 EC, 2 pt. (2 days)

or

Lannate LV (1 1/2 pt (1 day) or 3 pt (3 days)) or *Lannate SP* (1/2 lb (1 day) or 1 lb (3 days)) (RUP)

or

Actara, 1.5 to 3 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

LEAFHOPPERS: Apply if insects and damage are present.

* *Asana XL*, 5.8 to 9.6 oz. (3 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin XLR Plus* (1 qt) (3 days)

or

Bifenthrin

Bifenture EC, *Brigade 2EC*, *Capture 2 EC*, 2.6 to 6.4 oz. (3 days) (RUP)

or

Diazinon 50 WP (1 lb) or *Diazinon AG 500* (1 pt) (3 days) (RUP)

or

Dibrom 8 EC, 1 pt. (1 day)

or

Melons

Dimethoate 2.67 EC, 3/4 to 1 1/2 pt. (3 days)

or

Venom, 1 to 4 oz. (1 day)

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

APHIDS:

Dimethoate 2.67 EC, 3/4 to 1 1/2 pt. (3 days)

or

Diazinon 50 WP (1 lb) or *Diazinon* AG 500 (1 pt) (3 days) (RUP)

or

Fulfill, 2.75 oz. (0 days) Do not exceed 5.5 oz/acre per season.

May require 5 to 7 days for aphid mortality.

or

Lannate LV (1 1/2 pt (1 day) or 3 pt (3 days)) or *Lannate* SP (1/2

lb (1 day) or 1 lb (3 days)) (RUP)

or

Malathion 57 EC, 1 1/2 pt. (1 day)

or

Venom, 1 to 4 oz. (1 day)

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Actara, 1.5 to 3 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Assail 30 SG, 2.5 to 4 oz. (0 days)

THRIPS: Apply when damage is seen. Repeat as needed.

Diazinon 50 WP (1 lb) or *Diazinon* AG 500 (1 pt) (3 days) (RUP)

or

SpinTor 2 SC, 6 to 8 oz. (3 days)

or

Venom, 1 to 4 oz. (1 day)

or

Entrust, 2 to 2.5 oz. (3 days)

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

SQUASH BUG:

Venom, 3 to 4 oz. (1 day)

MITES

Apply when needed. Watermelons are particularly susceptible.

Usually a problem only in hot, dry weather.

Agri-Mek 0.15 EC, 8 to 16 fl oz. (7 days) (RUP)

or

Kelthane 35, 1 to 1 1/2 lb. (2 days)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 5.1 to 6.4 oz. (3 days) (RUP)

or

Danitol 2.4 EC, 10 2/3 fl oz. (7 days) (RUP)

or

Diazinon 50 WP (1 lb) or *Diazinon* AG 500 (1 pt) (3 days) (RUP)

or

Dibrom 8 EC, 1 pt. (1 day)

or

Oberon 2 SC, 7 to 8.5 fl oz. (7 days)

or

Zeal, 2 to 3 oz. (7 days)

SLUGS

Deadline M-Ps 4% (20 to 40 lb) or *Metaldehyde* 3.5 G (30 to 40

lb) Apply between rows. Avoid contact with edible product.

DISEASES

SEED TREATMENT:

DAMPING OFF (*Pythium* spp., *Rhizoctonia solani*): If possible, buy treated seed. Use only as directed; over-treatment may cause injury.

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Captan

Captan 300, *Captan* 30-DD, 1 2/3 fl oz/100 lb seed.

Captan 400, 1 1/2 to 2 fl oz/100 lb seed.

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only.

or

Thiram

42-S Thiram, *Thiram* 50 WP Dyed, 4 1/2 oz/100 lb seed.

SEEDBED PREPARATION:

DAMPING OFF, ROOT ROT (*Pythium* spp., *Rhizoctonia solani*):

Grow transplants in disease-free soil (sterilized) and fumigate fields before planting. To sterilize soil use steam or fumigate with Chemicals suggested for seedbed sterilization in Appendix A. Follow manufacturer's recommendations for use with particular crops. Avoid planting until soil is free of fumigant.

PREPLANT SOIL FUMIGATION:

DAMPING OFF, ROOT ROTTS (*Phytophthora* spp., *Pythium* spp., *Rhizoctonia solani*), **FUSARIUM WILT or ROOT ROT** (*Fusarium oxysporum*): See bulletin E-2099. This protects plants grown from seed or transplanted in the field.

Soil sterilization by fumigation is best achieved by proper application of material. Correct soil moisture, temperature, and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or immediate tarping.

1,3 Dichloropropene/chloropicrin

Telone C35, 13-136 gal. (RUP)

or

Metam Sodium

Sectagon 42, *Vapam* HL, 37.5-75 gal.

or

Potassium N-methylidithiocarbamate

Sectagon-K54, 30-60 gal.

GREENHOUSE PREPLANT INCORPORATION:

DAMPING OFF (*Pythium* spp.), **ROOT ROT** (*Rhizoctonia* spp.):
Gliocladium virens GL-21

SoilGard 12 G, 1 to 1.5 lb per cubic yard. Biological control product that needs to be applied before disease development. Control may be limited under heavy disease pressure.

PREPLANT TREATMENT:

DAMPING OFF and COTTONY LEAK (*Pythium* spp.):

* Mefenoxam. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold SL, 1-2 pt.

Ultra Flourish, 2 to 4 pt.

FOLIAR TREATMENT:

POWDERY MILDEW (*Sphaerotheca fuliginea*, *Erysiphe cichoracearum*):

* Myclobutanil

Rally 40 WSP, 2.5 to 5 oz, 7 to 10 day schedule.. (0 days) Do not apply more than 1.5 lbs per acre per crop.

or

* Pyraclostrobin

Cabrio, 12-16 oz. (0 days) Alternate one-to-one with fungicides having a different mode of action.

or

* Pyraclostrobin/Boscalid

Pristine, 12.5 to 18.5 oz. (0 days) To avoid crop injury, do not add adjuvants.

or

* Thiophanate-Methyl

Topsin M 70 WP, *Topsin* M WSB, 1/4 to 1/2 lb. (0 days) Apply at 7 to 14 day intervals after disease appears.

or

* Trifloxystrobin

Flint, 1 1/2 to 2 oz, 7- to 14-day intervals. (0 days) Maximum 2 consecutive applications, 4 applications/year and 16 oz/season.

or

* Quinoxifen

Quintec, 4 to 6 fl oz, 10- to 14-day intervals. (3 days)

or

Azoxystrobin

Amistar, 3.5 to 5 oz. (1 day)

Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

Bacillus subtilis

Serenade, 6 to 8 lb every 7 days. (0 days) Biological control product that needs to be applied before disease development. Control will be limited under heavy disease pressure.

or
Serenade Max, 1 - 3 lb every 7 to 10 days. (0 days)

or

Chlorothalonil

Bravo Ultrex, *Equus* DF, 1.8 to 2.7 lb. (0 days)

Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or

Bravo Weather Stik, or *Echo* 720 (2 to 3 pt, 7-day intervals)

or *Equus* 720 SST (2 to 3 pt every 7 days) (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 1 to 2 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, *Kocide* 4.5 LF, 1 1/3 pt. (0 days)

Champion WP, 1.5 to 3 lb. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 to 4 pt, 5- to 10-day intervals. (0 days)

or

Copper Sulfate

Cuprofix Ultra, 1.25 lb. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Sulfur

Kumulus DF, 20 to 25 lb. Do not use on sulfur-sensitive varieties. (0 days)

or

Microthiol Disperss, 5 to 10 lb. (0 days)

Thiolux Jet, 6 to 15 lb. (0 days)

or

Triflumizole

Procure 480 SC, 4 to 8 fl oz every 7-14 days. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

or

Tebuconazole

Folicur 3.6F, 4-6 fl oz. (7 days) 12 hr REI.

ALTERNARIA LEAF BLIGHT (*Alternaria cucumerin*):

* Azoxystrobin

Amistar, 3.5 to 5 oz. (1 day)

Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

* Chlorothalonil

Bravo Ultrex, *Equus* DF, 1.8 to 2.7 lb. (0 days)

Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or

Bravo Weather Stik, *Echo* 720, *Equus* 720 SST, 2 to 3 pt. (0 days)

or

Melons

* Mancozeb

Dithane DF Rainshield, *Dithane* M-45, *Dithane* WSP, 2 to 3 lb. (5 days)

or

Dithane F-45 Rainshield, 1 3/5 to 2 2/5 qt. (5 days)

Manzate 75 DF, 2 to 3 lb. (5 days)

Penncozeb 4 F, 1.2 to 2.4 qt. (5 days)

Penncozeb 75 DF, *Penncozeb* 80 WP, 2 to 3 lb. (5 days)

or

* Maneb

Maneb 75 DF, *Maneb* 80 WP, 1 to 2 lb. (5 days)

Manex, 1 1/5 to 1 3/5 qt. (5 days)

or

* Pyraclostrobin

Cabrio, 12-16 oz. (0 days) No more than 2 consecutive applications before alternating with a fungicide having a different mode of action.

or

* Pyraclostrobin/Boscalid

Pristine, 12.5 to 18.5 oz. (0 days) To avoid crop injury, do not add adjuvants.

or

Copper Ammonium Carbonate

Copper Count N, 1 to 2 qt. (0 days)

or

Mancozeb/Copper Hydroxide

ManKocide, 2.5 lb. (5 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, *Kocide* 4.5 LF, 1 1/3 pt. (0 days)

Champion WP, 1.5 to 3 lb. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 to 4 pt. (0 days)

or

Copper Sulfate

Cuprofix Ultra, 1.25 lb. (0 days)

or

Mancozeb/Copper Sulfate

Cuprofix MZ Disperss, 5 - 7.25 lb. (5 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

SCAB (*Cladosporium cucumerinum*): Treat every 7 days beginning after the plants have flowered.

* Chlorothalonil

Bravo Ultrex, *Equus* DF, 1.8 to 2.7 lb. (0 days)

Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or

Bravo Weather Stik, *Echo* 720, *Equus* 720 SST, 2 to 3 pt. (0 days)

or

* Mancozeb

Dithane DF Rainshield (2 to 3 lb (watermelon)) or *Dithane* M-45 (2 to 3 lb (watermelon)) or *Dithane* WSP (2 to 3 lb (watermelon)) (5 days)

or

Dithane F-45 Rainshield, 1.6 to 2.4 qt (watermelon). (5 days)

Manex II, 1.6 to 2.4 qt every 7 to 10 days. (5 days)

or

Copper Ammonium Carbonate

Copper Count N, 2 to 3 qt. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

ANTHRACNOSE (*Colletotrichum lagenarium*): Treat every 7 to 14 days after flowering.

* Azoxystrobin

Amistar, 3.5 to 5 oz. (1 day)

Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

* Chlorothalonil

Bravo Ultrex, *Equus* DF, 1.4 to 1.8 lb. (0 days)

Echo 90 DF, 1.3 to 1.6 lb every 7 days. (0 days)

or

Bravo Weather Stik, *Echo* 720, *Equus* 720 SST, 1.5 to 2 pt. (0 days)

or

* Mancozeb

Dithane DF Rainshield, *Dithane* M-45, *Dithane* WSP, 2 to 3 lb. (5 days)

or

Dithane F-45 Rainshield, 1 3/5 to 2 2/5 qt. (5 days)

Manzate 75 DF, 2 to 3 lb. (5 days)

Penncozeb 4 F, 1.2 to 2.4 qt. (5 days)

Penncozeb 75 DF, *Penncozeb* 80 WP, 2 to 3 lb. (5 days)

or

* Maneb

Maneb 75 DF, *Maneb* 80 WP, 1 to 2 lb. (5 days)

Manex, 1 1/5 to 1 3/5 qt. (5 days)

or

* Pyraclostrobin

Cabrio, 12-16 oz. (0 days) No more than 2 consecutive applications before alternating with a fungicide having a different mode of action.

or

* Pyraclostrobin/Boscalid

Pristine, 18.5 oz. (0 days) To avoid crop injury, do not add adjuvants.

or

* Thiophanate-Methyl

Topsin M 70 WP, Topsin M WSB, 4 to 8 oz. (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 1 to 2 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, 1 1/3 pt. (0 days)

or

Champion WP (1.5 to 3 lb) or Kocide DF (2 lb) (0 days) Watermelon.

or

Kocide 2000, 1 1/2 lb. (0 days)

Kocide 4.5 LF, 1 1/3 pt. (0 days) Watermelon.

Nu-Cop 3 L, 1 to 4 pt. (0 days)

or

Mancozeb/Copper Hydroxide

ManKocide, 2.5 lb. (5 days)

or

Copper Oxychloride / Copper Sulfate

C-O-C-S WDG, 2 to 4 lb every 7 days. (0 days)

or

Copper Sulfate

Basic Copper 53, Basicop, 2 lb. (0 days)

Cuprofix Ultra, 1.25 lb. (0 days)

or

Mancozeb/Copper Sulfate

Cuprofix MZ Disperss, 5 - 7.25 lb. (5 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

ANGULAR LEAF SPOT (*Pseudomonas lachrymans*): Copper may be used for control of this bacterial disease. Spray every 7 days, starting before the first fruit form and continue to protect fruit at all stages of development.

Copper Ammonium Carbonate

Copper Count N, 1 to 2 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, Kocide 4.5 LF, 1 1/3 pt. (0 days)

Champion WP, 1.5 to 3 lb. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 to 4 pt. (0 days)

or

Copper Sulfate

Basic Copper 53, Basicop, 2 lb. (0 days)

Cuprofix Ultra, 1.25 lb. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

DOWNY MILDEW (*Pseudoperonospora cubensis*): Treat plants when in the 2-leaf stage and continue at 7-14 day intervals.

* Propamocarb

Previcur Flex, 1.2 pt every 7 - 14 days. (2 days)

or

* Chlorothalonil

Bravo Ultrex, Equus DF, 1.8 to 2.7 lb. (0 days)

Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or

Bravo Weather Stik, Echo 720, Equus 720 SST, 2 to 3 pt. (0 days)

or

* Cyazofamid

Ranman, 2.1 to 2.75 fl oz every 7 to 10 days. (0 days)

or

* Cymoxanil

Curzate 60 DF, 3.2 oz every 5 - 7 days. (3 days)

or

* Fluopicolide

Presidio, 3-4 fl oz. (2 days)

or

* Mancozeb

Dithane DF Rainshield, Dithane M-45, Dithane WSP, 2 to 3 lb. (5 days)

or

Dithane F-45 Rainshield, 1 3/5 to 2 2/5 qt. (5 days)

Manzate 75 DF, 2 to 3 lb. (5 days)

Penncozeb 4 F, 1.2 to 2.4 qt. (5 days)

Penncozeb 75 DF, Penncozeb 80 WP, 2 to 3 lb. (5 days)

or

* Famoxadone/Cymoxanil

Tanos, 8 oz. (3 days)

or

* Mancozeb/Zoxamide

Gavel 75 DF, 1.5-2.0 lb. (5 days)

or

* Propamocarb

Previcur Flex, 1.2 pt every 7 - 14 days. (2 days)

or

Azoxystrobin

Amistar, 3.5 to 5 oz. (1 day)

Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

Dimethomorph

Acrobat 50 WP, 6.4 oz every 5 to 7 days. (0 days)

Forum, 6 fl oz. (0 days)

or

Fenamidone

Reason 500 SC, 5.5 fl oz every 5 to 10 days. (14 days)

or

Fosetyl-Aluminum

Aliette WDG, 2 to 5 lb, 7- to 14-day intervals. (0 days) Do not tank mix with copper fungicides.

Melons

or

Mancozeb/Copper Sulfate

Cuprofix MZ Disperss, 5 - 7.25 lb. (5 days)

or

Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 2 lb. (0 days) Maximum 4 applications.

or

Mefenoxam/Copper Hydroxide

Ridomil Gold Copper, 2 lb. (7 days) Maximum 4 applications.

or

Mefenoxam/Mancozeb

Ridomil Gold MZ, 2 1/2 lb. (5 days) Maximum 4 applications.

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 2.5 to 5 pt every 7 - 14 days. (0 days)

Prophyt, 2 to 4 pt. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Pyraclostrobin/Boscalid

Pristine, 12.5 to 18.5 oz. (0 days) To avoid crop injury, avoid adding adjuvants.

or

Trifloxystrobin

Flint, 4 oz, 7- to 14-day intervals. (0 days) Maximum 2 consecutive applications, 4 applications/year and 16 oz/season. Alternate with Ridomil Gold Bravo.

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

or

Maneb

Maneb 75 DF, *Maneb* 80 WP, 1 to 2 lb. (5 days)

Manex, 1 1/5 to 1 3/5 qt. (5 days)

or

Mono-, dibasic sodium salts of phosphorous acid

Fosphite, 1 to 3 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)

or

Mandipropamid

Revus, 8 fl oz. (0 day)

Note: Most fungicides that protect against *Alternaria* may also provide limited downy mildew protection.

GUMMY STEM BLIGHT or BLACK ROT (*Didymella bryoniae* also called *Mycosphaerella melonis*): Begin at the 2-leaf stage and apply every 7 days.

* Azoxystrobin

Amistar, 3.5 to 5 oz. (1 day)

Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (0 days)

or

* Chlorothalonil

Bravo Ultrex (1.8 to 2.6 lb) or *Equus* DF (1.8 to 2.7 lb) (0 days)

Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or

Bravo Weather Stik, *Echo* 720, *Equus* 720 SST, 2 to 3 pt. (0 days)

or

* Mancozeb

Dithane DF Rainshield, *Dithane* M-45, *Dithane* WSP, 2 to 3 lb. (5 days)

or

Dithane F-45 Rainshield, 1 3/5 to 2 2/5 qt. (5 days)

Manzate 75 DF, 2 to 3 lb. (5 days)

Penncozeb 4 F, 1.2 to 2.4 qt. (5 days)

Penncozeb 75 DF, *Penncozeb* 80 WP, 2 to 3 lb. (5 days)

or

* Maneb

Maneb 75 DF, *Maneb* 80 WP, 1 to 2 lb. (5 days)

Manex, 1 1/5 to 1 3/5 qt. (5 days)

or

* Pyraclostrobin

Cabrio, 12-16 oz. (0 days) No more than 2 consecutive applications before alternating with a fungicide having a different mode of action.

or

* Thiophanate-Methyl

Topsin M 70 WP, *Topsin* M WSB, 1/4 to 1/2 lb. (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 1 to 2 qt. (0 days)

or

Mancozeb/Copper Hydroxide

ManKocide, 2.5 lb. (5 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, *Kocide* 4.5 LF, 1 1/3 pt. (0 days)

Champion WP, 1.5 to 3 lb. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 to 4 pt. (0 days)

or

Copper Sulfate

Cuprofix Ultra, 1.25 lb. (0 days)

or

Mancozeb/Copper Sulfate

Cuprofix MZ Disperss, 5 - 7.25 lb. (7 days)

or

Pyraclostrobin/Boscalid

Pristine, 12.5 to 18.5 oz. (0 days) To avoid crop injury, avoid adding adjuvants.

or

Tebuconazole

Folicur 3.6F, 8 fl oz. (7 days) Approved for gummy stem blight. Suppression only.

PHYTOPHTHORA CROWN and FRUIT ROT*(Phytophthora spp.):**** Dimethomorph***Acrobat 50 WP*, 6.4 oz every 7 days. (0 days)*Forum*, 6 fl oz. (0 days)

or

*** Famoxadone/Cymoxanil***Tanos*, 8 - 10 oz every 5 - 7 days. (3 days)

or

*** Fluopicolide***Presidio*, 3-4 fl oz. (2 days)

or

*** Mancozeb/Zoxamide***Gavel 75 DF*, 1.5-2.0 lb. (5 days)

or

*** Mandipropamid***Revus*, 8 fl oz. (0 day)

or

Cyazofamid*Ranman*, 2.75 fl oz every 7 to 10 days. (0 days)

or

Fosetyl-Aluminum*Aliette WDG*, 2 to 5 lb, 7- to 14-day intervals. (0 days) Do not tank mix with copper fungicides.

or

Mono-, dibasic sodium, potassium and ammonium phosphites*Phostrol*, 2.5 to 5 pt every 7 - 14 days. (0 days)*Prophyt*, 4 pt. (0 days)

or

Mono-, dibasic sodium salts of phosphorous acid*Fosphite*, 1 to 3 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)**Note:** Most fungicides applied to control downy mildew may have limited efficacy against Phytophthora crown and fruit rot.

Mint

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Root-lesion, false root-lesion and needle nematodes can cause reduction in yields, especially in the presence of the Verticillium wilt fungus. Fields should be tested for nematodes prior to planting. If any of these nematodes exceed damage threshold estimates, soil fumigation in the fall may be recommended.

FALL SOIL FUMIGATION (BROADCAST):

1,3-D

Telone II, 25 gal/A (muck soil). Fumigate in the fall when soil temperatures at an 8-inch depth are above 50F. Inject the fumigant to a depth of 6 inches and seal the soil with a drag

immediately after application. Use soil fumigants only as directed on the label.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

or

Metam Sodium*Vapam HL*, 37.5 to 75 gal/A (use higher rate for muck soil).

Inject with shanks spaced 5 inches apart or to a depth of 4 to 10 inches in well pre-prepared soil. Follow immediately with a roller to smooth and compact surface. Light watering to the treated surface helps to prevent escape of gas.

INSECTS

FOLIAR TREATMENT:

MINT ROOT BORER:

Lorsban 4 E / Lorsban Advanced, 2 to 4 pt. (90 days) Apply post-harvest when larvae are present. Follow with at least 1 inch of irrigation. (RUP)

MINT FLEA BEETLE: Apply prior to egg-laying activity (July 20 to August 10) if needed to control adult stage, which will reduce root-damaging populations of larvae the following year. Three applications, 7 to 10 days apart, may be needed to control severe infestations (common only in older fields). Timing is critical. *Actara*, 1.5 to 3 oz. (7 days) Do not exceed 12.0 oz/Acre per season.

or

Lannate LV (2 1/4 to 3 pt) or *Lannate SP* (3/4 to 1 lb) (14 days) (RUP)

or

Malathion 57 EC, 1 1/2 pt. (7 days)

CUTWORM, LOOPERS: Apply before worms are 3/4 inch long for best results.

Acephate

Acephate 97 UP, *Orthene 97*, 1 lb. (14 days) Do not apply more than 2-1/8 lb per season.

or

Bacillus thuringiensis

Agree, *Biobit*, *Dipel*, *Javelin*, *Lepinox*, *Xentari*. (0 days)

or

Lannate LV (3 pt) or *Lannate SP* (1 lb) (14 days) (RUP)

or

Lorsban 4 E / Lorsban Advanced, 2 to 4 pt. (90 days) One application only. (RUP)

or

Avaunt, 3.5 oz. (7 days) Do not exceed 14 oz/acre per crop.

or

Radiant SC, 4 to 12 fl oz. (7 days) Do not make more than 4 applications or exceed 60.5 fl oz/acre per season.

APHIDS: Apply when damage is first seen or when insects are noticeable.

Acephate

Acephate 97 UP, *Orthene 97*, 1 lb. (14 days) Do not apply more than 2-1/8 lb per season.

or

Onions

Actara, 1.5 to 3 oz. (7 days) Do not exceed 12.0 oz/Acre per season.

or

Malathion 57 EC, 1 1/2 pt. (7 days)

MITES

Apply if needed.

Kelthane MF, 1 3/4 to 2 1/2 pt. (30 days) Limited to one application per season.

or

Agri-Mek 0.15 EC, 8 to 12 fl oz. (28 days) (RUP)

DISEASES

PREPLANT SOIL FUMIGATION:

VERTICILLIUM WILT (*Verticillium dahliae*): See Bulletin E-2099.

Apply as a broadcast or row treatment, placing the fumigant at least 12 to 14 inches below the final soil surface.

Soil sterilization by fumigation is best achieved by proper application of material. Correct soil moisture, temperature, and soil structure is needed for effective control of soil-borne pests.

Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or immediate tarping.

1,3 Dichloropropene/chloropicrin

Telone C35, 13-35 gal. (RUP)

or

Metam Sodium

Sectagon 42, Vapam HL, 37.5-75 gal.

or

Potassium N-methylidithiocarbamate

Sectagon-K54, 30-60 gal.

FOLIAR TREATMENT:

MINT RUST (*Puccinia menthae*): Apply to plants 4 to 8 inches tall at 7 to 10 day intervals. Do not apply more than 3 times. Do not feed hay to livestock.

Azoxystrobin

Amistar, 2 to 5 oz. (0 days fresh; 7 days processed)

Quadris, 6.2 to 15.4 fl oz. (0 days fresh; 7 days processed)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Chlorothalonil

Bravo Ultrex, 1 lb. (80 days)

or

Bravo Weather Stik, Echo 720, Equus 720 SST, 1 3/8 pt. (80 days)

or

Myclobutanil

Rally 40 WSP, 4 to 5 oz. (30 days)

POWDERY MILDEW (ERYSYYPHE CICHORACEARUM):

Azoxystrobin

Amistar, 2 to 5 oz. (0 days fresh; 7 days processed)

Quadris, 6.2 to 15.4 fl oz. (0 days fresh; 7 days processed)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Sulfur

Kumulus DF, 4 lb, 21-day intervals. (28 days) Do not apply unless buyer of oil has authorized use.

or

Microthiol Special, Thiolux Jet, 4 to 6 lb, 30-day intervals. (30 days) Maximum 3 applications.

or

Myclobutanil

Rally 40 WSP, 4 to 5 oz. (30 days)

Onions

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Northern root-knot, root-lesion, onion bloat, common needle and stubby-root nematodes can reduce onion yields. Fields with soil or root problems of undetermined cause should be tested for nematodes (see Appendix C). If the plant-parasitic nematodes are present in population densities above the economic threshold for onions, crop rotation or application of a nematicide is recommended. The following nematicides are suitable for control of northern root-knot, root-lesion, onion bloat and stubby-root nematodes in onion production.

FALL SOIL FUMIGATION (BROADCAST):

1,3-D

Telone II, 25 gal/A (muck soil), 9-18 gal/A (mineral soil).

Fumigate in the fall when soil temperatures at a 6-inch depth are above 50F. Inject the fumigant to a soil depth of 6 to 8 inches and lightly seal the soil immediately after application. Use soil fumigants only as directed on the label. In some limited situations soil fumigants can be applied in the spring in Michigan.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

or

Metam Sodium

Vapam HL, 37.5 to 75 gal/A (use higher rate for muck soil).

Inject with shanks spaced 5 inches apart to a depth of 4 to 10 inches in well-prepared soil. Material should be applied with adequate water and the soil surface sealed (light watering) after the application.

AT-PLANTING TREATMENT:

Vydate L, 3/4 to 1 gal per acre. Apply at planting as an in-furrow drench using 100-150 gallons of water per acre or 1-1/2 to 2 gal per acre as an in-furrow band using 20-50 gallons of water per acre or 1/2 to 1 gal/A as an in-furrow spray followed by 1 to 2 postemergence band treatments at 1/2 to 1 gal/A in a minimum of 20 gal water per acre. Do not apply within 14 days of harvest. Do not apply more than 2 1/4 gal of *Vydate L*/acre/season. Do not use on green onions. (RUP)

INSECTS**SEED TREATMENT:**

ONION MAGGOT: Trigard-treated seed is available as a pelleted or film-coated seed. Check with your seed supplier.

AT-PLANTING TREATMENT:

ONION MAGGOT: Apply to open furrow immediately after seeding but before furrow is closed. Use on dry bulb onions only. *Lorsban 15 G*, 3.7 oz per 1,000 ft of row. (RUP)

FOLIAR TREATMENT:

ONION MAGGOT: Apply as a directed spray or drench in a minimum of 100 gallons of water to the base of onion seedlings or transplants during peak egg laying of the onion maggot adults. Proper timing is critical.

Lorsban 4 E / Lorsban Advanced, 1 qt. (60 days) Use on dry bulb onions only. Maximum of 2 applications, maximum of 1 application if *Lorsban 4 E* or *15 G* was used at planting (Special Michigan SLN label). (RUP)

CUTWORM, ARMYWORM: Apply in late evening when first seen. Repeat treatments if needed.

Cypermethrin

Ammo 2.5 EC (2 to 5 oz) or *Ammo WSB* (1 to 2 bags) or *UP-Cyde 2.5 EC* (2 to 5 oz) (7 days) (RUP)

or

Lannate LV (1 1/2 to 3 pt) or *Lannate SP* (1/2 to 1 lb) (7 days) (RUP)

or

Mustang Max, 2.2 to 4.0 oz. (7 days) (RUP)

or

Warrior with Zeon Technology, 1.9 to 3.8 fl oz. (14 days) (RUP)

or

Entrust, 1 to 2 oz. (1 day) Do not apply more than 9 oz per acre per crop. Do not make more than 5 applications per year.

or

Lambda-cyhalothrin

Lambda-Cy, Proaxis, 2.6 to 3.8 fl oz. (14 days) (RUP)

or

SpinTor 2 SC, 3 to 6 oz. (1 day) Do not apply more than 29 oz per acre per crop. Do not make more than 5 applications per year.

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 5 applications or exceed 30 fl oz/acre per season

THRIPS: Usually appear around mid-summer. Damage is most severe on the new growth. Dry growing conditions usually intensify the problem. Treat when damage becomes visible or numbers exceed 10 to 15 per plant. Repeat as needed.

* Cypermethrin

Ammo 2.5 EC (4 to 5 fl oz) or *Ammo WSB* (1 to 2 bags) or *UP-Cyde 2.5 EC* (4 to 5 fl oz) (7 days) (RUP)

or

* *Lannate LV* (3 pt) or *Lannate SP* (1 lb) (7 days) (RUP)

or

* *Mustang Max*, 2.9 to 4.0 oz. (7 days) (RUP)

or

* *Warrior* with Zeon Technology, 1.3 to 3.8 fl oz. (14 days) (RUP)

or

Diazinon 50 WP (1 lb) or *Diazinon AG 500* (1 pt) (10 days) (RUP)

or

Malathion 25 WP (4 lb) or *Malathion 57 EC* (1 1/2 pt) (3 days)

or

Pennncap-M 2 F, 2 pt. (15 days) (RUP)

or

Permethrin

Ambush 25 W, 6.4 to 19.2 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 to 12 oz) or *Pounce 25 WP* (6.4 to 19.2 oz) or *Pounce 3.2 EC* (4 to 12 oz) (1 day) (RUP)

or

Vydate L, 1 to 2 pt. (14 days) Dry bulb onions only. (RUP)

or

Entrust, 1.25 to 2.5 oz. (1 day) Do not apply more than 9 oz per acre per crop. Do not make more than 5 applications per year.

or

Lambda-cyhalothrin

Lambda-Cy, Proaxis, 2.6 to 3.8 fl oz. (14 days) (RUP)

or

SpinTor 2 SC, 4 to 8 oz. (1 day) Do not apply more than 29 oz per acre per crop. Do not make more than 5 applications per year.

or

Radiant SC, 6 to 10 fl oz. (1 day) Do not make more than 5 applications or exceed 30 fl oz/acre per season.

or

Assail 30 SG, 5.0 to 8.0 Oz. (7 days) Do not make more than 4 applications per season.

DISEASES**PREPLANT SOIL FUMIGATION:**

PINK ROOT (*Phoma terrestris*): See Bulletin E-2099. Apply as a broadcast or row treatment, placing the fumigant at least 12 to 14 inches below the final soil surface.

Soil sterilization by fumigation is best achieved by proper application of material. Correct soil moisture, temperature, and soil structure is needed for effective control of soil-borne pests.

Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or immediate tarping.

1,3 Dichloropropene/chloropicrin

Telone C35, 13-35 gal. (RUP)

or

Metam Sodium

Sectagon 42, Vapam HL, 37.5-75 gal.

or

Potassium N-methylidithiocarbamate

Sectagon-K54, 30-60 gal.

Onions

AT-PLANTING TREATMENT:

SMUT (*Urocystis cepulae*): Apply in planter box at seeding or purchase treated seed. **Note:** Use only as directed; overtreatment may cause injury.

Mancozeb

Dithane DF Rainshield, *Dithane* M-45, *Dithane* WSP, 3 lb per acre. Apply as an in-furrow drench at planting in 75 to 125 gallons of water per acre (field-seeded onions only).

or

Dithane F-45 Rainshield, 2 to 4 qt per acre. Apply as an in-furrow drench at planting in 75 to 125 gallons of water per acre (field-seeded onions only).

or

Manzate 75 DF, 3 lb per acre. Apply as an in-furrow drench at planting in 75 to 125 gallons of water per acre (field-seeded onions only).

or

Penncozeb 4 F, 2.4 qt. (7 days)

or

Penncozeb 75 DF, *Penncozeb* 80 WP, 3 lb per acre. Apply as an in-furrow drench at planting in 75 to 125 gallons of water per acre (field-seeded onions only).

or

Maneb

Maneb 75 DF, *Maneb* 80 WP, 3 lb per acre. Apply as an in-furrow drench at planting in 75 to 125 gallons of water per acre (field-seeded onions only).

or

Manex, 2.4 qt. Apply 75 to 100 gal as a furrow drench.

or

Thiophanate-Methyl

Topsin M 70 WP, *Topsin* M WSB, 2 lb (broadcast).

DAMPING OFF (*Pythium* spp. only): Apply as a seed treatment before planting.

* Mefenoxam. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold SL, 0.5-1 pt.

Ultra Flourish, 1 to 2 pt.

or

Thiram

42-S Thiram, 6 oz/100 lb seed.

FOLIAR TREATMENT:

BOTRYTIS LEAF BLIGHT (*Botrytis squamosa*): Apply every 7 to 10 days after the 4-leaf stage or according to the onion leaf blight predictor.

* Chlorothalonil

Bravo Ultrex, 0.9 to 2.7 lb. (7 days) May be applied through sprinkler irrigation systems. Applications of more than 9 lb of *Bravo* Ultrex per season may result in yield reductions.

or

Bravo Weather Stik, *Equus* 720 SST, 1 1/2 to 3 pt (green bunching) (14 days) or 1 to 3 pt (dry bulb) (7 days). Do not apply more than 3 times per season on green bunching onions.

or

Bravo Weather Stik Zn, 1 to 2 pt. (7 days dry bulb onions; 14 days green onions)

or

Echo 720, 1 to 2 pt. (7 days)

Echo 90 DF, 1.2 to 1.7 lb. (7 days)

Equus DF, 0.9 to 2.7 lb. (7 days)

or

* DCNA

Botran 75 W, 1 1/2 to 2 2/3 lb. (14 days) Maximum 5 1/3 lb per season.

or

* Iprodione

Iprodione 4L AG, 1.5 pt. (7 days)

or

Rovral, 1 lb as tank mix with another fungicide, 7-day intervals. (7 days) **Note:** See label for permissible crop rotations.

Maximum 5 applications.

or

Rovral 4 F, 1 1/2 pt, 14-day interval. (7 days) Or 1 pt as tank mix with another fungicide, 7-day intervals. **Note:** See label for permissible crop rotations. Maximum 5 applications.

or

* Mancozeb

Dithane DF Rainshield, *Dithane* M-45, 3 lb. (7 days)

Dithane F-45 Rainshield, 2.4 qt. (7 days)

Penncozeb 4 F, 1.6 to 2.4 qt. (7 days)

Penncozeb 75 DF, *Penncozeb* 80 WP, 2 to 3 lb. (7 days)

or

Manzate 75 DF, 3 lb. (7 days) Do not apply to exposed bulbs. Maximum 30 lb/year.

or

* Maneb

Maneb 75 DF, *Maneb* 80 WP, 2 to 3 lb. (7 days)

Manex, 1.6 to 2.4 qt. (7 days)

or

Azoxystrobin

Amistar, 3 to 5 oz. (0 days)

Quadris, 9.2 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of *Amistar* and *Quadris* or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Boscalid

Endura, 6.8 oz. (7 days)

or

Mancozeb/Copper Hydroxide

ManKocide, 2 1/2 lb. (7 days)

or

Cyprodinil/Fludioxonil

Switch 62.5 WG, 11 - 14 oz every 7 to 10 days. (7 days)

or

Mancozeb/Copper Sulfate

Cuprofix MZ Disperss, 5 - 7.25 lb. (7 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Pyraclostrobin/Boscalid

Pristine, 14.5 to 18.5 oz. (7 days)

or

Pyraclostrobin*Cabrio*, 12 oz. (0 days)

or

Pyrimethanil*Scala*, 9 to 18 oz. (7 days)

or

Copper Resinate*Tenn-Cop 5 E*, 3 pt. (0 days)

or

Propiconazole*Propimax EC*, 4 fl oz. (14 days)*Tilt*, 4-8 fl oz. (14 days)

DOWNY MILDEW (*Peronospora destructor*): Apply after the 4-leaf stage.

* Fosetyl-Aluminum

Aliette WDG, 2 to 3 lb, 7- to 14-day intervals. (7 days) Do not make more than 7 applications per season. Do not tank mix with copper fungicides.

or

* Mancozeb

Dithane DF Rainshield, *Dithane M-45*, 3 lb. (7 days) Do not apply to exposed bulbs. Maximum 30 lb/year.

or

Dithane F-45 Rainshield, 2.4 qt. (7 days)*Manzate 75 DF*, 3 lb. (7 days)*Penncozeb 4 F*, 1.6 to 2.4 qt. (7 days)*Penncozeb 75 DF*, *Penncozeb 80 WP*, 2 to 3 lb. (7 days)

or

* Maneb*Maneb 75 DF*, *Maneb 80 WP*, 2 to 3 lb. (7 days)*Manex*, 1.6 to 2.4 qt. (7 days)

or

* Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 2 lb. (7 days dry bulb onions, maximum 4 applications; 21 days green onion) Maximum 3 applications.

or

* Mefenoxam/Copper Hydroxide

Ridomil Gold Copper, 2 lb. (10 days dry bulb onions, maximum 4 applications; 7 days green onion) Maximum 3 applications.

or

* Mefenoxam/Mancozeb

Ridomil Gold MZ, 2.5 lb. (7 days - dry bulb, maximum 4 applications) (21 days - green onion, maximum 3 applications). (7 days) See label.

Note: It is not legal to plant any crop not on the Ridomil Gold MZ label for 12 months following the last application, except that wheat, barley, or oats may be planted 40 days after the last application. It is not legal to plant any crop not on the Ridomil Gold-Bravo label for 12 months following the last application. This restriction includes celery and carrots.

or

Dimethomorph

Acrobat 50 WP, 6.4 oz. (0 days) Tank mix with another fungicide.

or

Forum, 6 fl oz. (0 days)

or

Azoxystrobin*Amistar*, 3 to 5 oz every 5 - 7 days. (0 days)*Quadris*, 9.2 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Chlorothalonil. Downy mildew suppression.*Bravo Ultrex*, 0.9 - 2.7 lb every 7 to 10 days. (7 days)*Echo 90 DF*, 1.2 to 2.4 lb. (7 days)

or

Bravo Weather Stik, *Equus 720 SST*, 1 to 3 pt. (7 days dry bulb onions; 14 days green bunching onions)

or

Fenamidone*Reason 500 SC*, 5.5 fl oz every 5 to 10 days. (7 days)

or

Mancozeb/Copper Sulfate*Cuprofix MZ Disperss*, 5 - 7.25 lb. (7 days)

or

Mono-, dibasic sodium, potassium and ammonium phosphites*Phostrol*, 2.5 to 3.75 pt every 7 - 14 days. (0 days)*Prophyt*, 4 pt. (0 days)

or

Pyraclostrobin

Cabrio, 12 oz. (7 days) Make no more than one application before alternating with fungicides that have a different mode of action.

or

Pyraclostrobin/Boscalid*Pristine*, 18.5 oz. (7 days)

or

Neem Oil*Trilogy*, 2 pt. (0 days)

or

Mandipropamid*Revus*, 8 fl oz. (7 day)

Note: Most fungicides that protect against purple blotch may also provide limited downy mildew protection.

PURPLE BLOTCH (*Alternaria porri*): Apply every 7 to 10 days after the 4-leaf stage.

* Azoxystrobin*Amistar*, 2 to 4 oz every 7 - 14 days. (0 days)*Quadris*, 6.2 to 12.3 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Chlorothalonil

Bravo Ultrex, 0.9 to 2.7 lb. (7 days) May be applied through sprinkler irrigation systems. Applications of more than 9 lb of Bravo Ultrex per season may result in yield reductions.

or

Bravo Weather Stik, *Equus 720 SST*, 1 1/2 to 3 pt (green bunching) (14 days) or 1 to 3 pt (dry bulb) (7 days). (14 days) Do not apply more than 3 times per season on green bunching onions.

or

Onions

Bravo Weather Stik Zn, 1 to 2 pt. (7 days dry bulb onions;
14 days green onions)

or

Echo 720, 1 to 2 pt. (7 days)

Echo 90 DF, 1.2 to 1.7 lb. (7 days)

Equus DF, 0.9 to 2.7 lb. (7 days)

or

* Cyprodinil/Fludioxonil

Switch 62.5 WG, 11-14 oz. (7 days)

or

* Iprodione

Iprodione, *Rovral 4 F*, 1.5 pt, 14-day intervals or 1 pt as tank mix with another fungicide, 7-day intervals. (7 days)

or

Rovral, 1 lb as tank mix with another fungicide, 7-day intervals.

Note: See label for permissible crop rotations. Maximum 5 applications.

or

* Mancozeb

Dithane DF Rainshield, *Dithane M-45*, *Dithane WSP*, 2 to 3 lb. (7 days)

or

Dithane F-45 Rainshield, 2.4 qt. (7 days)

Penncozeb 4 F, 1.6 to 2.4 qt. (7 days)

Penncozeb 75 DF, *Penncozeb 80 WP*, 2 to 3 lb. (7 days)

or

Manzate 75 DF, 3 lb. (7 days) Do not apply to exposed bulbs. Maximum 30 lb/year.

or

* Maneb

Maneb 75 DF, *Maneb 80 WP*, 2 to 3 lb. (7 days)

Manex, 1.6 to 2.4 qt. (7 days)

or

* Pyraclostrobin

Cabrio, 8-12 oz. (7 days) Do not apply more than three sequential applications.

or

* Pyraclostrobin/Boscalid

Pristine, 12.5 to 18.5 oz. (7 days)

or

Copper Ammonium Carbonate

Copper Count N, 2 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, *Kocide 4.5 LF*, 1 1/3 pt. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 1/3 to 2 2/3 pt. (0 days)

or

Champion WP, *Kocide 101*, *Kocide DF*, *Nu-Cop 50 DF*, 2 lb. (0 days)

or

Mancozeb/Copper Hydroxide

ManKocide, 2.5 lb. (7 days)

or

Copper Sulfate

Cuprofix Ultra, 1.25 to 3 lb. (0 days)

or

Fenamidone

Reason 500 SC, 5.5 fl oz every 5 to 10 days. (7 days)

or

Fosetyl-Aluminum

Aliette WDG, 2 to 3 lb, 7- to 14-day intervals. (7 days) Do not tank mix with copper fungicides.

or

Mancozeb/Copper Sulfate

Cuprofix MZ Disperss, 5 - 7.25 lb. (7 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Pyrimethanil

Scala, 9 to 18 fl oz. (7 days)

or

Propiconazole

Propimax EC, 4 fl oz. (14 days)

or

Tilt, 4-8 fl oz. (14 days)

or

Tebuconazole

Folicur 3.6F, 4-6 fl oz. (7 days) Maximum 12 fl oz/acre/season. 12 hr REI.

NECK ROT (*Botrytis* spp.):

Bacillus subtilis

Serenade, 6 to 10 lb. (0 days) Biological control product that needs to be applied before disease development. Control may be limited under heavy disease pressure.

or

Chlorothalonil

Bravo Ultrex, 1.25 - 2.7 lb every 7 days. (7 days)

or

Mancozeb

Penncozeb 4 F, 1.6 to 2.4 qt. (7 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

Note: Treatments for onion leaf blight may retard or prevent symptomless spread in the field prior to harvest.

BACTERIAL BLIGHT (*Erwinia carotovora* subsp. *carotovora*, *Pseudomonas* spp.):

Copper Hydroxide. Apply at 7 to 10 day intervals when plants are 4-6 in. tall. Can cause foliar phytotoxicity.

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, *Kocide 4.5 LF*, 1 1/3 pt. (0 days)

Kocide 2000, 3/4 to 1 1/4 lb. (0 days)

or

Copper Sulfate

Cuprofix Ultra, 1.25 to 3 lb. (0 days)

Parsnips

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Northern root-knot nematodes can reduce parsnip yields. Fields with soil or root problems of undetermined cause should be tested for nematodes (see Appendix C). If the plant-parasitic nematodes are present in population densities above the economic threshold for parsnips, crop rotation or application of a nematicide is recommended. The following nematicide is suitable for control of root-knot nematodes in parsnip production.

FALL SOIL TREATMENT (BROADCAST):

1,3-D

Telone II, 25 gal/A (muck soil), 9-18 gal/A (mineral soil). Fumigate in the fall when soil temperatures at a 6 inch depth are above 50F. Inject the fumigant to a soil depth of 8 inches and lightly seal the soil immediately after application. Use soil fumigants only as directed on the label.

In some limited situations soil fumigants can be applied in the spring in Michigan.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

INSECTS

SEED TREATMENT:

WIREWORM, BEAN LEAF BEETLE, APHIDS: No treatment currently available.

SOIL TREATMENT:

APHIDS, FLEA BEETLE: See label for application methods. Imidacloprid

Admire Pro, 4.4 - 10.5 fl oz. (21 days)

or

Platinum, 5 to 12 fl oz. (30 days) See label for application methods.

FOLIAR TREATMENT:

FLEA BEETLE: Apply as needed, usually soon after plants emerge.

Actara, 1.5 to 3 oz. (7 days)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin XLR Plus* (1 qt) (7 days)

LEAFHOPPERS: Apply when first seen. Repeat as needed.

Actara, 1.5 to 3 oz. (7 days)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin XLR Plus* (1 qt) (7 days)

ARMYWORM, CUTWORM: Apply if needed. Repeat as needed.

Carbaryl

Sevin 5 B (40 lb) or *Sevin 80 S* (2 1/2 lb) or *Sevin XLR Plus* (2 qt) (7 days)

or

Entrust, 1 to 2 oz. (3 days)

or

SpinTor 2 SC, 3 to 6 oz. (3 days)

or

Radiant SC, 6 to 8 fl oz. (3 days) Do not make more than 3 applications or exceed 24 fl oz/acre per season.

APHIDS: Apply if necessary.

Actara, 1.5 to 3 oz. (7 days)

or

Malathion 57 EC, 2 pt. (7 days)

DISEASES

SEED TREATMENT:

DAMPING OFF (*Pythium* spp.):

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only.

PREPLANT INCORPORATED:

DAMPING OFF (*Pythium* and *Phytophthora* spp., *Rhizoctonia solani*):

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only.

or

* *Mefenoxam*. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. sprinkler irrigation.

Ridomil Gold SL, 1-2 pt.

Ultra Flourish, 2 to 4 pt.

FOLIAR TREATMENT:

CERCOSPORA LEAF SPOT (*Cercospora* spp.), **ALTERNARIA LEAF SPOT** (*Alternaria* spp.): Apply at first sign of disease and repeat every 7 to 10 days.

* *Azoxystrobin*

Amistar, 2 to 5 oz every 7 - 14 days. (0 days)

Quadris, 6.2 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of *Amistar* and *Quadris* or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* *Pyraclostrobin*

Cabrio, 8-12 oz. (0 days)

or

Peas

* Trifloxystrobin

Flint, 2 to 3 oz. (7 days) Do not apply more than three sequential foliar applications of strobilurin fungicides before alternating with a fungicide that has a different mode of action.

or

Chlorothalonil

Bravo Ultrex, *Equus DF*, 1.4 to 1.8 lb. (10 days) (Alternaria) Do not apply more than 4 times per season.

or

Bravo Weather Stik, *Echo 720*, *Equus 720 SST*, 1.5 to 2 pt. (10 days) (Alternaria) Do not apply more than 4 times per season.

or

Echo 90 DF, 1.2 to 1.7 lb. (10 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

Peas

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

INSECTS

SEED TREATMENT:

Treatments applied to seed prior to planting. Insecticide and fungicide treatments can be combined according to directions. Handle seed carefully to prevent cracking.

APHIDS, BEAN LEAF BEETLE, MEXICAN BEAN BEETLE, LEAFHOPPERS, SEED CORN MAGGOT: Early season protection.

Cruiser 5 FS, 1.28 fl oz/100 lb seed.

SEED CORN MAGGOT:

Diazinon 50 WP, 1/2 oz per bushel of seed. Planter box treatment (RUP)

or

Lorsban 50 SL, 2 oz/100 lb seed. Use as a slurry. (RUP)

SOIL TREATMENT:

LEAFHOPPERS, APHIDS:

Imidacloprid

Admire Pro, 7.0 - 10.5 fl oz. (21 days) See label for application methods.

or

Nuprid 2 F, 16 to 24 fl oz. (21 days) Apply preplant, in furrow, or as a post-planting drench.

or

Di-Syston 15 G (6.7 to 16.7 lb) or *Di-Syston 8 E* (1 to 2 1/2 pt) (50 days) Apply in a band (not in contact with seed) at planting time, or as a sidedress after emergence. (RUP)

FOLIAR TREATMENT:

ARMYWORM, LOOPERS, CUTWORM: Apply if there are more than 1/25 sweeps. Pay special attention to grassy areas in the field.

* *Asana XL*, 5.8 to 9.6 oz. (3 days) (RUP)

or

* *Baythroid XL*, 2.4 to 3.2 fl oz. (7 days) (RUP)

or

* Bifenthrin

Bifenture EC, *Brigade 2EC*, *Capture 2 EC*, 2.1 to 6.4 oz. (3 days) (RUP)

or

* *Warrior* with Zeon Technology, 2.6 to 3.8 fl oz. (7 days) (RUP)

or

Carbaryl

Sevin 80 S (1 7/8 lb) or *Sevin XLR Plus* (1 to 1 1/2 qt) (3 days) See label for pre-harvest intervals for forage and fodder.

or

Dibrom 8 EC, 1 pt. (1 day)

Note: Do not feed treated vines to livestock.

or

Lannate LV (1 1/2 to 3 pt) or *Lannate SP* (1/2 to 1 lb) (1 day; 5 days if forage is fed to livestock; 14 days if fed as hay) (RUP)

or

SpinTor 2 SC, 4 to 6 oz. (3 days)

or

Entrust, 1.25 to 2 oz. (3 days)

or

Mustang Max, 1.3 to 4.0 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (7 days) (RUP)

or

Hero, 4 to 10.3 oz. (3 days) (RUP)

or

Radiant SC, 4 to 8 fl oz. (3 days) Do not make more than 6 applications or exceed 28 fl oz/acre per season.

LEAFHOPPERS: Apply as necessary

Baythroid XL, 0.8 to 1.6 fl oz. (0 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade 2EC*, *Capture 2 EC*, 1.6 to 6.4 oz. (3 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin XLR Plus* (1 qt) (3 days)

or

Imidacloprid

Nuprid 1.6 F, *Provado 1.6 F*, 3.5 fl oz. (7 days) Do not exceed 10.5 oz/Acre per season.

or

Warrior with Zeon Technology, 2.6 to 3.8 fl oz. (7 days) (RUP)

or

Mustang Max, 2.8 to 4.0 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (7 days) (RUP)

or

Hero, 4 to 10.3 oz. (3 days) (RUP)

or

Assail 30 SG, 2.5 to 5.3 oz. (7 days)

APHIDS: Apply if there are more than 1/pod or 10/sweep

Diazinon AG 500, 1 pt. (7 days) (RUP)

or

Dibrom 8 EC, 1 pt. (1 day) **Note:** Do not feed treated vines to livestock.

or

Dimethoate 2.67 EC, 1/2 pt. (0 days; 21 days if vines are fed to livestock)

or

Lannate LV (1 1/2 to 3 pt) or *Lannate* SP (1/2 to 1 lb) (1 day; 5 days if forage is fed to livestock; 14 days if fed as hay) (RUP)

or

Malathion 57 EC, 2 pt. (3 days; 7 days if vines are fed to livestock)

or

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.5 fl oz. (7 days) Do not exceed 10.5 oz/Acre per season.

or

Assail 30 SG, 2.5 to 5.3 oz. (7 days)

PEA WEEVIL: Apply when they appear at blossom time, usually at 10 to 50% bloom and 7 days later.

Baythroid XL, 1.6 to 2.4 fl oz. (7 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.1 to 6.4 oz. (3 days) (RUP)

or

Carbaryl

Sevin 80 S (1 7/8 lb) or *Sevin* XLR Plus (1 1/2 qt) (3 days)

See label for pre-harvest intervals for forage and fodder.

or

Malathion 57 EC, 2 pt. (3 days; 7 days if vines are fed to livestock)

or

Mustang Max, 2.8 to 4.0 oz. (1 day) (RUP)

or

Hero, 4 to 10.3 oz. (3 days) (RUP)

MITES

Apply if necessary. Usually most serious in dry weather.

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 5.1 to 6.4 oz. (3 days) (RUP)

or

Dibrom 8 EC, 1 pt. (1 day) Do not feed treated vines to livestock.

or

Danitol 2.4 EC, 10 2/3 fl oz. (7 days) (RUP)

DISEASES

SEED TREATMENT:

DAMPING OFF (*Pythium* spp., *Rhizoctonia solani*): Use slurry or dust method. **Note:** If possible, buy fungicide treated seed instead of treating seed on the farm.

Bacillus subtilis GB03

Kodiak, 0.125 oz/100 lb seed (*Fusarium*, *Rhizoctonia*).

or

Captan

Captan 30-DD, 2 oz/100 lb seed.

Captan 400, 2 1/2 oz/100 lb seed.

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only.

or

Mefenoxam

Apron XL LS, 0.32 to 0.64 fl oz/100 lb seed (*Pythium* and

Phytophthora) or 1.28 oz/100 lb seed (*Pythium* and systemic downy mildew).

or

Metalaxyl

Allegiance-FL, 0.75 fl oz/100 lb seed (*Pythium*) or 1.5 fl oz/100 lb seed (systemic down mildew).

or

Apron 50 W, 1/2 to 1 oz/100 lb seed (*Pythium* and *Phytophthora*) or 2 1/4 oz/100 lb seed (*Pythium* and systemic downy mildew).

or

Apron FS, 0.75 to 1.5 oz/100 lb seed (*Pythium*) or 3.4 oz/100 lb seed (*Pythium* and systemic downy mildew).

or

Thiram

42-S Thiram (3 oz/100 lb seed) or *Thiram* 50 WP Dyed (8 oz/100 lb seed)

PREPLANT INCORPORATED:

DAMPING OFF (*Pythium* spp.):

* Mefenoxam

Ridomil Gold SL, 0.5-1 pt.

or

Azoxystrobin

Quadris, 0.4 to 0.8 fl oz per 1000 ft in furrow.

FOLIAR TREATMENT:

POWDERY MILDEW (*Erysiphe polygoni*): Apply every 7 to 10 days after disease appears.

Sulfur

Kumulus DF, 3 to 5 lb. (0 days)

Thiolux Jet, 3 to 10 lb. (0 days)

or

Copper Hydroxide

Champ DP, 1 to 2 lb every 7 days. (0 days)

Champ Formula 2 F, *Kocide* 4.5 LF, 1 to 2 pt. (0 days)

Kocide 2000, 1 1/4 to 2 1/4 lb.

Nu-Cop 3 L, 1 to 4 pt. (0 days)

or

Champion WP, *Kocide* 101, *Kocide* DF, *Nu-Cop* 50 DF, 1 1/2 to 3 lb. (7 days)

or

Copper Sulfate

Cuprofix Ultra, 1 to 2 lb. (0 days)

Peppers

ANTHRACNOSE (*Colletotrichum lindemuthianum*),

ALTERNARIA BLIGHT (*Alternaria* spp.),

RUST (*Phakospora* spp.):

Azoxystrobin

Quadris, 6.2 - 15.4 fl oz every 7 - 14 days. Follow guidelines for resistance management.

Peppers

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Northern root-knot nematodes can reduce pepper yields. Fields with soil or root problems of undetermined cause should be tested for nematodes (see Appendix C). If the plant parasitic nematode is present at a population density above the economic threshold for peppers, crop rotation or application of a nematicide is recommended. The following nematicides are suitable for control of root-knot nematodes in pepper production.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

FALL SOIL TREATMENT (BROADCAST):

1,3-D

Telone II, 25 gal/A (muck soil), 9-18 gal/A (mineral soil).

Fumigate in the fall when soil temperatures at 6-inch depth are above 50F. Inject the fumigant to soil depth of 8 inches and lightly seal the soil immediately after application. Use soil fumigants only as directed on the label. In some limited situations soil fumigants can be applied in the spring in Michigan.

SOIL INJECTION:

Metam Sodium

Vapam HL, 37.5 to 75 gal/A (use higher rate for muck soil).

Inject with injector, shanks spaced 5 inches apart at a depth of 4 to 10 inches. Roll and irrigate treated surfaces to prevent escape of gas.

TRANSPLANT WATER TREATMENT:

Apply as needed.

Vydate L, 2 pt in at least 200 gallons of water. Do not apply during periods of slow plant growth, such as when temperatures are below 45F. (RUP)

This treatment should be followed by broadcast or band applications using ground equipment at 1 gal/A in 20-50 gal water. Response is usually best if application is made to seedling plants from flag leaf to 2 or 3 true leaves.

CHEMIGATION TREATMENT:

Metam Sodium

Vapam HL, 37.5 to 75 gal/A (use higher rate for muck soil).

Apply with an irrigation system. Soil should be moist prior to treatment See Bulletin E-2099. Do not plant for 14 to 30 days after treatment (the wetter the soil, the longer the waiting period).

INSECTS

AT PLANTING OR TRANSPLANTING:

APHIDS: For early season control.

Imidacloprid

Admire Pro, 7 - 14 fl oz. (21 days) Consult label for application methods, rotation restrictions and other requirements

or

Nuprid 2 F, 16 to 24 fl oz. (21 days)

or

Platinum, 5 to 11 fl oz. (30 days) Apply as in-furrow spray or narrow surface band, as a post seeding, transplant or hill drench, in trickle or drip irrigation, or shanked into root zone after establishment or transplanting.

or

Venom, 5 to 6 oz. (21 days) See label for application methods.

FOLIAR TREATMENT:

FLEA BEETLE:

Actara, 2 to 3 oz. (0 days) Do not apply if a neonicotinoid was used at planting. Do not exceed 11 oz/acre per season.

or

Asana XL, 5.8 to 9.6 oz. (7 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin XLR Plus* (1 qt) (3 days)

or

Endosulfan 3 EC, 2 pt. (4 days) Consult label for rotation restrictions.

or

Permethrin. Bell peppers only.

Ambush 25 W, 6.4 to 12.8 oz. (3 days) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce 25 WP* (6.4 to 12.8 oz)

or *Pounce 3.2 EC* (4 to 8 oz) (3 days) (RUP)

or

Venom, 1 to 4 oz. (1 day)

or

Warrior with Zeon Technology, 1.3 to 3.8 fl oz. (5 days) (RUP)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (5 days) (RUP)

or

Heró, 4 to 10.3 oz. (7 days) (RUP)

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (7 days) (RUP)

CUTWORM: Apply as needed to protect new transplants.

* Permethrin. Bell peppers only.

Ambush 25 W, 6.4 to 12.8 oz. (3 days) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz)

or *Pounce* 3.2 EC (4 to 8 oz) (3 days) (RUP)

or

* *Warrior* with Zeon Technology, 1.3 to 3.8 fl oz. (5 days) (RUP)

or

Carbaryl

Sevin 80 S (2 1/2 lb) or *Sevin* XLR Plus (2 qt) (3 days)

or

Lannate LV (3/4 to 1 1/2 pt) or *Lannate* SP (1/2 lb) (3 days)

(RUP)

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (5 days) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (7 days) (RUP)

APHIDS: Apply if needed.

* Acephate

Orthene 75 S, 2/3 to 1 2/3 lb for bell peppers, 2/3 lb for non-bell peppers. (7 days) Consult label for further restrictions regarding use on non-bell peppers.

or

* *Assail* 30 SG, 1.9 to 2.8 oz. (7 days)

or

* Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.8-6.2 fl oz. (0 days) Do not use if neonicotinoids were applied at planting. Do not exceed 19.2 oz/acre per season.

or

* *Actara*, 2 to 3 oz. (0 days) Do not apply if a neonicotinoid was used at planting. Do not exceed 11 oz/acre per season.

or

Dimethoate 2.67 EC, 3/4 to 1 pt. (0 days)

or

Endosulfan 3 EC, 1 qt. (4 days; 1 day at 2/3 qt rate) Consult label for rotation restrictions.

or

Fulfill, 2.75 oz (0 days) May require 5-7 days for aphid mortality.

or

Lannate LV (1 1/2 pt) or *Lannate* SP (1/2 lb) (3 days) (RUP)

or

Venom, 1 to 4 oz. (1 day)

or

Vydate L, 2 to 4 pt. (7 days) (RUP)

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Brigadier, 3.8 to 9.8 oz. (7 days)

EUROPEAN CORN BORER: Apply treatments to coincide with fruit formation and second-brood egg-laying period (usually around July 20 to August 15) and continue as needed. Direct spray to underside of leaves and cap area of fruit.

* Acephate

Orthene 75 S, 1 to 1 1/3 lb (2/3 lb on non-bell peppers). (7 days) Do not make more than two applications per season.

or

Asana XL, 5.8 to 9.6 oz. (7 days) (RUP)

or

Baythroid XL, 1.6 to 2.8 fl oz. (7 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 to 2 1/2 lb) or *Sevin* XLR Plus (1 to 2 qt) (3 days)

or

Permethrin. Bell peppers only.

Ambush 25 W, 12.8 oz. (3 days) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (12.8 oz)

or *Pounce* 3.2 EC (4 to 8 oz) (3 days) (RUP)

or

SpinTor 2 SC, 4 to 8 oz. (1 day)

or

Warrior with Zeon Technology, 1.3 to 3.8 fl oz. (5 days) (RUP)

or

Entrust, 1 to 2 oz. (1 day)

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (5 days) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (7 days) (RUP)

MITES: Apply if needed.

Agri-Mek 0.15 EC, 8 to 16 fl oz. (7 days) (RUP)

or

Kelthane MF, 3/4 to 1 1/2 pt. (2 days) Limited to 2 applications per season.

or

Oberon 2 SC, 7 to 8.5 fl oz. (7 days)

or

Hero, 10.3 oz. (7 days) (RUP)

or

Bifenthrin

Bifenture EC, 5.1 to 6.4 oz. (7 days) (RUP)

DISEASES

SEED TREATMENT:

PRE-EMERGENCE DAMPING OFF (*Rhizoctonia solani*, *Pythium* spp., *Phytophthora* spp.):

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Captan

Captan 30-DD, 2 1/3 oz/100 lb seed.

Captan 400, 2 to 3 oz/100 lb seed.

or

Thiram

42-S Thiram, Thiram 50 WP Dyed, 8 oz/100 lb seed.

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia solani*).

SOIL FUMIGATION:

VERTICILLIUM WILT, PHYTOPHTHORA: Apply to production fields before planting. **Note:** Most fumigants applied to the soil for control of disease organisms will also control soil insects, nematodes and weed seeds.

Soil sterilization by fumigation is best achieved by proper application of material. Correct soil moisture, temperature, and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or immediate tarping.

1,3 Dichloropropene/chloropicrin

Telone C35, 13-35 gal. (RUP)

or

Metam Sodium

Sectagon 42, Vapam HL, 37.5-75 gal.

or

Potassium N-methylidithiocarbamate

Sectagon-K54, 30-60 gal.

GREENHOUSE PREPLANT

INCORPORATION:

DAMPING OFF (*Pythium* spp.) and **ROOT ROT** (*Rhizoctonia* spp.):

Gliocladium virens GL-21

SoilGard 12 G, 1 to 1.5 lb per cubic yard. Biological control product that needs to be applied before disease development. Control may be limited under heavy disease pressure.

ROOT/STEM ROT (*Rhizoctonia solani*):

PCNB

Terraclor 400, see label for rates specific to soil depth.

PREPLANT OR AT PLANTING

INCORPORATED:

DAMPING OFF (*Pythium* spp.), **PHYTOPHTHORA CROWN, STEM and FRUIT ROT** (*Phytophthora capsici*):

* Mefenoxam. Ridomil and Ultra Flourish must be applied to the soil before the plants are infected with *Phytophthora* to obtain satisfactory disease control).

Ridomil Gold SL, 1 pt. (7 days)

Ultra Flourish, 2 pt. (7 days)

Incorporate mechanically before planting or move into root zone after planting with 1/2 to 1 inch sprinkler water. For banded applications, use 12- to 16-inch band. One supplemental directed application at 1 pt (Ridomil Gold EC) or 2 pt (Ultra Flourish) should be made 30 days later followed by foliar applications of Ridomil Gold/Copper (MEFENOXAM/COPPER), 2 1/2 lb (1/4 lb a.i.) (7 days). Make 3 to 4 applications of Ridomil Gold/Copper at 10 to 14 day intervals.

Note: Observe limit of active ingredient/crop on label.

FOLIAR TREATMENT:

GRAY MOLD (*Botrytis* spp.), **CLADOSPORIUM LEAF MOLD** (*Cladosporium capsici*), **SCLEROTINIA WHITE MOLD** (*Sclerotinia sclerotiorum*):

Bacillus subtilis

Serenade, 4 to 8 lb (*Botrytis*). (0 days) Biological control product that needs to be applied before disease development. Control may be limited under heavy disease pressure.

or

Potassium Bicarbonate

Armcarb 100, 2.5 to 5 lb (*Botrytis*). (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

ANTHRACNOSE (*Colletotrichum* spp.), **ALTERNARIA (RIPE) ROT** (*Alternaria tenuis*): Apply when disease threatens and every 7 to 10 days.

* Azoxystrobin

Amistar, 2 to 5 oz every 7 - 14 days. (0 days)

Quadris, 6.2 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Maneb

Maneb 75 DF, Maneb 80 WP, 1.5 to 3 lb. (7 days)

Manex, 1.2 to 2.4 qt. (7 days)

or

* Pyraclostrobin

Cabrio, 8-12 oz. (0 days) No more than two applications before rotating to a different chemical.

or

* Trifloxystrobin

Flint, 3 to 4 oz. (3 days) Do not apply more than three sequential foliar applications of strobilurin fungicides before alternating with a fungicide that has a different mode of action.

or

* Boscalid

Endura, 2.5 to 3.5 oz. (0 days)

or

Copper Sulfate

Basic Copper 53, 3 to 4 lb. (0 days)

Basicop, 2 to 4 lb. (0 days)

Cuprofix Ultra, 1.25 to 3 lb. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Potassium Bicarbonate*Armcarb* 100, 2.5 to 5 lb.**BACTERIAL SPOT** (*Xanthomonas campestris* pv. *vesicatoria*):

Apply as needed every 5 to 7 days.

Copper Ammonium Carbonate*Copper Count N*, 1 1/2 to 3 qt. (0 days)

or

Copper Hydroxide*Champ DP*, 1 1/3 to 2 lb. (0 days)*Champ Formula 2 F*, *Kocide 4.5 LF*, 1 1/3 to 2 pt. (0 days)*Kocide 2000*, 1 1/2 to 2 1/4 lb. (0 days)*Nu-Cop 3 L*, 1 1/3 to 4 pt, 7- to 10-day intervals. (0 days)

or

Champion WP, *Kocide 101*, *Kocide DF*, *Nu-Cop 50 DF*, 2 to 3 lb. (0 days)

or

Copper Resinate*Tenn-Cop 5 E*, 3 to 4.5 pt. (0 days)

or

Copper Sulfate*Basic Copper 53*, 3 to 4 lb. (0 days)*Basicop*, 2 to 4 lb. (0 days)*Cuprofix Ultra*, 1.25 to 3 lb. (0 days)

or

Famoxadone/Cymoxanil*Tanos*, 8 - 10 oz every 5 - 7 days. (3 days)**PHYTOPHTHORA BLIGHT** (*Phytophthora capsici*):* Dimethomorph*Acrobat 50 WP*, 6.4 oz every 5 to 10 days. (0 days)*Forum*, 6 fl oz. (0 days)

or

* Famoxadone/Cymoxanil*Tanos*, 8 to 10 oz. (3 days)

or

Fluopicolide*Presidio*, 3-4 fl oz. (2 days)

or

* Mandipropamid*Revus*, 8 fl oz. (1 day)

or

* Mefenoxam/Copper Hydroxide*Ridomil Gold Copper*, 1 lb. (7 days) Make 3-4 applications of *Ridomil Gold Copper* (2.5 lb) at 10 to 14 day intervals.

or

Maneb*Maneb 75 DF*, *Maneb 80 WP*, 1 1/2 to 3 lb, 7- 10 day intervals. (7 days)

or

Manex, 1.2 to 2.4 qt, 7- to 10-day intervals. (7 days)

or

Mono-, dibasic sodium, potassium and ammonium phosphites*Phostrol*, 1 to 2 qt every 14 - 21 days. (0 days)*Prophyt*, 6 pt. (0 days)

or

Mono-, dibasic sodium salts of phosphorous acid*Fosphite*, 1 to 3 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)

Potatoes

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Root-lesion, root-knot and potato rot nematodes can reduce potato yields. Fields with soil or root problems of undetermined cause should be tested for nematodes (see Appendix C). If these plant-parasitic nematodes are present in population densities above the economic threshold for potatoes, crop rotation or application of a nematicide is recommended. Potato growers should not rely on a single strategy or tactic for their total nematode control program. The following nematicides are suitable for control of these nematodes in potato production.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

FALL SOIL TREATMENT (BROADCAST):

1,3-D

Telone II, 25 gal/A for muck soil, 9-18 gal/A for mineral soil.

or

1,3-D and chloropicrin

Telone C-17, 27-30 gal/A for muck soil, 10-21 gal/A for mineral soil. (RUP)

or

Metam Sodium

Vapam HL, 37.5 to 75 gal/A (use higher rate for muck soil).

Inject with injector, shanks spaced 5 inches apart at a depth of 4 to 10 inches. Material should be applied with at least equal parts water or in a 2 to 1, water to fumigant, ratio. Seal surface after application.

Fumigate in the fall when soil temperatures at a 6-inch depth are above 50F. Inject the fumigant to a soil depth of 8 inches and lightly seal the soil immediately after application. Use soil fumigants only as directed on the label. In some limited situations, soil fumigants can be applied in the spring in Michigan.

PREPLANT SOIL TREATMENT:

Mocap 6 EC, broadcast 1 to 1.5 gal/A within 2 weeks before planting until crop emergence. (RUP)

or

Mocap 15 G, broadcast 40 to 60 lb and incorporate to a depth of 2 to 4 inches. (RUP)

SOIL TREATMENT AT PLANTING:

Mocap 15 G, 20 lb/acre (36 inch row spacing) or 1/4 lb/1000 row feet in a band 12 inches wide on the row at planting. Mix with the top 2-4 inches of soil

Potatoes

Note: Mocap use may result in delayed emergence particularly if excessive quantities of material contact seed. (RUP)

or

Vydate L, 1 to 2 gal in at least 20 gallons of water in furrow at planting. May aid in early season insect control. (RUP)

CHEMIGATION TREATMENT:

Metam Sodium

Vapam HL, 37.5 to 75 gal/A (use higher rate for muck soil) for mineral soil situations. Apply in the fall, although in some years spring application is possible.

Fall application in center pivot irrigation water. Have local product distributor provide additional application methodology and safety details from manufacturer. All recommended safety equipment must be installed to prevent groundwater contamination.

INSECTS

RESISTANCE MANAGEMENT.:

Insecticide resistance is a severe problem with Colorado potato beetle. Crop rotation is the single most effective practice for managing Colorado potato beetle and resistance problems. If a neonicotinoid insecticide is used at planting, foliar application of any neonicotinoid later in the season must be avoided. Likewise, repeated application of any insecticide is likely to result in resistance problems.

SEED TREATMENT:

COLORADO POTATO BEETLE, POTATO LEAFHOPPER, APHIDS:

Imidacloprid

Admire Pro, 0.17 - 0.35 fl oz/100 lb seed. See label for application instructions.

or

Nuprid 2 F, 0.4 to 0.8 fl oz/100 lb seed.

or

Cruiser 5 FS, See label for application rates and methods.

or

Gaucho 480, MZ, 0.75 lb/100 lb cut seed. Use a seed dust metering applicator. See label for application instructions. Includes the fungicide mancozeb.

SOIL TREATMENT AT PLANTING:

WIREWORM: Broadcast evenly on soil surface and incorporate 4 to 6 inches deep prior to planting.

Mocap 15 G (27 to 40 lb) or *Mocap 20 G* (20 to 30 lb) (RUP)

WHITE GRUBS: Effective chemical control is not presently available. Rotation to a less sensitive crop like corn, with a soil insecticide, is recommended.

FURROW TREATMENT:

COLORADO POTATO BEETLE, POTATO LEAFHOPPER, APHIDS:

* Imidacloprid

Admire Pro, 5.7 - 8.7 fl oz. Apply in furrow, as side dress, or before hilling.

or

Nuprid 2 F, 0.9 to 1.3 oz per 1,000 row ft. Apply directly on seed in furrow. (Use high rate for muck soil. Consult label for rotation restrictions).

or

* *Venom*, 6.5 to 7.5 oz. See label for application methods.

APHIDS, FLEA BEETLE, LEAFHOPPERS: Apply in seed furrow or with fertilizer band at planting. Check the package label for further directions and limitations.

Phorate

Thimet 20 G, 11.3 oz (for light, sandy soils) 17.3 oz (for heavy, clay soils) / 1,000 row ft. (90 days) May also help control Colorado potato beetle. (RUP)

APHIDS, FLEA BEETLE, COLORADO POTATO BEETLE, LEAFHOPPER:

Platinum, 5 to 8 fl oz. (30 days) Apply as an in-furrow spray on the seed piece, impregnated on dry, granular fertilizer before or during planting, at plant emergence or as a direct spray at base of plant during last hilling operation.

COLORADO POTATO BEETLE:

Platinum Ridomil Gold, 34 fl oz. (12 hour) Impregnate on fertilizer at planting. Do not use other neonicotinoids at planting.

FOLIAR TREATMENT:

FLEA BEETLE: Apply if there are more than 50/25 sweeps. May occur soon after plants emerge and again in late July and August.

Asana XL, 5.8 oz. (7 days) (RUP)

or

Assail 30 SG, 1.4 to 2.5 oz. (7 days)

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin XLR Plus* (1 qt) (7 days)

or

Endosulfan 3 EC, 2 pt. (1 day) Consult label for rotation restrictions.

or

Furadan 4 F, 1 pt. (14 days) Consult label for tirther restrictions. (RUP)

or

Lannate LV (1 1/2 pt) or *Lannate SP* (1/2 lb) (6 days) (RUP)

or

Leverage 2.7, 3 to 3.75 oz. (7 days) Do not use if a neonicotinoid was used at planting. (RUP)

or

Monitor 4 EC, 1.5 - 2 pt. (14 days) (RUP)

or

PennCap-M 2 F, 2 to 4 pt. (5 days) (RUP)

or

Permethrin

Ambush 25 W, 6.4 oz. (14 days) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce 25 WP* (6.4 to 12.8 oz) or *Pounce 3.2 EC* (4 to 8 oz) (14 days) (RUP)

or

Venom, 1.5 oz. (7 days)

or

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.8 fl oz. (7 days) Do not use if neonicotinoids were applied at planting. Do not exceed 19.2 oz/acre per season.

or

Actara, 1.5 to 3 oz. (14 days) Do not apply if a neonicotinoid was used at planting. Do not exceed 6 oz/acre per season.

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (7 days) Do not exceed 15.4 fl oz/acre per season. (RUP)

or

Brigadier, 4.8 to 6.1 oz. (21 days)

COLORADO POTATO BEETLE: Apply if there is more than 1 large larva or adult per plant. Piperonyl butoxide (Butacide, Prentox PBO-8, Incite) at 1/2 to 1 pt per acre may be effective as a synergist to block resistance to organophosphate (Guthion, Imidan, etc.) and pyrethroid (Asana, etc.) insecticides.

* *Actara*, 1.5 to 3 oz. (14 days) Do not apply if a neonicotinoid was used at planting. Do not exceed 6 oz/acre per season.

or

* *Agri-Mek* 0.15 EC, 8 to 16 fl oz. (14 days) (RUP)

or

* *Assail* 30 SG, 1.5 to 4 oz. (7 days)

or

* *Leverage* 2.7, 3 to 3.75 oz. (7 days) Do not use if Imidacloprid, Gaucho, Genesis or Platinum was used at planting. (RUP)

or

* Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.75 fl oz. (7 days) Do not use if neonicotinoids were applied at planting. Do not exceed 19.2 oz/acre per season.

or

* *Rimon*, 9 to 12 fl oz. (14 days) Small larvae only. 2 applications per year.

or

* *SpinTor* 2 SC, 3 to 6 oz. (7 days)

or

* *Entrust*, 1 to 2 oz. (7 days)

or

* *Venom*, 1.5 oz. (7 days)

or

Asana XL, 9.6 oz. (7 days) (RUP)

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 to 2 1/2 lb) or *Sevin* XLR Plus (1 to 2 qt) (7 days)

or

Endosulfan 3 EC, 1 1/3 qt. (1 day)

or

Furadan 4 F, 2 pt. (14 days) Consult label for further restrictions. Do not use more than once per season or serious resistance problems may develop. (RUP)

or

Imidan 70 WP, 1 1/3 lb. (7 days)

or

PennCap-M 2 F, 2 to 6 pt. (5 days) (RUP)

or

Permethrin

Ambush 25 W, 8 oz. (14 days) (RUP)

or

Perm-UP 3.2 EC, *Pounce* 25 WP, *Pounce* 3.2 EC, 4 to 8 oz. (14 days) (RUP)

or

Vydate L, 2 to 4 pt. (7 days) (RUP)

or

Clutch 50 WGD, 1 to 1.5 oz. (14 days)

or

Radiant SC, 6 to 8 fl oz. (7 days) Do not make more than 4 applications or exceed 32 fl oz/acre per season.

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (7 days)

Do not exceed 15.4 fl oz/acre per season. (RUP)

or

Brigadier, 4.8 to 6.1 oz. (21 days)

LEAFHOPPERS: Apply if there are more than 0.5 adults/sweep or 1 nymph/10 leaves.

Actara, 1.5 to 3 oz. (14 days) Do not apply if a neonicotinoid was used at planting. Do not exceed 6 oz/acre per season.

or

Asana XL, 5.8 to 9.6 oz. (7 days) (RUP)

or

Assail 30 SG, 1.5 to 4 oz. (7 days)

or

Baythroid XL, 0.8 to 1.6 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin* XLR Plus (1 qt) (7 days)

or

Dimethoate 2.67 EC, 3/4 to 1 1/2 pt. (0 days)

or

Endosulfan 3 EC, 2 pt. (1 day)

or

Furadan 4 F, 1 pt. (14 days) Consult label for further restrictions. (RUP)

or

Imidan 70 WP, 1 1/3 lb. (7 days)

or

Lannate LV (1 1/2 to 3 pt) or *Lannate* SP (1/2 to 1 lb) (6 days) (RUP)

or

Leverage 2.7, 3 to 3.75 oz. (7 days) Do not use if a neonicotinoid was used at planting. (RUP)

or

Malathion 57 EC, 1 pt. (0 days)

or

Monitor 4 EC, 1.5 - 2 pt. (14 days) (RUP)

or

PennCap-M 2 F, 2 to 4 pt. (5 days) (RUP)

or

Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (14 days) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz) or *Pounce* 3.2 EC (4 to 8 oz) (14 days) (RUP)

or

Potatoes

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.75 fl oz. (7 days) Do not use if neonicotinoids were applied at planting. Do not exceed 19.2 oz/acre per season.

or

Venom, 1.5 oz. (7 days)

or

Clutch 50 WGD, 1 to 1.5 oz. (14 days)

or

Warrior with Zeon Technology, 1.9 to 3.2 fl oz. (7 days)

Do not exceed 15.4 fl oz/acre per season. (RUP)

or

Brigadier, 4.8 to 6.1 oz. (21 days)

APHIDS: Treat if numbers exceed 1 per leaf (1/10 leaves for seed potatoes). Control is especially important to reduce virus disease in seed potato production.

* *Assail* 30 SG, 2.3 to 4 oz. (7 days)

or

* *Fulfill*, 2.75 to 5.5 oz. (14 days) Do not apply more than 11.0 oz/acre per season. May require 5 to 7 days for aphid mortality.

or

* *Leverage* 2.7, 3.75 oz. (7 days) Do not use if a neonicotinoid was used at planting. (RUP)

or

* *Monitor* 4 EC, 1.5 - 2 pt. (14 days) (RUP)

or

* Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.75 fl oz. (7 days) Do not use if neonicotinoids were applied at planting. Do not exceed 19.2 oz/acre per season.

or

Dimethoate 2.67 EC, 3/4 to 1 1/2 pt. (0 days)

or

Endosulfan 3 EC, 2 pt. (1 day)

or

Lannate LV (1 1/2 to 3 pt) or *Lannate* SP (1/2 to 1 lb) (6 days) (RUP)

or

Beleaf 50 SG, 2 to 2.8 oz. (7 days)

or

Venom, 1.5 oz. (7 days)

or

Clutch 50 WGD, 1 to 1.5 oz. (14 days)

or

Actara, 1.5 to 3 oz. (14 days) Do not apply if a neonicotinoid was used at planting. Do not exceed 6 oz/acre per season.

or

Brigadier, 4.8 to 6.1 oz. (21 days)

TARNISHED PLANT BUG:

Asana XL, 5.8 to 9.6 oz. (7 days) (RUP)

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin* XLR Plus (1 qt) (7 days)

or

Leverage 2.7, 3 to 3.75 oz. (7 days) Do not use if a neonicotinoid was used at planting. (RUP)

or

PennCap-M 2 F, 2 to 4 pt. (5 days) (RUP)

or

Beleaf 50 SG, 2 to 2.8 oz. (7 days)

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (7 days)

Do not exceed 15.4 fl oz/acre per season. (RUP)

CUTWORM, ARMYWORM, LOOPERS: Apply if defoliation exceeds 10%.

* *Asana* XL, 5.8 to 9.6 oz. (7 days) (RUP)

or

* *Baythroid* XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

* *Leverage* 2.7, 3 to 3.75 oz. (7 days) Do not use if a neonicotinoid was used at planting. (RUP)

or

* Permethrin

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz) or *Pounce* 3.2 EC (4 to 8 oz) (14 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/2 to 2 1/2 lb) or *Sevin* XLR Plus (1 to 2 qt) (7 days)

or

Endosulfan 3 EC, 1 1/3 qt. (1 day)

or

Lannate LV (1 1/2 to 3 pt) or *Lannate* SP (1/2 to 1 lb) (6 days) (RUP)

or

Monitor 4 EC, 1.5 - 2 pt. (14 days) (RUP)

or

PennCap-M 4 F, 2 to 4 pt. (5 days) (RUP)

or

SpinTor 2 SC, 4.5 to 6 oz. (7 days)

or

Entrust, 1.5 to 3 oz. (7 days)

or

Warrior with Zeon Technology, 1.9 to 3.8 fl oz. (7 days)

Do not exceed 15.4 fl oz/acre per season. (RUP)

EUROPEAN CORN BORER: Plan treatment to coincide with first generation egg laying if there is more than 1 egg mass per 25 leaves.

* *Asana* XL, 5.8 to 9.6 oz. (7 days) (RUP)

or

* *Baythroid* XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

* *Leverage* 2.7, 3 to 3.75 oz. (7 days) Do not use if a neonicotinoid was used at planting. (RUP)

or

* Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (14 days) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz) or *Pounce* 3.2 EC (4 to 8 oz) (14 days) (RUP)

or

Avaunt, 3.5 - 6.0 oz. (3 days)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin* XLR Plus (1 qt) (7 days)

or

Endosulfan 3 EC, 2 2/3 pt. (1 day) Consult label for rotation restrictions.

or

Furadan 4 F, 1 1/2 to 2 pt. (14 days) (RUP)

or

Monitor 4 EC, 1.5 - 2 pt. (14 days) (RUP)

or

PennCap-M 4 F, 2 to 4 pt. (5 days) (RUP)

or

SpinTor 2 SC, 3 to 6 oz. (7 days)

or

Entrust, 1 to 2 oz. (7 days)

or

Radiant SC, 6 to 8 fl oz. (7 days) Do not make more than 4 applications or exceed 32 fl oz/acre per season.

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (7 days)

Do not exceed 15.4 fl oz/acre per season. (RUP)

DISEASES

SEED TREATMENT:

FUSARIUM TUBER ROT (*Fusarium* spp.): Fall treatment. Treat seed going into storage or at the time of shipping. This must be done at least 6 weeks before planting.

Thiabendazole

Mertect 340, 0.42 fl oz/ton of potatoes. Apply in enough water for complete coverage. Apply as a spray to potato tubers (seed and table stock) at time of storage and again at removal. See manufacturer's recommendations for equipment and methods to use. Treatment may be applied to washed or unwashed potatoes.

SOFT ROT and BLACK LEG (*Pectobacterium carotovorum*):

Streptomycin sulfate

Agri-mycin 17, 100 ppm. Mix with Maxim 4FS or Maxim MZ.

Bac-master, 100 ppm. Mix with Maxim 4FS or Maxim MZ.

SEED TREATMENT AND HANDLING:

FUSARIUM TUBER ROT (*Fusarium* spp.): Pre-planting treatment. Dust or spray cut or whole seed before planting.

Captan

Captan 10 Potato Seed Protectant, 0.75 lb per 100 lb cut seed pieces.

or

Mancozeb

Dithane F-45 Rainshield, 2 pt per 50 gal water. Treat as above.

Dithane M-45, 1.25 lb per 50 gal water. Treat as above.

or

Manzate 200 80 W, 2 1/2 lb per 100 gal water. Drain and plant as soon as possible.

or

Penncozeb 80 WP, 1 1/4 lb per 50 gal water.. (3 days) Treat as above.

or

Evolve, 0.75 lb per 100 lb seed potatoes.

or

Maneb

Maneb 80 WP, 1 lb per 10 gal water. Treat as above.

or

Manex 4 F, 1.6 pt per 10 gal water. Dip whole or cut tubers.

Place in a clean container and plant as soon as possible after treatment.

or

Fludioxinil

Maxim MZ 0.5 D, 0.5 lb per 100 lb seed potatoes.

or

Moncoat MZ, 0.75-1.0 lb/100 lb of seed potatoes.

or

Tops 2.5 D, 1 lb/100 lb seed.

or

Tops MZ 8.5 DS, 0.5 lb per 100 lb seed.

Use only as directed. **Note:** DO NOT feed treated seed to livestock.

RHIZOCTONIA DISEASE (*Rhizoctonia solani*): Dust cut or whole seed just before planting.

Evolve, 0.75lb/100 lb seed.

or

Fludioxinil

Maxim 0.5 D, 0.5 lb per 100 lb seed potatoes.

or

Maxim 4 FS, 0.08 fl oz. **Note:** If Maxim 4 FS is used for potatoes for seed production, a labeled rate of mancozeb seed treatment dust must be applied to seed tubers after the Maxim 4 FS treatment. Alternatively, an in-furrow application of Quadris at 6.1 - 9.2 fl oz/A may be used (34" row spacing).

or

Maxim MZ 0.5 D, 0.5 lb per 100 lb seed potatoes.

or

Moncoat MZ, 0.75-1.0 lb/100 lb seed potatoes.

or

Flutoloniil

Moncut, 0.71 - 1.1 lb/A in-furrow at planting with a minimum of 3 gal/A. 1.1 lb maximum per season.

or

Tops 2.5 D, 1 lb/100 lb seed.

or

Tops MZ 8.5 DS, 0.5 lb/100 lb seed.

or

PCNB

Blocker 4 F, an in-furrow application 5 - 10 pt/A applying at a rate of 10 - 20 gal water/A. Maximum of 10 pt per season (12months).

SILVER SCURF (*Helminthosporium solani*):

Fludioxinil

Maxim 0.5 D, 0.5 lb per 100 lb seed potatoes.

or

Maxim 4 FS, 0.08 fl oz/100 lb seed potatoes. **Note:** If Maxim 4 FS is used for potatoes for seed production, a labeled rate of mancozeb seed treatment dust must be applied to seed tubers after the Maxim 4 FS treatment.

or

Maxim MZ 0.5 D, 0.5 lb per 100 lb seed potatoes.

or

Moncoat MZ, 0.75 - 1.0 lb pre-plant per 100 lb seed. Maximum 1.0 lb per season.

Potatoes

DISINFECTION OF CUTTING KNIVES: Spray or mist surface of knives:

Quaternary ammonium compounds

Green Shield, 0.5 fl oz per gallon of water.

or

Hypochlorite 5.25% bleach, 1 part commercial formulation in 50 parts of water (2%).

PRE-PLANT TREATMENT:

WHITE MOLD (*Sclerotinia sclerotiorum*):

Coniothyrium Minitans

Contans, 1 - 4 lb.

IN FURROW AT PLANTING TREATMENTS:

For control of seed-borne and soil-borne diseases.

BLACK DOT (*Colletotrichum coccodes*):

Azoxystrobin

Quadris, in-furrow at planting at 6.1 - 9.2 fl oz/A (34" row spacing). Maximum 7.5 pt/A/per season. **Note:** A protectant partner such as an EDBC (mancozeb or metiram) or chlorothalonil product is recommended in the tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

RHIZOCTONIA DISEASE (*Rhizoctonia solani*):

Azoxystrobin

Quadris, in-furrow at planting at 6.1 - 9.2 fl oz/A (34" row spacing). Maximum of 7.5 pt/A/season. **Note:** A protectant partner such as an EDBC (mancozeb or metiram) or chlorothalonil product is recommended in the tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

or

Flutoloni

Moncut, 0.71 - 1.1 lb/A with a minimum of 3 gal/A. Maximum of 1.1 lb/season.

SILVER SCURF (*Helminthosporium solani*):

Azoxystrobin

Quadris, 6.2 to 9.2 fl oz. Maximum 7.5 pt/A/season.

Note: A protectant partner such as an EDBC (mancozeb or metiram) or chlorothalonil product is recommended in the tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

BLACK DOT, PINK ROT, PYTHIUM LEAK, PYTHIUM SEEDLING BLIGHT, RHIZOCTONIA STEM CANKER:

Quadris Ridomil Gold, 12.6 fl oz. (48 hours) See label for plantback restrictions.

PINK ROT (*Phytophthora erythroseptica*), **PYTHIUM LEAK** (*Pythium ultimum*):

Mono-, dibasic sodium, potassium and ammonium phosphites

Prophyt, 4 - 10 pt. Apply at least 3 gallons of mix per acre. Add Ridomil.

or

Cyazofamid

Ranman, 0.42 fl oz.

FOLIAR TREATMENT:

BLACK DOT (*Colletotrichum coccodes*):

Azoxystrobin/Chlorothalonil

Quadris Opti, 1.6 pt/A every 7 - 14 days. Maximum of 9.6 pt/season. (14 days).

or

Mandipropamid/Difenoconazole

Revus Top, 5.5-7 fl oz every 7-10 days. (14 days) Maximum 28 fl oz/A/season.

or

Potassium Bicarbonate

Armcarb 100, 2.5 to 5 lb every 5-14 days. (0 days)

EARLY BLIGHT (*Alternaria solani*): Apply every 5 to 7 days after emergence.

Iprodione

Iprodione 4L, 1 - 2 pt every 14-21 days. (14 days) Maximum 8 pt/A/season.

or

Nevado 4F, 1 - 2 pt every 14-21 days. (14 days) Maximum 8 pt/A/season.

or

Rovral 4 F, 1 to 2 pt. (7 days) See label for rotational crop and other restrictions.

or

Rovral 50 W, 2 lb. (14 days) See label for rotational crop restrictions.

Note: Garlic, dry bulb onions, broccoli, lettuce, peanuts, carrots, beans and potatoes can be rotated after harvest. Root crops, tomatoes and cotton may be rotated one month after last application.

or

Azoxystrobin

Quadris, 6.2 to 15.4 fl oz. Maximum 7.5 pt/A/per season.

Note: It is recommended that a protectant partner such as an EDBC (mancozeb or metiram) or chlorothalonil product is added in tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

or

Azoxystrobin/Chlorothalonil

Quadris Opti, 1.6 pt/A every 5 - 7 days. (14 days) Maximum of 9.6 pt/season.

or

Bacillus pumilis

Sonata, 4 - 8 pt/A every 5 - 7 days.

or

Bacillus subtilis

Serenade, 6 lb/A every 5 - 7 days.

or

Boscalid

Endura, 2.5 - 4.5 oz every 7 - 14 days. (30 days) Maximum of 20.5 oz/season.

or

Chlorothalonil

Applause 720, 1.0 to 1.5 pt. (7 days) Apply every 5-10 days. Do not apply more than 15 pt/A/season.

or

Bravo Ultrex, 0.9 to 1.4 lb. (7 days) Do not apply more than 14.5 lb in a growing season.

or

Bravo Weather Stik, 1 to 1.5 pt. (7 days) Do not apply more than 16 pt in a growing season.

or

Echo Zn, 1.5 to 2.2 pt. (7 days) Do not apply more than 21.5 pt in a growing season.

or

Equus 720 SST, 1 to 1.5 pt. (7 days) Do not apply more than 15 pt in a growing season.

or

Initiate 720, 1.0 to 1.5 pt. (7 days) Apply every 5-10 days. Maximum 15 pt/A/season.

Note: All chlorothalonil products may be applied through irrigation water.

or

Maneb

Maneb 80 WP, 1 1/2 to 2 lb. (3 days)

or

Mancozeb

Dithane DF Rainshield, *Dithane M-45*, 2 lb. (3 days) May be used through irrigation equipment.

or

Manex II, 3.2 pt. (3 days)

or

Manzate 75 DF, 1 to 2 lb. (3 days) May be used through irrigation equipment.

or

Penncozeb 75 DF, *Penncozeb 80 WP*, 2 lb. (3 days)

or

Polyram 80 DF, 2 lb. (3 days)

or

Famoxadone/Cymoxanil

Tanos, 6 oz/A every 7 to 10 days. (14 days) Maximum 3.0 lb/season.

or

Fenamidone

Reason 500 SC, 5.5 - 8.2 fl oz every 5 to 10 days. 24.6 fl oz maximum per season.. (7 days) **Note:** It is recommended that a protectant partner such as an EDBC (mancozeb or metiram) or chlorothalonil product is added in tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

or

Organotin-Based Compounds

Agritin 80 WP, *Supertin 80 WP*, 2.5 to 3.75 oz. (21 days) Use only in tank mixture with other fungicides. Do not apply more than 11.5 oz/acre in a growing season.

or

Pyraclostrobin

Headline 2 SC, 6-9 fl oz. (3 days) Do not apply more than 72 fl. oz per season. **Note:** It is recommended that a protectant partner such as an EDBC (mancozeb or metiram) or chlorothalonil product is added in tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

or

Pyrimethanil

Scala, 7 fl oz every 7 - 14 days. (7 days) Maximum of 35 fl oz per season. **Note:** It is recommended that a protectant partner such as an EDBC (mancozeb or metiram) or chlorothalonil product is added in tank mixture to any Qol product. Qol products should also be used in rotation with a fungicide with a different mode of action.

or

Trifloxystrobin

Gem 25 WDG, 6.0-8.0 oz. (7 days) Do not apply more than 48 oz. per season. **Note:** It is recommended that a protectant partner such as an EDBC (mancozeb or metiram) or chlorothalonil product is added in tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

or

Mancozeb/Zoxamide

Gavel 75 DF, 1.5 - 2.0 lb every 5 - 7 days. Maximum 12.0 lb/season.. (3 days)

or

Mandipropamid/Difenoconazole

Revus Top, 5.5-7 fl oz every 7-10 days. (14 days) Maximum 28 fl oz/A/season.

or

Potassium Bicarbonate

Armcarb 100, 2.5 to 5 lb every 5-14 days. (0 days)

or

Copper Hydroxide

Badge SC, 0.9 - 3.7 pt every 7-10 days.

C-O-C-S WDG, 1.5 to 4 lb every 7-10 days. (0 days)

Kentan DF, 3 lb every 7-10 days.

or

Copper Oxychloride / Copper Sulfate

Badge SC, 0.9 - 3.7 pt every 7-10 days.

C-O-C-S WDG, 1.5 to 4 lb every 7-10 days. (0 days)

Kentan DF, 3 lb every 7-10 days.

or

Copper Hydroxide/Copper Oxychloride

Badge SC, 0.9 - 3.7 pt every 7-10 days.

C-O-C-S WDG, 1.5 to 4 lb every 7-10 days. (0 days)

Kentan DF, 3 lb every 7-10 days.

or

Pyrimethanil/Trifloxystrobin

Distinguish 480SC, 10 fl oz every 7-14 days. (7 days) Maximum 50 fl oz/A/season.

or

Fluoxastrobin

Evito 480SC, 3.8 fl oz every 7-10 days. It is recommended that a protectant partner such as an EDBC (mancozeb or metiram) or chlorothalonil product is added in tank mixture to any strobilurine product.

Strobilurines should also be used in rotation with a fungicide with a different mode of action.

LATE BLIGHT (*Phytophthora infestans*): Apply after plants are 6 inches tall and every 5-7 days until vines are completely dead.

Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 2 lb. (7 days)

Ridomil Gold MZ, 2.5 lb. (7 days)

Potatoes

or

Ridomil Gold Copper, 2 lb. (7 days) Apply when foliage meets within the row and may be applied once more after 14 days. Use protectant fungicides between applications.

or

Mefenoxam/Copper Hydroxide

Ridomil Gold Bravo, 2 lb. (7 days)

Ridomil Gold MZ, 2.5 lb. (7 days)

or

Ridomil Gold Copper, 2 lb. (7 days) Apply when foliage meets within the row and may be applied once more after 14 days. Use protectant fungicides between applications.

or

Mefenoxam/Mancozeb

Ridomil Gold Bravo, 2 lb. (7 days)

Ridomil Gold MZ, 2.5 lb. (7 days)

or

Ridomil Gold Copper, 2 lb. (7 days) Apply when foliage meets within the row and may be applied once more after 14 days. Use protectant fungicides between applications.

or

Azoxystrobin

Quadris, 6.2-15.4 fl oz.

Note: It is recommended that a protectant partner such as an EBDC (mancozeb or metiram) or chlorothalonil product is added in tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

or

Azoxystrobin/Chlorothalonil

Quadris Opti, 1.6 pt/A every 5 - 7 days. (14 days) Maximum 9.6 pt/season.

or

Bacillus subtilis

Serenade, 6 lb/A every 5 - 7 days.

or

Bacillus pumilis

Sonata, 4 - 8 pt/A every 5 - 7 days.

or

Boscalid

Endura, 2.5 - 4.5 oz every 7 - 14 days. (30 days) Maximum 20.5 oz/season.

or

Chlorothalonil

Applause 720, 1.0 to 1.5 pt. (7 days) Apply every 5-10 days. Do not apply more than 15 pt/A/season.

or

Bravo Ultrex, 0.9 to 1.4 lb. (7 days)

or

Bravo Weather Stik, 1 to 1.5 pt. (7 days) Do not apply more than 16 pt in a growing season.

or

Bravo Weather Stik Zn, 1.0 to 1.5 pt. (7 days) Do not apply more than 16 pt in a growing season.

or

Echo Zn, 1.5 to 2 pt/A. (7 days) Do not apply more than 21.5 pt in a growing season.

or

Equus 720 SST, 1 to 1.5 pt. (7 days) Do not apply more than 15 pt in a growing season.

or

Initiate 720, 1.0 to 1.5 pt. (7 days) Apply every 5-10 days.

Maximum 15 pt/A/season.

Note: All chlorothalonil products may be applied through irrigation water.

or

Copper Hydroxide

Badge SC, 0.9 - 3.7 pt every 7-10 days.

Champ Formula 2 F, 1 1/3 to 2 pt. (0 days)

C-O-C-S WDG, 1.5 to 4 lb every 7-10 days. (0 days)

Kocide 2.4 LF, 2 lb. (0 days)

Note: During growing season, use copper-based compounds in mixture with chlorothalonil.

or

Copper-based compounds

Badge SC, 0.9 - 3.7 pt every 7-10 days.

Champ Formula 2 F, 1 1/3 to 2 pt. (0 days)

C-O-C-S WDG, 1.5 to 4 lb every 7-10 days. (0 days)

Kocide 2.4 LF, 2 lb. (0 days)

Note: During growing season, use copper-based compounds in mixture with chlorothalonil.

or

Copper Oxychloride / Copper Sulfate

Badge SC, 0.9 - 3.7 pt every 7-10 days.

Champ Formula 2 F, 1 1/3 to 2 pt. (0 days)

C-O-C-S WDG, 1.5 to 4 lb every 7-10 days. (0 days)

Kocide 2.4 LF, 2 lb. (0 days)

Note: During growing season, use copper-based compounds in mixture with chlorothalonil.

or

Copper Hydroxide/Copper Oxychloride

Badge SC, 0.9 - 3.7 pt every 7-10 days.

Champ Formula 2 F, 1 1/3 to 2 pt. (0 days)

C-O-C-S WDG, 1.5 to 4 lb every 7-10 days. (0 days)

Kocide 2.4 LF, 2 lb. (0 days)

Note: During growing season, use copper-based compounds in mixture with chlorothalonil.

or

Cymoxanil

Curzate 60 DF, 0.21 lb. (14 days) Use only in tank mixture with other fungicides from when foliage meets within rows to early senescence. May be used to prevent spread to uninfected foliage from within infected fields. Must be mixed with a fungicide partner such as an EBDC or chlorothalonil

or

Dimethomorph

Acrobat 50 WP, 4 to 6.4 oz. (4 days) Use from when foliage meets within rows to late senescence. May be used to prevent spread to uninfected foliage from within infected fields. Must be mixed with a fungicide partner such as an EBDC or chlorothalonil.

or

Acrobat MZ, 2.25 lb. (14 days) Use from when foliage meets within rows to late senescence. May be used to prevent spread to uninfected foliage from within infected fields.

or

Forum, 4 to 6 fl oz. (4 days) Use from when foliage meets within rows to late senescence. May be used to prevent spread to uninfected foliage from within infected fields. Must be mixed with a fungicide partner such as an EBDC or chlorothalonil.

or

Dimethomorph and Mancozeb

Acrobat 50 WP, 4 to 6.4 oz. (4 days) Use from when foliage meets within rows to late senescence. May be used to prevent spread to uninfected foliage from within infected fields. Must be mixed with a fungicide partner such as an EBDC or chlorothalonil.

or

Acrobat MZ, 2.25 lb. (14 days) Use from when foliage meets within rows to late senescence. May be used to prevent spread to uninfected foliage from within infected fields.

or

Forum, 4 to 6 fl oz. (4 days) Use from when foliage meets within rows to late senescence. May be used to prevent spread to uninfected foliage from within infected fields. Must be mixed with a fungicide partner such as an EBDC or chlorothalonil.

or

Mancozeb

Dithane DF Rainshield (2 lb) or *Manzate 75 DF* (1 to 2 lb) (3 days) May be used through irrigation equipment.

or

Manex II, 3.2 pt. (3 days)

or

Penncozeb 75 DF (2 lb) or *Penncozeb 80 WP* (1 to 2 lb) (3 days)

or

Polyram 80 DF, 2 lb. (3 days)

or

Famoxadone/Cymoxanil

Tanos, 6 - 8 oz/A every 7 to 10 days. (14 days)
Maximum 3.0 lb/season.

or

Fenamidone

Reason 500 SC, 5.5 - 8.2 fl oz every 5 to 10 days. (7 days) Maximum 24.6 fl oz/season.

Note: It is recommended that a protectant partner such as an EBDC (mancozeb or metiram) or chlorothalonil product is added in tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

or

Organotin-Based Compounds

Agritin 80 WP, *Supertin 80 WP*, 2.5 to 3.75 oz. (21 days) Use only in tank mixture with other fungicides. Do not apply more than 11.5 oz per growing season.

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 3.75 - 10 pt/A every 5 to 10 days. **Note:** It is recommended that a protectant partner such as an EBDC (mancozeb or metiram) or chlorothalonil product is added in tank mixture.

or

Prophyt, 4 pt every 5-10 days.

or

Propamocarb

Previcur Flex, 0.9 to 1.2 pt/acre depending on disease pressure; with chlorothalonil-based product at 2/3 rate or with EBDC-based product at 2/3 rate. (14 days)

or

Pyraclostrobin

Headline 2 SC, 6-9 fl oz. (3 days) Do not apply more than 72 fl. oz per season. **Note:** It is recommended that a protectant partner such as an EBDC (mancozeb or metiram) or chlorothalonil product is added in tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

or

Trifloxystrobin

Gem 25 WDG, 6.0-8.0 oz. (7 days) Do not apply more than 48 oz. per season. **Note:** It is recommended that a protectant partner such as an EBDC (mancozeb or metiram) or chlorothalonil product is added in tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

or

Mancozeb/Zoxamide

Gavel 75 DF, 1.5 - 2.0 lb every 5 - 7 days. (3 days) Maximum 12.0 lb/season.

or

Maneb

Maneb 80 WP, 1 1/2 to 2 lb. (3 days)

or

Fluazinam

Omega 500 F, 5.5 fl oz/A. (14 days) Do not apply more than 3.5 pt in a growing season.

or

Mandipropamid/Difenoconazole

Revus Top, 5.5-7 fl oz every 7-10 days. (14 days) Maximum 28 fl oz/A/season.

or

Fluoxastrobin

Evito 480SC, 3.8 fl oz every 7-10 days. It is recommended that a protectant partner such as an EBDC (mancozeb or metiram) or chlorothalonil product is added in tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

or

Fluopicolide

Presidio, 3-4 fl oz every 10 days. (7 days)

or

Cyazofamid

Ranman, 1.4 to 2.75 fl oz every 7 to 10 days. (7 days) Maximum 27.5 fl oz/A/season.

LATE BLIGHT TUBER ROT (*Phytophthora infestans*), **LEAK**

(*Phythium* spp.), **PINK ROT** (*Phytophthora erythroseptica*): Apply at flowering and again 14 days later.

Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, or *Ridomil Gold Copper* (2 lb) or *Ridomil Gold MZ* (2.5 lb) (21 days) Apply when foliage meets within the row and may be applied once more after 14 days. Use protectant fungicides between applications.

Potatoes

or

Mefenoxam/Copper Hydroxide

Ridomil Gold Bravo, or *Ridomil Gold Copper* (2 lb) or *Ridomil Gold MZ* (2.5 lb) (21 days) Apply when foliage meets within the row and may be applied once more after 14 days. Use protectant fungicides between applications.

or

Mefenoxam/Mancozeb

Ridomil Gold Bravo, or *Ridomil Gold Copper* (2 lb) or *Ridomil Gold MZ* (2.5 lb) (21 days) Apply when foliage meets within the row and may be applied once more after 14 days. Use protectant fungicides between applications.

BOTRYTIS BLIGHT (*Botrytis cinerea*): Apply after mid-season when disease symptoms are likely to appear.

Chlorothalonil

Applause 720, 1.0 to 1.5 pt. (7 days) Apply every 5-10 days. Do not apply more than 15 pt/A/season.

or

Bravo Ultrex, 0.9 to 1.4 lb. (7 days) Do not apply more than 21.5 lb in a growing season.

or

Bravo Weather Stik, *Equus 720 SST*, 1 to 1.5 pt. (7 days) Do not apply more than 15 pt in a growing season.

or

Echo Zn, 1.5 to 2.2 pt. (7 days) Do not apply more than 21.5 pt in a growing season.

or

Initiate 720, 1.0 to 1.5 pt. (7 days) Apply every 5-10 days. Maximum 15 pt/A/season.

Note: All chlorothalonil products may be applied through irrigation water.

or

Mancozeb

Dithane DF Rainshield, 2 lb. (3 days) May be used through irrigation equipment.

or

Manzate 75 DF, 1 to 2 lb. (3 days)

or

Penncozeb 75 DF (2 lb) or *Penncozeb 80 WP* (1 to 2 lb) (3 days)

or

Polyram 80 DF, 2 lb. (3 days)

or

Maneb

Maneb 80 WP, 1 1/2 to 2 lb. (3 days)

Manex 4 F, 3.2 pt. (3 days)

WHITE MOLD (*Sclerotinia sclerotiorum*): Apply at first sign of disease or immediately prior to row closing, and again 28 days later if needed.

Fluazinam

Omega 500 F, 5.5 fl oz. (14 days) Do not apply more than 3.5 pt in a growing season.

or

Iprodione

Iprodione 4L, 1 - 2 pt every 14-21 days. (14 days) Maximum 8 pt/A/season.

or

Nevado 4F, 1 - 2 pt every 14-21 days. (14 days) Maximum 8 pt/A/season.

or

Rovral 4 F, 2 pt in at least 10 gallons of water per acre. (14 days) See label for rotational crop restrictions.

or

Thiophanate-Methyl

Topsin M 70 WSB, 1-2 lb. (21 days) Do not apply more than 4 lb per season.

or

Boscalid

Endura, 5.5 - 10 oz/A every 14 days. (30 days) Maximum 20.5 oz/season.

BROWN LEAF SPOT (*Alternaria alternata*):

Mandipropamid/Difenoconazole

Revus Top, 5.5-7 fl oz every 7-10 days. (14 days) Maximum 28 fl oz/A/season.

or

Famoxadone/Cymoxanil

Tanos DF, 6 oz every 7-10 days. (14) Maximum 3 lb/A/season. It is recommended that a protectant partner such as an EBDC (mancozeb or metiram) or chlorothalonil product is added in tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

PRE-HARVEST SPRAYS:

LATE BLIGHT: When vines are seriously infected at harvest time. Apply as necessary.

Blue Viking Star Glow Powder 100 SC, 10 lb.

Blue Viking Star Shine Crystals 100 SC, 10 lb.

Note: The Blue Viking Concentrates should only be applied at vine-kill as they are phytotoxic.

or

Copper Hydroxide

Champ Formula 2 F, 2 to 5 pt.

or

Copper-based compounds

Kocide 2.4 LF, 2 lb.

STORAGE DISINFECTION:

To disinfect storages, boxes, truck beds, bags and equipment (tools, farm machinery), spray or drench surfaces with one of the following compounds:

Sodium Hypochlorite

Chlorine solution, 1,000 to 2,000 ppm concentration.

Commercial formulations vary in concentration; therefore, follow manufacturer's recommendation when mixing solutions.

Example: Perchlorin is a granule containing 70% calcium hypochlorite.

It takes 5 teaspoons in 3 gallons of water to make a solution of 1,000 ppm. Rinse food containers and implements that come in contact with food after treatment.

or

Quaternary ammonium compounds

Aquahyme (E-Z Flo), Use according to manufacturer's recommendations.

or

Green Shield, 0.5 fl oz per gallon of water.

or

Hy 2389 (Rohm & Haas), Use according to manufacturer's recommendations.

or

Odorless Disinfectant (Haviland), Use according to manufacturer's recommendations.

The addition of a wetting agent with quaternary ammonium sprays or drenches is suggested to obtain more uniform coverage of surfaces. Use only those wetting agents recommended by the manufacturer because some are not compatible. Rinse food containers and implements that come in contact with food after treatment.

or

Soluble copper sulfate (blue vitriol; bluestone; etc.), 10 to 15 lb in 100 gallons of water.

or

Hydrogen peroxide

Oxidate, 1.5 to 2.5 fl oz per 100 gal water. Apply at 1 gal of solution per 2000 lb of tubers.

Note: It is important to remove all dirt and trash from surfaces to be treated.

PRE-STORAGE TREATMENTS FOR STORAGE DISEASES:

BACTERIAL SOFT ROT (*Erwinia carotovora*): Wash potatoes in chlorinated water to (1) disinfect tuber surfaces; (2) cauterize wounds; and (3) promote rapid formation of protective tissue over injured surfaces.

Hydrogen peroxide

Oxidate, 1.5 to 2.5 fl oz per 100 gal water. Apply at 1 gal of solution per 2000 lb of tubers. May also be applied in humidification water (see manufacturers' recommendations).

or

Sodium Hypochlorite

Chlorine solution. Add a concentrated stock solution of chlorine to wash water to give a concentration of 200 ppm (= 2 pt household bleach (5.25% sodium hypochlorite) per 60 gallons of water or 1 gal of bleach per 240 gallons of water).

Mix stock solutions of chlorine in earthen-ware crocks or plastic containers. DO NOT USE metal containers. Dry washed potatoes before bagging or bulk storing by passing hot air over the end of the sorting table. Usually, the sponge drying technique is inadequate without the addition of heat.

FUSARIUM DRY ROT (*Fusarium* spp.):

Hydrogen peroxide

Oxidate, 1.5 to 2.5 fl oz per 100 gal water. Apply at 1 gal of solution per 2000 lb of tubers. May also be applied in humidification water (see manufacturers' recommendations).

or

Thiabendazole

Mertect 340, 42 oz flowable formulation in 100 gallons of water.

Apply as a spray to potato tubers (seed and table stock) at time of storage and again at removal; 1 gal of solution per 2,000 lb of tubers. See manufacturer's recommendations for equipment and methods to use. Treatment may be applied to washed or unwashed potatoes. Addition of chlorine (200 ppm) to solution

will help control bacterial soft rot. It is advisable to add a wetting agent when treating before storage to ensure good coverage.

LATE BLIGHT (*Phytophthora infestans*):

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 0.1 gal/ton. Apply at 2-4 pt/2000 lb of tubers.

or

Prophyt, 13 fl oz/ton.

PINK ROT (*Phytophthora erythroseptica*):

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 0.1 gal/ton. Apply at 2-4 pt/2000 lb of tubers.

Prophyt, 13 fl oz/ton.

PYTHIUM LEAK (*Pythium ultimum*):

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 0.1 gal/ton. Apply at 2-4 pt/2000 lb of tubers.

Pumpkins

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Pumpkins are hosts for root-knot and lesion nematodes. These nematodes can reduce pumpkin yields but yield losses in Michigan have not been documented. If you suspect nematodes are reducing pumpkin yields collect root and soil samples for analysis as described in Appendix C. If the numbers of nematodes recovered from those samples exceed damage thresholds; control options will be suggested. Vydate 2L is labeled for use in pumpkins.

INSECTS

SEED TREATMENT:

SEED CORN MAGGOT:

Lorsban 50 SL, 2 oz/100 lb seed. See label for directions. (RUP)

SOIL TREATMENT:

CUCUMBER BEETLE (STRIPED and SPOTTED), APHIDS,

THRIPS: Apply to soil in a narrow band 14 or less days before planting, as an in-furrow spray at planting, as a post-seeding drench, as a sidedress after plants are established or in drip or trickle irrigation water. Do not make more than 1 application per year.

Imidacloprid

Admire Pro, 7.0 - 10.5 fl oz. (21 days)

Nuprid 2 F, 16 to 24 oz. (21 days)

CUCUMBER BEETLE:

Furadan 4 F, 2.4 oz/1000 ft of row. Apply at planting or transplanting in a 7-inch band, incorporate into the top 3 inches of soil, or apply into the furrow and mix with the covering soil. (Special Michigan SLN label.) (RUP)

Pumpkins

APHIDS, FLEA BEETLE, LEAFHOPPER, THRIPS, CUCUMBER BEETLE:

Platinum, 5 to 11 oz. (30 days) See label for application methods.

APHIDS, THRIPS, SQUASH BUG:

Venom, 5 to 6 oz. (21 days) See label for application methods

FOLIAR TREATMENT:

Pumpkin plants may be sensitive to insecticide formulations under certain conditions. Be sure a problem exists before treatment.

Read and observe restrictions or the label. To avoid killing bees, do not treat pumpkins during bloom. See the Insecticide Effectiveness table for bee toxicity.

CUTWORM: Apply when damage is first seen and repeat as needed.

* *Asana* XL, 5.8 to 9.6 oz. (3 days) (RUP)

or

* *Baythroid* XL, 0.8 to 1.6 fl oz. (0 days) (RUP)

or

* Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.6 to 6.4 oz. (3 days) (RUP)

or

* Permethrin

Ambush 25 W, 12.8 oz. (0 days) (RUP)

or

Perm-UP 3.2 EC (8 oz) or *Pounce* 25 WP (12.8 oz) or *Pounce* 3.2 EC (8 oz) (0 days) (RUP)

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

STRIPED and SPOTTED CUCUMBER BEETLE: Apply as soon as beetle are seen and repeat as needed to prevent bacterial wilt disease.

Asana XL, 5.8 to 9.6 oz. (3 days) (RUP)

or

Baythroid XL, 2.4 to 2.8 fl oz. (0 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.6 to 6.4 oz. (3 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin* XLR Plus (1 qt) (3 days)

or

Endosulfan 3 EC, 1 qt. (2 days)

or

Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (0 days) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz) or *Pounce* 3.2 EC (4 to 8 oz) (0 days) (RUP)

or

Danitol 2.4 EC, 10 2/3 to 16 fl oz. (7 days) (RUP)

or

Venom, 3 to 4 oz. (1 day)

or

Actara, 3 to 5.5 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

or

Assail 30 SG, 2.5 to 5.3 oz. (0 days)

FLEA BEETLE: Apply as needed.

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin* XLR Plus (1 qt) (3 days)

or

Actara, 1.5 to 3 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

LEAFHOPPERS: Apply when damage is seen.

Asana XL, 5.8 to 9.6 oz. (3 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.6 to 6.4 oz. (3 days) (RUP)

or

Venom, 1 to 4 oz. (1 day)

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

SQUASH BUG: Apply as needed.

* *Asana* XL, 5.8 to 9.6 oz. (3 days) (RUP)

or

* Permethrin

Ambush 25 W, 12.8 oz. (0 days) (RUP)

or

Perm-UP 3.2 EC (8 oz) or *Pounce* 25 WP (12.8 oz) or *Pounce* 3.2 EC (8 oz) (0 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin* XLR Plus (1 qt) (3 days)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.6 to 6.4 oz. (3 days) (RUP)

or

Venom, 3 to 4 oz. (1 day)

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

or

Assail 30 SG, 5.3 oz. (0 days)

SQUASH VINE BORER: Apply to base of plants when moths are active, usually starting when plants start to vine. Repeat every 3 to 5 days for 3 weeks.

Asana XL, 5.8 to 9.6 oz. (3 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.6 to 6.4 oz. (3 days) (RUP)

or

Endosulfan 3 EC, 1 qt. (2 days)

or

Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (0 days) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz) or *Pounce* 3.2 EC (4 to 8 oz) (0 days) (RUP)

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

or

Assail 30 SG, 5.3 oz. (0 days)

APHIDS: Apply as needed to prevent disease transmission to plants. Repeat as needed.

Endosulfan 3 EC, 1 qt. (2 days)

or

Fulfill, 2.75 oz. (0 days) Do not exceed 5.5 oz/acre per season.

May require 5 to 7 days for aphid mortality.

or

Malathion 57 EC, 1 1/2 pt. (3 days)

or

Venom, 1 to 4 oz. (1 day)

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Actara, 1.5 to 3 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Assail 30 SG, 2.5 to 4 oz. (0 days)

MITES

Apply when needed. Usually a problem only in hot dry weather.

Agri-Mek 0.15 EC, 8 to 16 fl oz. (7 days) (RUP)

or

Bifenthrin

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 5.1 to 6.4 oz. (3 days) (RUP)

or

Danitol 2.4 EC, 10 2/3 fl oz. (7 days) (RUP)

or

Malathion 57 EC, 1 1/2 pt. (3 days)

or

Oberon 2 SC, 7 to 8.5 fl oz. (7 days)

SLUGS

Deadline M-Ps 4% (20 to 40 lb) or *Metaldehyde* 3.5 G (30 to 40 lb) Apply between rows. Avoid contact with edible product.

DISEASES**SEED TREATMENT:**

DAMPING OFF (*Pythium* spp., *Phytophthora* spp., *Rhizoctonia solani*): Use only as directed; over-treatment may cause injury.

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only.

or

Captan

Captan 30-DD, 1 2/3 oz/100 lb seed.

Captan 400, 1 1/2 to 2 oz/100 lb seed.

or

Thiram

42-S Thiram, *Thiram* 50 WP Dyed, 4 1/2 oz/100 lb seed.

PRE-PLANT FUMIGATION:

PHYTOPHTHORA: Apply to production fields before planting.

Note: Most fumigants applied to the soil for control of disease organisms will also control soil insects, nematodes and weed seeds.

Soil sterilization by fumigation is best achieved by proper application of material. Correct soil moisture, temperature, and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or immediate tarping.

1,3 Dichloropropene/chloropicrin

Telone C35, 13-35 gal. (RUP)

or

Metam Sodium

Sectagon 42, *Vapam* HL, 37.5-75 gal.

or

Potassium N-methylidithiocarbamate

Sectagon-K54, 30-60 gal.

Do not plant for 14 to 30 days after treatment (the wetter the soil, the longer the waiting period).

GREENHOUSE PREPLANT INCORPORATION:

DAMPING OFF (*Pythium* spp.), **ROOT ROT** (*Rhizoctonia* spp.):

Gliocladium virens GL-21

SoilGard 12 G, 1 to 1.5 lb per cubic yard.

Biological control product that needs to be applied before disease development. Control may be limited under heavy disease pressure.

PREPLANT INCORPORATED:

DAMPING OFF and COTTONY LEAK (*Pythium* spp.):

* Mefenoxam. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold SL, 1-2 pt.

Ultra Flourish, 2 to 4 pt.

FOLIAR TREATMENT:

ALTERNARIA LEAF SPOT (*Alternaria cucumerina*),

ANTHRACNOSE (*Colletotrichum lagenarium*): Apply every 7 to 14 days after disease appears.

* Azoxystrobin

Amistar, 3.5 to 5 oz. (1 day)

Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

Pumpkins

or

* Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

* Chlorothalonil

Bravo Ultrex (1.4 to 1.8 lb (*Anthraco*) or 1.8 to 2.7 lb (*Alternaria*)) or *Equus* DF (1.4 to 1.8 lb) (0 days)

or

Bravo Weather Stik, *Echo* 720, *Equus* 720 SST, 1.5 to 2 pt, (*Anthraco*) or 2 to 3 pt (*Alternaria*). (0 days)

or

Echo 90 DF, 1.3 to 1.6 lb every 7 days. (0 days)

or

* Pyraclostrobin

Cabrio, 12-16 oz. (0 days) No more than 2 consecutive applications before alternating with a fungicide having a different mode of action.

or

* Pyraclostrobin/Boscalid

Pristine, 12.5 to 18.5 oz for *Alternaria*, 18.5 oz for *Anthraco*. (0 days)

or

* Thiophanate-Methyl

Topsin 4.5 FL, 10 fl oz. (1 day)

or

Topsin 70 W, *Topsin* M WSB 1/4 to 1/2 lb (*Anthraco*) (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 1 to 2 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, *Kocide* 4.5 LF, 1 1/3 pt. (0 days)

Champion WP, 1.5 to 3 lb. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 to 4 pt. (0 days)

or

Copper Oxychloride / Copper Sulfate

C-O-C-S WDG, 2 to 4 lb every 7 days. (0 days)

or

Copper Sulfate

Cuprofix Ultra, 1.25 lb. (0 days)

or

Famoxadone/Cymoxanil

Tanos, 8 oz. (3 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Potassium Bicarbonate

Armcarb 100, 2.5 to 5 lb.

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

ANGULAR LEAF SPOT (*Pseudomonas lachrymans*): Spray every 7 days, starting before the first fruit forms and continue to protect fruit at all stages of development.

Copper Ammonium Carbonate

Copper Count N, 1 to 2 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, *Kocide* 4.5 LF, 1 1/3 pt. (0 days)

Champion WP, 1.5 to 3 lb. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 to 4 pt. (0 days)

or

Copper Sulfate

Cuprofix Ultra, 1.25 lb. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

SCAB (*Cladosporium cucumerinum*): Apply every 7 to 10 days after plants are 2 to 3 inches tall.

* Chlorothalonil

Bravo Ultrex, *Equus* DF, 1.8 to 2.7 lb. (0 days)

Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or

Bravo Weather Stik, *Echo* 720, *Equus* 720 SST, 2 to 3 pt. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

POWDERY MILDEW (*Sphaerotheca fuliginea*, *Erysiphe cichoracearum*): Treat at disease appearance and at 7-day intervals.

* Myclobutanil

Rally 40 WSP, 2.5 to 5 oz, 7 to 10 day schedule. (0 days) Do not apply more than 1.5 lb per acre per crop.

or

* Pyraclostrobin

Cabrio, 12-16 oz. (0 days) Alternate one-to-one with fungicides having a different mode of action.

or

* Pyraclostrobin/Boscalid

Pristine, 12.5 to 18.5 oz. (0 days)

or

* Thiophanate-Methyl

Topsin 4.5 FL, 10 fl oz. (1 day)

Topsin 70 W, *Topsin* M WSB, 1/4 to 1/2 lb. (0 days)

or

* Trifloxystrobin

Flint, 1 1/2 to 2 oz, 7- to 14-day intervals. (0 days) Maximum 2 consecutive applications, 4 applications/year and 16 oz/season.

or

Azoxystrobin

Amistar, 3.5 to 5 oz. (1 day)

Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

Bacillus subtilis

Serenade, 6 to 8 lb every 7 days. (0 days)

Serenade Max, 1 - 3 lb every 7 to 10 days. (0 days)

Biological control product that needs to be applied before disease development. Control will be limited under heavy disease pressure.

or

Chlorothalonil

Bravo Ultrex, Equus DF, 1.8 to 2.7 lb (*Sphaerotheca*). (0 days)

Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or

Bravo Weather Stik, Echo 720, Equus 720 SST, 2 to 3 pt (*Sphaerotheca*). (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 1 to 2 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, Kocide 4.5 LF, 1 1/3 pt. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 to 4 pt. (0 days)

or

Champion WP, Kocide 101, Kocide DF, Nu-Cop 50 DF, 1 1/2 to 3 lb. (0 days)

or

Copper Sulfate

Cuprofix Ultra, 1.25 lb. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Potassium Bicarbonate

Armcarb 100, 2.5 to 5 lb. (0 days)

or

Sulfur

Microthiol Disperss, 5 to 10 lb. (0 days)

Thiolux Jet, 4 to 6 lb, 10- to 14-day intervals. (0 days)

or

Triflumizole

Procur 480 SC, 4 to 8 fl oz every 7-14 days. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

or

Tebuconazole

Folicur 3.6F, 4-6 fl oz. (7 days) 12 hr REI.

GUMMY STEM BLIGHT, BLACK ROT (*Didymella bryoniae* also called *Mycosphaerella melonis*): Begin at the 2-leaf stage and apply every 7 to 14 days.

* Azoxystrobin

Amistar (3.5 to 5 oz) or Quadris (11.0 to 15.4 fl oz) (1 day) Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action

or

* Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

* Chlorothalonil

Bravo Ultrex, Equus DF, 1.8 to 2.7 lb. (0 days)

Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or

Bravo Weather Stik, Echo 720, Equus 720 SST, 2 to 3 pt. (0 days)

or

* Thiophanate-Methyl

Topsin 4.5 FL, 10 fl oz. (1 day)

Topsin M 70 WP, Topsin M WSB, 1/4 to 1/2 lb. (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 1 to 2 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, Kocide 4.5 LF, 1 1/3 pt. (0 days)

Champion WP, 1.5 to 3 lb. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 to 4 pt. (0 days)

or

Copper Sulfate

Cuprofix Ultra, 1.25 lb. (0 days)

or

Pyraclostrobin/Boscalid

Pristine, 12.5 to 18.5 oz. (0 days)

or

Tebuconazole

Folicur 3.6F, 8 fl oz. (7 days) Approved for gummy stem blight. Suppression only.

DOWNY MILDEW (*Pseudoperonospora cubensis*): Begin applications when conditions are favorable for disease, but before infection.

* Propamocarb

Previcur Flex, 1.2 pt every 7 - 14 days. (2 days)

or

* Cyazofamid

Ranman, 2.1 to 2.75 fl oz every 7 to 10 days. (0 days)

or

* Cymoxanil

Curzate 60 DF, 3.2 oz every 5 - 7 days. (3 days)

or

* Famoxadone/Cymoxanil

Tanos, 8 oz. (3 days)

or

* Chlorothalonil

Bravo Ultrex, Equus DF, 1.8 to 2.7 lb. (0 days)

Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or

Radishes

Bravo Weather Stik, Echo 720, Equus 720 SST, 2 to 3 pt.
(0 days)

or

* Fluopicolide

Presidio, 3-4 fl oz. (2 days)

or

Azoxystrobin

Amistar, 3.5 to 5 oz. (1 day)

Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

Dimethomorph

Acrobat 50 WP, 6.4 oz. (0 days) Tank mix with other fungicide.

Forum, 6 fl oz. (0 days)

or

Fenamidone

Reason 500 SC, 5.5 fl oz every 5 to 10 days. (14 days)

or

Fosetyl-Aluminum

Aliette WDG, 2 to 5 lb, 7- to 14-day intervals. (0 days) Do not tank mix with copper fungicides.

or

Maneb

Maneb 75 DF, Maneb 80 WP, 1.5 to 2 lb. (5 days)

Manex, 2.4 to 3.2 pt. (5 days)

or

Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 2 lb. Do not apply to mature or senescent plants. Maximum 4 applications.

or

Mefenoxam/Copper Hydroxide

Ridomil Gold Copper, 2 lb. (5 days) Maximum 4 applications.

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 2.5 to 5 pt every 7 - 14 days. (0 days)

Prophyt, 2 to 4 pt. (0 days)

or

Neem Oil

Trilogy, 2 pt.

or

Potassium Bicarbonate

Armcarb 100, 2.5 to 5 lb.

or

Pyraclostrobin

Cabrio, 8-12 oz. (0 days) Alternate one-to-one with fungicides having a different mode of action.

or

Pyraclostrobin/Boscalid

Pristine, 12.5 to 18.5 oz. (0 days)

or

Trifloxystrobin

Flint, 4 oz, 7- to 14-day intervals. (0 days) Maximum 2 consecutive applications, 4 applications/year and 16 oz/season. Alternate with Ridomil Gold Bravo.

or

Mono-, dibasic sodium salts of phosphorous acid

Fosphite, 1 to 3 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)

or

Mandipropamid

Revus, 8 fl oz. (0 day)

PHYTOPHTHORA ROOT and FRUIT ROT (*Phytophthora* spp.):

* Dimethomorph

Acrobat 50 WP, 6.4 oz every 7 days. (0 days)

Forum, 6 fl oz. (0 days)

or

* Famoxadone/Cymoxanil

Tanos, 8 - 10 oz every 5 - 7 days. (3 days)

or

* Fluopicolide

Presidio, 3-4 fl oz. (2 days)

or

* Fosetyl-Aluminum

Aliette WDG, 2 to 5 lb, 7- to 14-day intervals. (0 days) Do not tank mix with copper fungicides.

or

* Mandipropamid

Revus, 8 fl oz. (0 day)

or

Cyazofamid

Ranman, 2.75 fl oz every 7 to 10 days. (0 days)

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 2.5 to 5 pt every 7 - 14 days. (0 days)

Prophyt, 4 pt. (0 days) See label.

or

Mono-, dibasic sodium salts of phosphorous acid

Fosphite, 1 to 3 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)

Note: Most fungicides applied to control downy mildew may have limited efficacy against Phytophthora root and fruit rot.

Radishes

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Root-knot nematodes can reduce radish yields. Fields with soil or root problems of undetermined cause should be tested for nematodes (see Appendix C). If the root-knot nematode is present at a population density above the economical threshold for radishes, crop rotation or application of a nematicide is recommended. The following nematicide is suitable for control of root-knot nematodes in radish production. Application is only needed before the first crop. The radish life cycle is shorter than

that of the northern root-knot nematode and radishes serve as a good trap crop for this nematode.

FALL SOIL TREATMENT (BROADCAST): 1,3-D

Telone II, 25 gal/A (muck soil).

Fumigate in the fall when soil temperatures at a 6 inch depth are above 50F. Inject the fumigant to soil depth of 6 inches and lightly seal the soil immediately after application. Use soil fumigants only as directed on the label. In some limited situations soil fumigants can be applied in the spring in Michigan.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

INSECTS

SOIL TREATMENT:

CABBAGE MAGGOT:

Lorsban 15 G (3.3 oz/1,000 ft of row, in row with seed at time of planting) or *Lorsban 4 E / Lorsban Advanced* (1 fl oz/1,000 ft of row, in row with seed at time of planting) (RUP)

APHIDS, FLEA BEETLE: See label for application method.

Imidacloprid

Admire Pro, 4.4 - 10.5 fl oz. (21 days)

Nuprid 2 F, 10 to 24 oz. (21 days)

or

Platinum, 5 to 6.5 fl oz.

FOLIAR TREATMENT:

ARMYWORM, CUTWORM: Apply as needed.

Asana XL, 5.8 to 9.6 oz. (7 days) (RUP)

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 to 2 1/2 lb) or *Sevin XLR Plus* (1 to 2 qt) (7 days)

or

Entrust, 1 to 2 oz. (3 days)

or

SpinTor 2 SC, 3 to 6 oz. (3 days)

or

Radiant SC, 6 to 8 fl oz. (3 days) Do not make more than 3 applications or exceed 24 fl oz/acre per season.

FLEA BEETLE: Apply when damage is first seen. Repeat if needed.

Actara, 1.5 to 3 oz. (7 days)

or

Asana XL, 5.8 to 9.6 oz. (7 days) (RUP)

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S (2/3 to 1 1/4 lb) or *Sevin XLR Plus* (1/2 to 1 qt) (7 days)

or

Diazinon AG 500, 1 pt. (14 days) (RUP)

or

Imidacloprid

Nuprid 1.6 F, *Provado 1.6 F*, 3.5 fl oz. (7 days) Do not exceed 3.5 oz/Acre per season.

CABBAGE "WORM": Apply as needed.

Bacillus thuringiensis

Agree, *Biobit*, *Dipel*, *Javelin*, *Lepinox*. (0 days)

APHIDS: Apply as necessary.

Actara, 1.5 to 3 oz. (7 days)

or

Diazinon AG 500, 1 pt. (14 days) (RUP)

or

Malathion 57 EC, 2 pt. (7 days)

or

Imidacloprid

Nuprid 1.6 F, *Provado 1.6 F*, 3.5 fl oz. (7 days) Do not exceed 3.5 oz/Acre per season.

SLUGS

Deadline M-Ps 4% (20 to 40 lb) or *Metaldehyde 3.5 G* (30 to 40 lb) Apply between rows. Avoid contact with edible product.

DISEASES

SEED TREATMENT:

DAMPING OFF (*Pythium* spp., *Rhizoctonia solani*):

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only.

or

Captan

Captan 30-DD, 1 1/4 oz/100 lb seed.

Captan 400, 1 to 2 oz/100 lb seed.

or

Thiram

42-S *Thiram*, *Thiram 50 WP Dyed*, 8 oz/100 lb seed.

SOIL TREATMENT:

DAMPING OFF (*Pythium* and *Phytophthora* spp.):

* *Mefenoxam*. Apply as a broadcast preplant application or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold SL, 1-2 pt.

Ridomil Gold WSP, 1 to 2 lb.

FOLIAR TREATMENT:

ALTERNARIA LEAF SPOT (*Alternaria raphani*):

* *Azoxystrobin*

Amistar, 2 to 5 oz every 7 - 14 days. (0 days)

Quadris, 6.2 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of *Amistar* and *Quadris* or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

Rhubarb

or

* Pyraclostrobin

Cabrio, 8 to 12 oz. (0 days)

WHITE RUST (*Albugo candida*): Apply foliar spray 40 to 50 days following Ridomil at-planting application and make 2 to 4 applications on a 14-day schedule depending on disease development.

Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 2 lb. (7 days)

or

Pyraclostrobin

Cabrio, 8 to 16 oz. (0 days)

Rhubarb

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

INSECTS

AT PLANTING OR SIDE DRESS:

APHIDS: Apply preplant, in furrow or as a post-planting drench. Imidacloprid

Admire Pro, 4.4 - 10.5 fl oz. (45 days)

Nuprid 2 F, 10 to 24 fl oz. (45 days)

or

Venom, 5 to 6 oz. (21 days) See label for application method.

or

Platinum, 5 to 11 oz. (30 days) See label for application methods.

FOLIAR TREATMENT:

CUTWORM, LOOPERS:

Baythroid XL, 1.6 to 3.2 fl oz. (0 days) (RUP)

or

Thiodicarb

Larvin 3.2 EC, 16 to 30 oz. (14 days)

or

Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce 25 WP* (6.4 to 12.8 oz)

or *Pounce 3.2 EC* (4 to 8 oz) (1 day) (RUP)

or

SpinTor 2 SC, 3 to 6 oz. (1 day)

or

Entrust, 1 to 2 oz. (1 day)

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day) or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

APHIDS:

Assail 30 SG, 1.9 to 2.8 oz. (7 days)

or

Fulfill, 2.75 oz. (7 days) Do not exceed 5.5 oz/acre per season.

May require 5 to 7 days for aphid mortality.

or

Venom, 1 to 3 oz. (7 days)

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Actara, 1.5 to 3 oz. (7 days) Do not exceed 11.0 oz/Acre per season.

RHUBARB CURCULIO:

No materials are currently registered for this use.

DISEASES

SEED TREATMENT:

DAMPING OFF (*Pythium* spp., *Rhizoctonia solani*):

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only.

PREPLANT INCORPORATED:

DAMPING OFF (*Pythium* spp.):

* Mefenoxam. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold GR, 20 to 40 lb.

Ridomil Gold SL, 1-2 pt.

Ridomil Gold WSP, 1 to 2 lb.

Ultra Flourish, 2 to 4 pt.

FOLIAR TREATMENT:

LEAF ROT, BOTRYTIS GRAY MOLD (*Botrytis cinerea*):

Azoxystrobin

Quadris, 6 to 15.5 fl oz every 5 - 14 days. (0 days)

or

DCNA

Botran 75 W, 1 1/3 lb (for greenhouse use only). (3 days)

Rutabagas

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

INSECTS

SOIL TREATMENT:

CABBAGE MAGGOT: Apply in a 4- to 6-inch band around seed at time of planting so plants grow in treated soil.
Lorsban 15 G (4.6 to 9.2 oz per 1,000 ft of row) or *Lorsban 4 E / Lorsban Advanced* (1.6 to 3.3 fl oz per 1,000 ft of row) (RUP)

APHIDS, FLEA BEETLE: See label for application methods.

Imidacloprid

Admire Pro, 4.4 - 10.5 fl oz. (21 days)

Nuprid 2 F, 10 to 24 fl oz. (21 days) Apply pre-plant or in furrow.

or

Platinum, 5 to 12 fl oz. (30 days) See label for application methods.

FOLIAR TREATMENT:

FLEA BEETLE: Apply if necessary.

Actara, 1.5 to 3 oz. (7 days)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin XLR Plus* (1 qt) (7 days)

or

Imidacloprid

Nuprid 1.6 F, *Provado 1.6 F*, 3.5 fl oz. (7 days) Do not exceed 10.5 oz/Acre per season.

CABBAGE "WORM": Apply if damage is severe.

* *Bacillus thuringiensis*

Agree, *Biobit*, *Dipel*, *Javelin*, *Lepinox*. (0 days)

APHIDS: Apply as needed to prevent population build up.

Actara, 1.5 to 3 oz. (7 days)

or

Malathion 57 EC, 1 1/2 pt. (1 day)

or

Imidacloprid

Nuprid 1.6 F, *Provado 1.6 F*, 3.5 fl oz. (7 days) Do not exceed 10.5 oz/Acre per season.

DISEASES

SEED TREATMENT:

DAMPING OFF (*Pythium* and *Phytophthora* spp.):

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only.

SOIL TREATMENT:

DAMPING OFF (*Pythium* spp.):

* *Mefenoxam*. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold SL, 1-2 pt.

Ridomil Gold WSP, 1 to 2 lb.

Ultra Flourish, 2 to 4 pt.

FOLIAR TREATMENT:

LEAF ROT, BOTRYTIS GRAY MOLD (*Botrytis cinerea*):

Azoxystrobin

Quadris, 6 to 15.5 fl oz. (0 days)

or

Pyraclostrobin

Cabrio, 8 to 12 oz. (0 days)

Spinach

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

INSECTS

SOIL TREATMENT:

APHIDS:

Imidacloprid

Admire Pro, 4.4 - 10.5 fl oz. (21 days) See label for application methods.

or

Venom, 5 to 6 oz. (21 days) See label for application methods.

APHIDS, FLEA BEETLE, LEAF MINERS, LEAFHOPPER:

Platinum, 5 to 11 oz. (30 days) See label for application methods.

FOLIAR TREATMENT:

FLEA BEETLE: May be a problem on young seedlings. Apply as needed.

Baythroid XL, 2.4 to 3.2 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S (2/3 to 1 1/4 lb) or *Sevin XLR Plus* (1/2 to 1 qt) (14 days)

or

Mustang Max, 2.4 to 4.3 oz. (1 day) (RUP)

or

Spinach

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.75 fl oz. (7 days) Do not use if Imidacloprid was used at planting. Do not exceed 19.2 oz/Acre per season.

or *Venom*, 2 to 3 oz. (7 days)

or

Actara, 1.5 to 3 oz. (7 days) Do not exceed 11.0 oz/Acre per season.

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (7 days) (RUP)

CROWN MAGGOTS (Several species are involved):
Chemical control is not presently available for this use.

LEAFHOPPERS: Apply as necessary.

Baythroid XL, 0.8 to 1.6 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin* XLR Plus (1 qt) (14 days)

or

Mustang Max, 2.4 to 4.3 oz. (1 day) (RUP)

or

Permethrin

Ambush 25 W, 6.4 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 oz) or *Pounce* 25 WP (6.4 oz) or *Pounce* 3.2 EC (4 oz) (1 day) (RUP)

or

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.8 fl oz. (7 days) Do not exceed 19.2 oz/Acre per season.

or

Actara, 1.5 to 3 oz. (7 days) Do not exceed 11.0 oz/Acre per season.

or

Brigadier, 5.1 to 6.1 oz. (40 days)

LOOPERS, ARMYWORM: Apply when insects are small.

* *Baythroid* XL, 2.4 to 3.2 fl oz. (0 days) (RUP)

or

* *Lannate* LV (1 1/2 to 3 pt) or *Lannate* SP (1/2 to 1 lb) (7 days) Do not apply to seedlings less than 3 inches in diameter. (RUP)

or

* Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz) or *Pounce* 3.2 EC (4 to 8 oz) (1 day) (RUP)

or

Bacillus thuringiensis

Agree, *Biobit*, *Dipel*, *Javelin*, *Lepinox*, *Xentari*. (0 days)

or

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin* XLR Plus (1 qt) (14 days)

or

Thiodicarb

Larvin 3.2 EC, 16 to 30 oz. (14 days)

or

Mustang Max, 3.4 to 4.3 oz. (1 day) (RUP)

or

SpinTor 2 SC, 4 to 8 oz. (1 day)

or

Entrust, 1 to 2 oz. (1 day)

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or

Avaunt, 3.5 oz. (3 days) Do not exceed 14 oz/acre per crop.

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

APHIDS: Apply as needed to avoid contamination at harvest.

* *Assail* 30 SG, 1.9 to 2.8 oz. (7 days)

or

Diazinon 50 WP (1 lb) or *Diazinon* AG 500 (1 pt) (14 days) (RUP)

or

Dibrom 8 EC, 1 pt. (1 day) Ground application only.

or

Endosulfan 3 EC, 1 qt. (21 days) Maximum of one application.

or

Malathion 57 EC, 2 pt. (7 days)

or

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.75 fl oz. (7 days) Do not use if Imidacloprid was used at planting. Do not exceed 19.2 oz/Acre per season.

or

Venom, 1 to 3 oz. (7 days)

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Actara, 1.5 to 3 oz. (7 days) Do not exceed 11.0 oz/Acre per season.

or

Fulfill, 2.75 oz. (7 days) Do not exceed 5.5 oz/acre per season. May require 5 to 7 days for aphid mortality.

LEAF MINERS: Apply when eggs are first seen on undersides of leaves to prevent miners from entering leaves. Treatment after larvae are in the leaf is generally unsuccessful. Early-planted spinach is less susceptible to damage than when planted late.

Dimethoate 4 EC, 1/2 pt. (14 days)

or

Diazinon 50 WP (1 lb) or *Diazinon* AG 500 (1 pt) (10 days) (RUP)

or

Dibrom 8 EC, 1 pt. (1 day)

or

Permethrin

Ambush 25 W, 6.4 to 12.8 oz. (1 day) (RUP)

or

Perm-UP 3.2 EC (4 to 8 oz) or *Pounce* 25 WP (6.4 to 12.8 oz) or *Pounce* 3.2 EC (4 to 8 oz) (1 day) (RUP)

or

SpinTor 2 SC, 6 to 10 oz. (1 day)

or

Venom, 1 to 3 oz. (7 days)

or

Entrust, 2 to 3 oz. (1 day)

or

Radiant SC, 6 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.
or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (7 days) (RUP)

or

Brigadier, 5.1 to 6.1 oz. (40 days)

LOOPERS:

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (7 days) (RUP)

or

Brigadier, 5.1 to 6.1 oz. (40 days)

SLUGS

Deadline M-Ps 4% (20 to 40 lb) or *Metaldehyde* 3.5 G (30 to 40 lb) Apply between rows. Avoid contact to edible product.

DISEASES

SEED TREATMENT:

DAMPING OFF (*Pythium* spp., *Rhizoctonia solani*):

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Captan

Captan 30-DD, 4 3/4 oz/100 lb seed.

Captan 400, 4 to 6 oz/100 lb seed.

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only.

or

Metalaxyl

Allegiance-FL, 0.75 fl oz/100 lb seed (*Pythium*).

or

Apron 50 W, 1/2 to 1 oz/100 lb seed (*Pythium*).

or

Mefenoxam

Apron XL LS, 0.32 to 0.64 fl oz/100 lb seed (*Pythium*).

or

Thiram

42-S *Thiram*, *Thiram* 50 WP Dyed, 8 oz/100 lb seed.

PREPLANT INCORPORATED:

WHITE RUST (*Albugo occidentalis*), **DAMPING OFF** (*Pythium* spp.), **DOWNY MILDEW** (*Peronospora effusa*):

* *Mefenoxam*. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. of sprinkler irrigation. Observe limit of amount of a.i./A per season.

Ridomil Gold GR, 20 to 40 lb.

Ridomil Gold WSP, 1 to 2 lb.

Ultra Flourish, 2 to 4 pt.

or

Ridomil Gold SL, 1-2 pt (*Pythium*) or 0.25 pt (downy mildew or white rust; 7 day PHI).

FOLIAR TREATMENT:

DOWNY MILDEW (*Peronospora effusa*):

* *Fosetyl-Aluminum*

Aliette WDG, 2 to 5 lb, 7- to 21-day intervals. (3 days) Do not tank mix with copper fungicides.

or

* *Fluopicolide*

Presidio, 3-4 fl oz. (2 days)

or

* *Mefenoxam*

Ridomil Gold GR, 5 lb as a side-dressing. (21 days) Apply first as a preplant incorporated. Then apply shanked in 21 days after planting or after first cutting. One other application may be shanked in after the next cutting. A total of 2 supplemental applications may be used on a 21-day interval. Observe limit of amount of a.i./A per season.

or

Ridomil Gold WSP, 1/4 lb. (21 days)

or

* *Mefenoxam/Copper Hydroxide*

Ridomil Gold Copper, 2 1/2 lb, 14-day intervals. (21 days) Maximum 2 applications. **Note:** Apply 21 days after *Ridomil* Gold at planting or after each repeated cutting.

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 2.5 to 5 pt every 7 - 21 days. (0 days)

Prophyt, 2 to 4 pt. (0 days)

or

Acibenzolar-S-methyl

Actigard, 3/4 oz per 20 gal (ground) or 10 gal (aerial) of water. (14 days) Do not apply more than 2-1/4 oz o *Actigard* per acre per season.

or

Mono-, dibasic sodium salts of phosphorous acid

Fosphite, 1 to 3 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)

or

Mandipropamid

Revus, 8 fl oz. (1 day)

Note: Fungicides that protect against Anthracnose and *Cercospora* leaf spot provide limited downy mildew protection.

ANTHRACNOSE (*Colletotrichum spinaciae*), **CERCOSPORA LEAF SPOT** (*Cercospora beticola*): Apply at 7 to 10 day intervals.

* *Azoxystrobin*

Amistar, 2 to 5 oz. (0 days)

Quadris, 6.2 to 15.4 fl oz. (0 days)

Do not apply more than one foliar application of *Amistar* and *Quadris* or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Copper Ammonium Carbonate

Copper Count N, 1 1/2 qt. (0 days)

or

Copper Hydroxide

Champ Formula 2 F, *Nu-Cop* 3 L, 1 1/3 to 2 2/3 pt. (0 days)

Champion WP, *Nu-Cop* 50 DF, 2 to 4 lb. (0 days)

Kocide 101, 1 to 2 lb. (0 days)

Kocide 2000, 1 1/2 to 2 1/4 lb. (0 days)

Squash

or

Kocide 4.5 LF, 1 1/3 to 2 pt. (0 days)

Kocide DF, 2 to 3 lb. (0 days)

or

Copper Sulfate

Basicop 53 WP, 2 to 4 lb. (0 days)

Cuprofix Ultra, 1.25 to 2 lb. (0 days)

WHITE RUST (*Albugo occidentalis*):

Azoxystrobin

Amistar, 2 to 5 oz every 7 - 14 days. (0 days)

Quadris, 6.2 - 15.4 fl oz every 7 - 14 days. (0 days)

Do not apply more than one foliar application of *Amistar* and *Quadris* or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Copper Hydroxide

Champ Formula 2 F, *Nu-Cop* 3 L, 1 1/3 to 2 2/3 pt, 7- to 10-day intervals. (0 days)

or

Champion WP, *Nu-Cop* 50 DF, 2 to 4 lb, 7- to 10-day intervals. (0 days)

or

Kocide 101, 1 to 2 lb. (0 days)

Kocide 2000, 1 1/2 to 2 1/4 lb. (0 days)

Kocide 4.5 LF, 1 1/3 to 2 pt. (0 days)

Kocide DF, 2 to 3 lb. (0 days)

or

Copper Sulfate

Basicop 53 WP, 2 to 4 lb, 7- to 10-day intervals. (0 days)

Cuprofix Ultra, 1.25 to 2 lb. (0 days)

or

Fosetyl-Aluminum

Aliette WDG, 2 to 5 lb, 7- to 10-day intervals. (0 days)

or

Mefenoxam/Copper Hydroxide

Ridomil Gold Copper, 2 1/2 lb, 14-day intervals. (21 days) Maximum 2 applications. **Note:** Apply 21 days after *Ridomil* Gold at planting or after each repeated cutting.

or

Fluopicolide

Presidio, 3-4 fl oz. (2 days)

Squash

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Squash are hosts for root-knot and lesion nematodes. These nematodes can reduce squash yields but yield losses in Michigan have not been documented. If you suspect nematodes are reducing squash yields collect root and soil samples for analysis

as described in Appendix C. If the numbers of nematodes recovered from those samples exceed damage thresholds; control options will be suggested. *Vydate* 2L is labeled for use in squash.

INSECTS

SOIL TREATMENT:

CUCUMBER BEETLE (STRIPED and SPOTTED), APHIDS, THRIPS:

* *Imidacloprid*

Admire Pro, 7.0 - 10.5 fl oz. (21 days)

or

Nuprid 2 F, 16 to 24 oz. (21 days) Apply to soil in a narrow band 14 or less days before planting, as an in-furrow spray at planting, as a post-seeding drench, as a sidedress after plants are established or in drip or trickle irrigation water. Do not make more than 1 application per year. Cucumber beetle. Use on hard squash in areas with high beetle populations to control bacterial wilt disease.

or

* *Furadan* 4 F, 2.4 oz/1000 ft of row. Apply at planting or transplanting in a 12- to 15-inch band, incorporate into the top 3 inches of soil or apply into the furrow and mix with the covering soil. (Special Michigan SLN label.) (RUP)

APHIDS, FLEA BEETLE, CUCUMBER BEETLE, LEAFHOPPER, THRIPS:

Platinum, 5 to 11 oz. (30 days) See label for application methods.

APHIDS, THRIPS, SQUASH BUG:

Venom, 5 to 6 oz. (21 days) See label for application methods.

FOLIAR TREATMENT:

Summer and winter squash plants may be sensitive to certain insecticide formulations. Make certain a problem exists before treatment. Read and observe restrictions on the label. To avoid killing bees, do not treat plants during bloom.

CUTWORM: Apply if >1% of plants are injured.

* *Asana* XL, 5.8 to 9.6 oz. (3 days) (RUP)

or

* *Baythroid* XL, 0.8 to 1.6 fl oz. (0 days) (RUP)

or

* *Bifenthrin*

Bifenture EC, *Brigade* 2EC, *Capture* 2 EC, 2.6 to 6.4 oz. (3 days) (RUP)

or

* *Permethrin*

Ambush 25 W, 12.8 oz. (0 days) (RUP)

or

Perm-UP 3.2 EC (8 oz) or *Pounce* 25 WP (12.8 oz) or *Pounce* 3.2 EC (8 oz) (0 days) (RUP)

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

STRIPED and SPOTTED CUCUMBER BEETLE: Apply to hard squash if numbers exceed 0.1 to 1/plant to prevent bacterial wilt disease.

Asana XL, 5.8 to 9.6 oz. (3 days) (RUP)

or

Baythroid XL, 2.4 to 2.8 fl oz. (0 days) (RUP)

or
 Bifenthrin
Bifenture EC, Brigade 2EC, Capture 2 EC, 2.6 to 6.4 oz.
 (3 days) (RUP)

or
 Carbaryl
Sevin 80 S (1 1/4 lb) or Sevin XLR Plus (1 qt) (3 days)

or
Dibrom 8 EC, 1 pt. (1 day) Use on summer squash only.

or
Endosulfan 3 EC, 1 qt. (2 days)

or
Lannate LV (1 1/2 to 3 pt (1 1/2 pt, 1 day; over 1 1/2, pt 3 days))
 or *Lannate SP (1/2 to 1 lb (1/2 lb, 1 day; over 1/2 lb, 3 days))*
 Use on summer squash only. (RUP)

or
 Permethrin
Ambush 25 W, 6.4 to 12.8 oz. (0 days) (RUP)
 or
Perm-UP 3.2 EC (4 to 8 oz) or Pounce 25 WP (6.4 to 12.8 oz)
 or *Pounce 3.2 EC (4 to 8 oz) (0 days) (RUP)*

or
Danitol 2.4 EC, 10 2/3 to 16 fl oz. (7 days) (RUP)

or
Venom, 3 to 4 oz. (1 day)

or
Actara, 3 to 5.5 oz. (0 days) Do not exceed 11.0 oz/Acre per
 season.

or
Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)
 Do not exceed 23 fl oz/acre per season. (RUP)

or
Assail 30 SG, 2.5 to 5.3 oz. (0 days)

FLEA BEETLE: Apply if needed.

Carbaryl
Sevin 80 S (1 1/4 lb) or Sevin XLR Plus (1 qt) (3 days)

or
Endosulfan 3 EC, 1 qt. (2 days)

or
Lannate LV (1 1/2 to 3 pt (1 1/2 pt, 1 day; over 1 1/2, pt 3 days))
 or *Lannate SP (1/2 to 1 lb (1/2 lb, 1 day; over 1/2 lb, 3 days))*
 Use on summer squash only. (RUP)

or
Actara, 1.5 to 3 oz. (0 days) Do not exceed 11.0 oz/Acre per
 season.

or
Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)
 Do not exceed 23 fl oz/acre per season. (RUP)

LEAFHOPPERS: Apply if necessary.
Asana XL, 5.8 to 9.6 oz. (3 days) (RUP)

or
 Bifenthrin
Bifenture EC, Brigade 2EC, Capture 2 EC, 2.6 to 6.4 oz.
 (3 days) (RUP)

or
 Carbaryl
Sevin 80 S (1 1/4 lb) or Sevin XLR Plus (1 qt) (3 days)

or
Venom, 1 to 4 oz. (1 day)

or
Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)
 Do not exceed 23 fl oz/acre per season. (RUP)

SQUASH BUG: Apply if egg masses exceed 1/plant. Large
 nymphs and adults are difficult to control.
 * *Asana XL, 5.8 to 9.6 oz. (3 days) (RUP)*

or
 Bifenthrin
Bifenture EC, Brigade 2EC, Capture 2 EC, 2.6 to 6.4 oz.
 (3 days) (RUP)

or
 Carbaryl
Sevin 80 S (1 1/4 lb) or Sevin XLR Plus (1 qt) (3 days)

or
Endosulfan 3 EC, 1 qt. (2 days)

or
 Permethrin
Ambush 25 W, 12.8 oz. (0 days) (RUP)
 or
Perm-UP 3.2 EC (8 oz) or Pounce 25 WP (12.8 oz) or Pounce
3.2 EC (8 oz) (0 days) (RUP)

or
Venom, 3 to 4 oz. (1 day)

or
Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)
 Do not exceed 23 fl oz/acre per season. (RUP)

or
Assail 30 SG, 5.3 oz. (0 days)

SQUASH VINE BORER: Apply to base of plants when moths are
 active, or when the first tunnels appear, usually starting when
 plants start to vine. Repeat in 5 to 7 days.
Asana XL, 5.8 to 9.6 oz. (3 days) (RUP)

or
 Bifenthrin
Bifenture EC, Brigade 2EC, Capture 2 EC, 2.6 to 6.4 oz.
 (3 days) (RUP)

or
Endosulfan 3 EC, 1 qt. (2 days)

or
 Permethrin
Ambush 25 W, 6.4 to 12.8 oz. (0 days) (RUP)
 or
Perm-UP 3.2 EC (4 to 8 oz) or Pounce 25 WP (6.4 to 12.8 oz)
 or *Pounce 3.2 EC (4 to 8 oz) (0 days) (RUP)*

or
Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)
 Do not exceed 23 fl oz/acre per season. (RUP)

or
Assail 30 SG, 5.3 oz. (0 days)

APHIDS: Apply if numbers are high.
Dibrom 8 EC, 1 pt. (1 day) Use on summer squash only.

or
Endosulfan 3 EC, 1 qt. (2 days)

or
Fulfill, 2.75 oz. (0 days) Do not exceed 5.5 oz/acre per season.
 May require 5 to 7 days for aphid mortality.

or
Malathion 57 EC, 1 1/2 pt. (1 day)

or

Squash

Venom, 1 to 4 oz. (1 day)

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Actara, 1.5 to 3 oz. (0 days) Do not exceed 11.0 oz/Acre per season.

or

Assail 30 SG, 2.5 to 4 oz. (0 days)

THRIPS: Apply when damage is seen. Repeat as needed.

Dibrom 8 EC, 1 pt. (1 day) Summer squash only.

or

Venom, 1 to 4 oz. (1 day)

or

Entrust, 2 to 2.5 oz. (3 days)

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (1 day)

Do not exceed 23 fl oz/acre per season. (RUP)

MITES

Apply when needed. Usually a problem only in hot, dry weather.

Agri-Mek 0.15 EC, 8 to 16 fl oz. (7 days) (RUP)

or

Bifenthrin

Bifenxure EC, Brigade 2EC, Capture 2 EC, 5.1 to 6.4 oz. (3 days) (RUP)

or

Danitol 2.4 EC, 10 2/3 fl oz. (7 days) (RUP)

or

Oberon 2 SC, 7 to 8.5 fl oz. (7 days)

SLUGS

Deadline M-Ps 4% (20 to 40 lb) or Metaldehyde 3.5 G (30 to 40 lb) Apply between rows. Avoid contact to edible product.

DISEASES

SEED TREATMENT:

DAMPING OFF (*Pythium* spp., *Rhizoctonia solani*):

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Captan

Captan 30-DD, 1 2/3 oz/100 lb seed.

Captan 400, 1 1/2 to 2 oz/100 lb seed.

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only.

or

Thiram

42-S Thiram, Thiram 50 WP Dyed, 4 1/2 oz/100 lb seed.

PRE-PLANT FUMIGATION:

PHYTOPHTHORA: Apply to production fields before planting.

Note: Most fumigants applied to the soil for control of disease organisms will also control soil insects, nematodes and weed seeds.

Soil sterilization by fumigation is best achieved by proper application of material. Correct soil moisture, temperature, and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or immediate tarping.

1,3 Dichloropropene/chloropicrin

Telone C35, 13-35 gal. (RUP)

or

Metam Sodium

Sectagon 42, Vapam HL, 37.5-75 gal.

or

Potassium N-methylidithiocarbamate

Sectagon-K54, 30-60 gal. Do not plant for 14 to 30 days after treatment (the wetter the soil, the longer the waiting period).

GREENHOUSE PREPLANT INCORPORATION:

DAMPING OFF (*Pythium* spp.), **ROOT ROT** (*Rhizoctonia* spp.):

Gliocladium virens GL-21

SoilGard 12 G, 1 to 1.5 lb per cubic yard. Biological control product that needs to be applied before disease development. Control may be limited under heavy disease pressure.

PREPLANT INCORPORATED:

DAMPING OFF and COTTONY LEAK (*Pythium* spp.):

* Mefenoxam. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold SL, 1-2 pt.

Ridomil Gold WSP, 1 to 2 lb.

Ultra Flourish, 2 to 4 pt.

FOLIAR TREATMENT:

POWDERY MILDEW (*Sphaerotheca fuliginea* or *Erysiphe cichoracearum*): Treat at disease appearance.

* Myclobutanil

Rally 40 WSP, 2.5 to 5 oz, 7 to 10 day schedule. (0 days) Do not apply more than 1.5 lb per acre per crop.

or

* Pyraclostrobin

Cabrio, 12-16 oz. (0 days) Alternate one-to-one with fungicides having a different mode of action.

or

* Pyraclostrobin/Boscalid

Pristine, 12.5 to 18.5 oz. (0 days)

or

* Thiophanate-Methyl

Topsin 4.5 FL, 10 fl oz. (1 day)

Topsin 70 W, Topsin M WSB, 1/4 to 1/2 lb. (0 days)

or

* Trifloxystrobin

Flint, 1 1/2 to 2 oz, 7- to 14-day intervals. (0 days) Maximum 2 consecutive applications, 4 applications/year and 16 oz/season.

or

Azoxystrobin

Amistar, 3.5 to 5 oz. (1 day)

or
Quadris, 11.0 to 15.4 fl oz. (1 day)
 Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or
Azoxystrobin/Chlorothalonil
Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or
Bacillus subtilis
Serenade, 6 to 8 lb every 7 days. (0 days) Biological control product that needs to be applied before disease development. Control will be limited under heavy disease pressure.

or
Serenade Max, 1 - 3 lb every 7 to 10 days. (0 days)

or
Chlorothalonil
Bravo Ultrex (1.8 to 2.7 lb) or *Equus DF* (1.8 to 2.7 lb (*Sphaerotheca*)) (0 days)
 or
Bravo Weather Stik, or *Echo 720* (2 to 3 pt, 7-day intervals) or *Equus 720 SST* (2 to 3 pt every 7 days) (0 days) *Sphaerotheca*.
 or
Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or
Copper Ammonium Carbonate
Copper Count N, 1 to 2 qt. (0 days)

or
Copper Hydroxide
Champ DP, 1 1/3 lb. (0 days)
Kocide 2000, 1 1/2 lb. (0 days)
Nu-Cop 3 L, 1 to 4 pt, 5- to 10-day intervals. (0 days)
 or
Champ Formula 2 F, *Kocide 4.5 LF*, 1 to 2 pt, 7-day intervals. (0 days)
 or
Champion WP, *Kocide 101*, *Kocide DF*, *Nu-Cop 50 DF*, 1 1/2 to 3 lb, 7-day intervals. (0 days)

or
Copper Sulfate
Cuprofix Ultra, 1.25 lb. (0 days)

or
Neem Oil
Trilogy, 2 pt. (0 days)

or
Sulfur
Kumulus DF, *Micro Sulf*, *Microthiol Disperss*, *Microthiol Special*, 5 to 10 lb. (0 days)
 or
Thiolux Jet, 4 to 10 lb, 10- to 14-day intervals. (0 days)

or
Triflumizole
Procure 50 WS, 4 to 8 oz every 7 - 14 days. (0 days)

or
Tebuconazole
Folicur 3.6F, 4-6 fl oz. (7 days) 12 hr REI.

SCAB (*Cladosporium cucumerinum*): Treat every 7 to 10 days after plants are 2 to 3 inches tall.

Chlorothalonil
Bravo Ultrex, *Equus DF*, 1.8 to 2.7 lb. (0 days)
Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)
 or
Bravo Weather Stik, *Echo 720*, *Equus 720 SST*, 2 to 3 pt. (0 days)

or
Copper Ammonium Carbonate
Copper Count N, 2 to 3 qt. (0 days)

or
Neem Oil
Trilogy, 2 pt. (0 days)

ALTERNARIA LEAF SPOT (*Alternaria cucumerina*): Treat every 7 to 10 days when conditions favor disease.

* Azoxystrobin
Amistar, 3.5 to 5 oz. (1 day)
Quadris, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or
 * Azoxystrobin/Chlorothalonil
Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or
 * Chlorothalonil
Bravo Ultrex, *Equus DF*, 1.8 to 2.7 lb. (0 days)
Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or
Bravo Weather Stik, *Echo 720*, *Equus 720 SST*, 2 to 3 pt. (0 days)

or
 * Pyraclostrobin
Cabrio, 12-16 oz. (0 days) No more than 2 consecutive applications before alternating with a fungicide having a different mode of action.

or
 * Pyraclostrobin/Boscalid
Pristine, 12.5 to 18.5 oz. (0 days)

or
Copper Ammonium Carbonate
Copper Count N, 1 to 2 qt. (0 days)

or
Copper Hydroxide
Champ DP, 1 1/3 lb. (0 days)
Champ Formula 2 F, *Kocide 4.5 LF*, 1 1/3 pt. (0 days)
Champion WP, 1.5 to 3 lb. (0 days)
Kocide 2000, 1 1/2 lb. (0 days)
Nu-Cop 3 L, 1 to 4 pt. (0 days)

or
Copper Sulfate
Cuprofix Ultra, 1.25 lb. (0 days)

or
Famoxadone/Cymoxanil
Tanos, 8 oz. (3 days)

or
Neem Oil
Trilogy, 2 pt. (0 days)

Squash

ANTHRACNOSE (*Colletotrichum lagenarium*): Treat every 7 to 14 days after disease appears.

* Azoxystrobin

Amistar, 3.5 to 5 oz. (1 day)

Quadris, 6.2 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

* Chlorothalonil

Bravo Ultrex, 1.4 to 1.8 lb. (0 days)

Echo 90 DF, 1.3 to 1.6 lb every 7 days. (0 days)

or

Bravo Weather Stik, *Echo 720*, *Equus 720 SST*, 1.5 to 2 pt. (0 days)

or

* Mancozeb. Summer squash.

Dithane DF Rainshield, *Manzate 75 DF*, *Penncozeb 75 DF*, 2 to 3 lb. (5 days)

or

Penncozeb 4 F, 1.6 to 2.4 qt. (5 days)

or

* Maneb

Maneb 75 DF, *Maneb 80 WP*, 1 1/2 to 2 lb. (5 days)

Manex, 1 1/5 to 1 3/5 qt. (5 days)

or

* Pyraclostrobin

Cabrio, 12-16 oz. (0 days) No more than 2 consecutive applications before alternating with a fungicide having a different mode of action.

or

* Pyraclostrobin/Boscalid

Pristine, 18.5 oz. (0 days)

or

* Thiophanate-Methyl

Topsin 4.5 FL, 10 fl oz. (1 day)

Topsin 70 W, *Topsin M WSB*, 1/4 to 1/2 lb. (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 1 to 2 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, *Kocide 4.5 LF*, 1 1/3 pt. (0 days)

Champion WP, 1.5 to 3 lb. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 to 4 pt. (0 days)

or

Copper Oxychloride / Copper Sulfate

C-O-C-S WDG, 2 to 4 lb every 7 days. (0 days)

or

Copper Sulfate

Basic Copper 53, *Basicop*, 2 lb. (0 days)

Cuprofix Ultra, 1.25 lb. (0 days)

or

Famoxadone/Cymoxanil

Tanos, 8 oz. (3 days)

or

Mancozeb/Copper Sulfate

Cuprofix MZ Disperss, 5 - 7.25 lb. (5 days)

or

Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 2 to 3 lb, 10- to 14-day intervals. Maximum

4 applications. Do not apply to mature or senescent plants.

or

Neem Oil

Trilogy, 2 pt. (0 days)

ANGULAR LEAF SPOT (*Pseudomonas lachrymans*): Spray

every 7 days, starting before the first fruit forms and continue to protect fruit at all stages of development.

Copper Ammonium Carbonate

Copper Count N, 1 to 2 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb. (0 days)

Champ Formula 2 F, *Kocide 4.5 LF*, 1 1/3 pt. (0 days)

Champion WP, 1.5 to 3 lb. (0 days)

Kocide 2000, 1 1/2 lb. (0 days)

Nu-Cop 3 L, 1 to 4 pt. (0 days)

or

Copper Sulfate

Basic Copper 53, *Basicop*, 2 lb. (0 days)

Cuprofix Ultra, 1.25 lb. (0 days)

or

Neem Oil

Trilogy, 2 pt.

GUMMY STEM BLIGHT (*Didymella bryoniae* also called *Mycosphaerella melonis*):

* Azoxystrobin/Chlorothalonil

Quadris Opti, 3.2 pt every 7 - 14 days. (1 day)

or

* Chlorothalonil

Bravo Ultrex, *Equus DF*, 1.8 to 2.7 lb. (0 days)

Echo 90 DF, 1.6 to 2.4 lb every 7 days. (0 days)

or

Bravo Weather Stik, *Echo 720*, *Equus 720 SST*, 2 to 3 pt. (0 days)

or

* Pyraclostrobin

Cabrio, 12-16 oz. (0 days) No more than 2 consecutive

applications before alternating with a fungicide having a different mode of action.

or

* Pyraclostrobin/Boscalid

Pristine, 12.5 to 18.5 oz. (0 days)

or

* Thiophanate-Methyl

Topsin 4.5 FL, 10 fl oz. (1 day)

or

Topsin 70 W, *Topsin M WSB*, 1/4 to 1/2 lb, at 7-14 day intervals. (0 days)

or

* Azoxystrobin*Amistar*, 3.5 to 5 oz. (1 day)

or

Quadris, 6.2 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Copper Ammonium Carbonate*Copper Count N*, 1 to 2 qt. (0 days)

or

Copper Hydroxide*Champ DP*, 1 1/3 lb. (0 days)*Champ Formula 2 F*, *Kocide 4.5 LF*, 1 1/3 pt. (0 days)*Champion WP*, 1.5 to 3 lb. (0 days)*Kocide 2000*, 1 1/2 lb. (0 days)*Nu-Cop 3 L*, 1 to 4 pt. (0 days)

or

Copper Sulfate*Cuprofix Ultra*, 1.25 lb. (0 days)

or

Tebuconazole*Folicur 3.6F*, 8 fl oz. (7 days) Suppression only.**DOWNY MILDEW** (*Pseudoperonospora cubensis*):* Famoxadone/Cymoxanil*Tanos*, 8 oz. (3 days)

or

* Propamocarb*Previcur Flex*, 1.2 pt every 7 - 14 days. (2 days)

or

* Cyazofamid*Ranman*, 2.1 to 2.75 fl oz every 7 to 10 days. (0 days)

or

* Cymoxanil*Curzate 60 DF*, 3.2 oz every 5 - 7 days. (3 days)

or

* Fluopicolide*Presidio*, 3-4 fl oz. (2 days)

or

* Mancozeb. Summer squash only.*Dithane DF Rainshield*, *Manzate 75 DF*, *Penncozeb 75 DF*, 2 to 3 lb. (5 days)

or

Penncozeb 4 F, 1.6 to 2.4 qt. (7 days) Summer squash only.

or

* Chlorothalonil*Bravo Ultrex*, *Equus DF*, 1.8 to 2.7 lb. (0 days)*Echo 90 DF*, 1.6 to 2.4 lb every 7 days. (0 days)

or

Bravo Weather Stik, *Echo 720*, *Equus 720 SST*, 2 to 3 pt. (0 days)

or

Azoxystrobin*Amistar*, 3.5 to 5 oz. (1 day)*Quadris*, 11.0 to 15.4 fl oz. (1 day)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Azoxystrobin/Chlorothalonil*Quadris Opti*, 3.2 pt every 7 - 14 days. (1 day)

or

Fenamidone*Reason 500 SC*, 5.5 fl oz every 5 to 10 days. (14 days)

or

Fosetyl-Aluminum*Aliette WDG*, 2 to 5 lb, 7- to 14-day intervals. (0 days) Do not tank mix with copper fungicides.

or

Mancozeb/Copper Sulfate. Summer squash.*Cuprofix MZ Disperss*, 5 - 7.25 lb. (5 days)

or

Maneb*Maneb 75 DF*, *Maneb 80 WP*, 1.5 to 2 lb. (5 days)*Manex*, 1.2 to 1.6 qt. (5 days)

or

Mefenoxam/Chlorothalonil*Ridomil Gold Bravo*, 2 lb. Maximum 4 applications. Do not apply to mature or senescent plants.

or

Mefenoxam/Copper Hydroxide*Ridomil Gold Copper*, 2 to 2 1/2 lb. (5 days) Maximum 4 applications.

or

Mefenoxam/Mancozeb. Summer squash.*Ridomil Gold MZ*, 2 1/2 lb. (5 days) Maximum 4 applications.

or

Mono-, dibasic sodium, potassium and ammonium phosphites*Phostrol*, 2.5 to 5 pt every 7 - 14 days. (0 days)*Prophyt*, 2 to 4 pt. (0 days)

or

Neem Oil*Trilogy*, 2 pt. (0 days)

or

Pyraclostrobin*Cabrio*, 8-12 oz. (0 days) Alternate one-to-one with fungicides having a different mode of action.

or

Pyraclostrobin/Boscalid*Pristine*, 12.5 to 18.5 oz. (0 days)

or

Trifloxystrobin*Flint*, 4 oz, 7- to 14-day intervals. (0 days) Maximum 2 consecutive applications, 4 applications/year and 16 oz/season. Alternate with Ridomil Gold Bravo.

or

Mono-, dibasic sodium salts of phosphorous acid*Fosphite*, 1 to 3 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)

or

Mandipropamid*Revus*, 8 fl oz. (0 day)

Note: Most fungicides that protect against Alternaria, anthracnose and gummy stem blight may also provide limited downy mildew protection.

Sweet Potatoes

PHYTOPHTHORA CROWN and FRUIT ROT

(*Phytophthora* spp.):

* Dimethomorph

Acrobat 50 WP, 6.4 oz every 7 days. (7 days)

or

* Fluopicolide

Presidio, 3-4 fl oz. (2 days)

or

* Mancozeb/Zoxamide

Gavel 75 DF, 1.5-2.0 lb. (5 days) Summer squash only.

or

* Famoxadone/Cymoxanil

Tanos, 8 - 10 oz every 5 - 7 days. (3 days)

or

* Mandipropamid

Revus, 8 fl oz. (0 day)

or

Cyazofamid

Ranman, 2.75 fl oz every 7 to 10 days.

or

Fosetyl-Aluminum

Aliette WDG, 2 to 5 lb, 7- to 14-day intervals. (0 days) Do not tank mix with copper fungicides.

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 2.5 to 5 pt every 7 - 14 days. (0 days)

Prophyt, 2 to 4 pt. (see label)

or

Mono-, dibasic sodium salts of phosphorous acid

Fosphite, 1 to 3 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)

Note: Most fungicides applied to control downy mildew may have limited efficacy against *Phytophthora* crown and fruit rot.

Sweet Potatoes

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number or days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Root-lesion, root-knot and other nematodes are associated with sweet potato. If you believe you have a nematode problem associated with sweet potato production, a sample should be tested (see Appendix C). If plant-parasitic nematodes are present in population densities above estimated damage thresholds for sweet potatoes, management recommendations will be provided at that time. Vydate L and Mocap 15G are labeled for use on sweet potatoes for nematode control.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

INSECTS

SOIL TREATMENT:

APHIDS, FLEA BEETLE:

Imidacloprid

Admire Pro, 4.4 - 10.5 fl oz. (21 days) See label for application methods.

APHIDS, FLEA BEETLE, LEAFHOPPER:

Platinum, 5 to 8 fl oz. (30 days) See label for application methods.

FOLIAR TREATMENT:

FLEA BEETLE: Apply when damage is first seen.

Assail 30 SG, 1.4 to 2.5 oz. (7 days)

or

Carbaryl

Sevin 80 S (1 1/4 to 2 1/2 lb) or *Sevin* XLR Plus (1 to 2 qt) (7 days)

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.5 fl oz. (7 days) Do not exceed 10.5 oz/Acre per season.

or

Actara, 1.5 to 3 oz. (14 days) Do not exceed 6 oz/acre per season.

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (7 days)

Do not exceed 15.4 fl oz/acre per season. (RUP)

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (21 days) (RUP)

or

Brigadier, 5.1 to 7.7 oz. (21 days)

ARMYWORM, CUTWORM: Apply at first feeding damage.

Carbaryl

Sevin 80 S (2 1/2 lb) or *Sevin* XLR Plus (1 to 2 qt) (7 days)

or

SpinTor 2 SC, 4.5 to 6 oz. (7 days)

or

Entrust, 1.5 to 3 oz. (7 days)

or

Rimon, 9 to 12 fl oz. (14 days)

or

Radiant SC, 6 to 8 fl oz. (7 days) Do not make more than 4 applications or exceed 32 fl oz/acre per season.

or

Warrior with Zeon Technology, 2.56 to 3.84 fl oz. (7 days)

Do not exceed 15.4 fl oz/acre per season. (RUP)

LEAFHOPPER: Treat as necessary.

Actara, 1.5 to 3 oz. (14 days) Do not exceed 6 oz per season.

or

Malathion 57 EC, 2 pt. (3 days)

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.5 fl oz. (7 days) Do not exceed 10.5 oz/Acre per season.

or

Warrior with Zeon Technology, 1.9 to 3.2 fl oz. (7 days)

Do not exceed 15.4 fl oz/acre per season. (RUP)

or

Brigadier, 3.8 to 7.7 oz. (21 days)

APHIDS:

* *Assail* 30 SG, 2.3 to 4 oz. (7 days)

or

* *Fulfill*, 2.75 to 5.5 oz. (14 days) Do not apply more than 11.0 oz/acre per season. May require 5 to 7 days for aphid mortality.

or

Malathion 57 EC, 2 pt. (3 days)

or

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.5 fl oz. (7 days) Do not exceed 10.5 oz/Acre per season.

or

Actara, 3 oz. (14 days) Do not exceed 6 oz/acre per season.

or

Brigadier, 3.8 to 7.7 oz. (21 days)

DISEASES**SEED (ROOT) TREATMENT:**

BLACK ROT, SCURF (*Ceratostomella simbrata*, *Monilochaetes infuscans*): Dip roots and sprouts in one of the following suspensions. Plant immediately.

DCNA

Botran 75 W, 1 lb/7 1/2 gal water, dip for 10 to 15 seconds, drain and plant immediately.

or

Thiabendazole

Mertect 340, 53 1/2 oz per 50 gal of water (8 fl oz per 7 1/2 gal) dip for 1 to 2 minutes. Do not use treated roots for food or feed.

PYTHIUM DAMPING OFF:Mefenoxam

Apron XL, 0.085 - 0.64 fl oz/100 lb seed. (0 days)

PREPLANT INCORPORATED:

DAMPING OFF (*Pythium* and *Phytophthora* spp.):

* Mefenoxam. Apply as a preplant incorporation or a surface application. For banded applications use a 7" band.

Note: If natural rainfalls not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1" of sprinkler irrigation.

Ridomil Gold SL, 1-2 pt.

Ridomil Gold WSP, 1 to 2 lb.

EARLY BLIGHT (*Alternaria solani*):Pyrimethanil

Scala, 7 fl oz every 7 - 14 days. (7 days) Maximum 35 fl oz/season.

WHITE RUST (*Albugo ipomoeae-panduratae*):Fenamidone

Reason 500 SC, 5.5 - 8.2 fl oz every 5 to 10 days. (7 days)

Note: It is recommended that a protectant partner such as an EDBC (mancozeb or metiram) or chlorothalonil product is added in tank mixture to any strobilurine product. Strobilurines should also be used in rotation with a fungicide with a different mode of action.

FOLIAR TREATMENT:

WHITE RUST (*Albugo tragoponsis*):

Azoxystrobin

Heritage, 3.2 - 10.5 oz every 5-7 days. (0 days) Maximum 3 lb/A/season.

Tomatoes

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

NEMATODES

Root-knot and root-lesion nematodes can reduce tomato yields. Fields with soil or root problems of undetermined cause should be tested for nematodes (see Appendix C). If the plant-parasitic nematodes are present in population densities above the economic threshold for tomatoes, crop rotation or application of a nematicide is recommended. The following nematicide is suitable for control of root-knot and root-lesion nematodes in tomato production.

1,3-D

Telone II, 9-18 gal/A (mineral soil).

Fumigate in the fall when soil temperatures at a 6-inch depth are above 50F. Inject the fumigant to a soil depth of 6 to 8 inches and lightly seal the soil immediately after application. Use soil fumigants only as directed on the label. In some limited situations soil fumigants can be applied in the spring in Michigan.

Correct soil moisture, temperature and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or by immediate tarping.

or

Metam Sodium

Vapam HL, 37.5 to 75 gal/A (use higher rate for muck soil).

Inject with shanks spaced 5 inches apart or to a depth of 4 to 10 inches in well prepared soil. Follow immediately with a roller to smooth and compact surface. Light watering to the treated surface helps to prevent escape of gas.

INSECTS

SEEDBED TREATMENT:

APHIDS, FLEA BEETLE, LEAFHOPPERS: Apply evenly over soil surface and incorporate 2 to 3 inches, or apply evenly over soil surface after plant emergence and water thoroughly.

SOIL TREATMENT:

COLORADO POTATO BEETLE, APHIDS, FLEA BEETLE: Apply at planting or transplanting. Consult label for rotation restrictions and application methods.

* Imidacloprid

Admire Pro, 7.0 - 10.5 fl oz. (21 days)

Nuprid 2 F, 16 to 24 fl oz.

or

* *Venom*, 5 to 6 oz. (21 days) See label for application methods.

WIREWORM, CUTWORM: Apply treatments evenly to soil surface before planting and incorporate to a 4- to 6-inch depth.

Diazinon 4 EC, 4 qt. Preplant treatment only. (RUP)

or

Brigadier, 3.4 to 6.8 oz. See label for application methods.

LEAFHOPPER, THRIPS, FLEA BEETLE, WHITEFLIES, APHIDS, COLORADO POTATO BEETLE:

Platinum, 5 to 11 fl oz. (30 days) Apply as an in-furrow spray or narrow surface band, as a post seeding, transplant or hill drench, in trickle or drip irrigation, or shanked into root zone after establishment or transplanting.

FOLIAR TREATMENT:

CUTWORM, ARMYWORM: Apply if there is more than 1 cutworm per 100 plants on transplants or if defoliation is >10% on larger plants.

* *Asana XL*, 5.8 to 9.6 oz. (1 day) (RUP)

or

* *Warrior* with Zeon Technology, 1.3 to 3.8 fl oz. (5 days) (RUP)

or

Baythroid XL, 2.1 to 2.8 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 20 B (10 lb) or *Sevin 5 B* (40 lb) or *Sevin 80 S* (2 lb)

or *Sevin XLR Plus* (1 to 2 qt) (3 days)

or

Danitol 2.4 EC, 10 2/3 fl oz. (3 days) (RUP)

or

SpinTor 2 SC, 4 to 8 fl oz. (0 days)

or

Entrust, 1.25 to 2.5 oz. (1 day)

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (5 days) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (1 day) (RUP)

or

Brigadier, 5.1 to 7.5 oz. (1 day)

FLEA BEETLE: Apply if necessary.

Actara, 2 to 3 oz. (0 days) Do not apply if a neonicitinoid was used at planting. Do not exceed 11 oz/acre per season.

or

Baythroid XL, 2.8 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S, 1 1/4 lb. (3 days)

or

Endosulfan 3 EC, 1 1/3 pt. (1 day) Consult label for rotation restrictions.

or

Imidacloprid

Nuprid 1.6 F, *Provado 1.6 F*, 3.8-6.2 fl oz. (0 days) Do not use if neonicitinoids were used at planting. Do not apply more than 19.2 oz/acre per season.

or

Venom, 1 to 4 oz. (1 day) Do not use if neonicitinoids were used at planting.

or

Warrior with Zeon Technology, 1.9 to 3.2 fl oz. (5 days) (RUP)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 1.9 to 3.2 fl oz. (5 days) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (1 day) (RUP)

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (1 day) (RUP)

or

Brigadier, 5.1 to 7.5 oz. (1 day)

COLORADO POTATO BEETLE: Apply to entire field or field borders if needed to protect new transplants or if defoliation on larger plants is greater than 10%.

* *Actara*, 2 to 3 oz. (0 days) Do not apply if a neonicitinoid was used at planting. Do not exceed 11 oz/acre per season.

or

* *Assail 30 SG*, 1.9 to 2.8 oz. (7 days)

or

* Imidacloprid

Nuprid 1.6 F, *Provado 1.6 F*, 3.8-6.2 fl oz. (0 days) Do not use if neonicitinoids were used at planting. Do not apply more than 19.2 oz/acre per season.

or

* *Venom*, 1 to 4 oz. (1 day) Do not use if neonicitinoids were used at planting.

or

Agri-Mek 0.15 EC, 8 to 16 fl oz. (7 days) (RUP)

or

Asana XL, 5.8 to 9.6 oz. (1 day) (RUP)

or

Bacillus thuringiensis tenebrionis

Novodor, 1 to 4 qts. (0 days) Small larvae only.

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 to 2 1/2 lb) or *Sevin* XLR Plus (1 to 2 qt) (3 days)

or

Endosulfan 3 EC, 2/3 qt. (2 days)

or

SpinTor 2 SC, 2.25 to 4.5 oz. (1 day)

or

Warrior with Zeon Technology, 1.3 to 3.8 fl oz. (5 days) (RUP)

or

Entrust, 1 to 2 oz. (1 day)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 2.6 to 3.8 fl oz. (5 days) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Brigadier, 5.1 to 7.5 oz. (1 day)

APHIDS: Apply as needed. May be a problem on transplants.

Assail 30 SG, 1.9 to 2.8 oz. (7 days)

or

Diazinon 50 WP (1/2 lb) or *Diazinon* AG 500 (1/2 pt) (1 day) (RUP)

or

Dimethoate 2.67 EC, 3/4 to 1 1/2 pt. (7 days)

or

Endosulfan 3 EC, 2/3 qt. (2 days)

or

Fulfill, 2.75 oz. (0 days) May require 5 to 7 days for aphid mortality.

or

Lannate LV (1 1/2 to 3 pt) or *Lannate* SP (1/2 to 1 lb) (1 day) (RUP)

or

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.8-6.2 fl oz. (0 days) Do not use if neonicotinoids were used at planting. Do not apply more than 19.2 oz/acre per season.

or

Venom, 1 to 4 oz. (1 day) Do not use if neonicotinoids were used at planting.

or

Beleaf 50 SG, 2 to 2.8 oz. (0 days)

or

Actara, 1.5 to 3 oz. (0 days) Do not apply if a neonicotinoid was used at planting. Do not exceed 11 oz/acre per season.

or

Brigadier, 3.8 to 9.85 oz. (1 day)

LEAFHOPPERS: Occasionally a problem early in the season.

Apply as needed.

Carbaryl

Sevin 80 S (1 1/4 lb) or *Sevin* XLR Plus (1 qt) (3 days)

or

Dimethoate 2.67 EC, 3/4 to 1 1/2 pt. (7 days)

or

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.8-6.2 fl oz. (0 days) Do not use if neonicotinoids were used at planting. Do not apply more than 19.2 oz/acre per season.

or

Venom, 1 to 4 oz. (1 day) Do not use if neonicotinoids were used at planting.

or

Warrior with Zeon Technology, 1.9 to 3.2 fl oz. (5 days) (RUP)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, *Proaxis*, 1.9 to 3.2 fl oz. (5 days) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (1 day) (RUP)

or

Brigadier, 3.8 to 9.85 oz. (1 day)

HORNWORMS: Apply if numbers exceed 1/plant.

Asana XL, 2.9 to 5.8 oz. (1 day) (RUP)

or

Avaunt, 2.5 to 3.5 oz. (3 days)

or

Bacillus thuringiensis

Agree, *Biobit*, *Dipel*, *Javelin*, *Lepinox*. (0 days)

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 to 2 1/2 lb) or *Sevin* XLR Plus (1 to 2 qt) (3 days)

or

Endosulfan 3 EC, 2/3 qt. (2 days)

or

Warrior with Zeon Technology, 1.9 to 3.2 fl oz. (5 days) (RUP)

or

Danitol 2.4 EC, 10 2/3 fl oz. (3 days) (RUP)

or

Entrust, 1 to 2 oz. (1 day)

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Tomatoes

Lambda-cyhalothrin

Lambda-Cy, Proaxis, 1.9 to 3.2 fl oz. (5 days) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Permethrin

Perm-UP 3.2 EC, 2 to 8 oz. (0 days) (RUP)

CABBAGE LOOPERS: Apply to prevent larvae from pupating on ripe fruit or if defoliation is greater than 10%.

* *Asana XL*, 5.8 to 9.6 oz. (1 day) (RUP)

or

* *Avaunt*, 2.5 to 3.5 oz. (3 days)

or

* *Baythroid XL*, 2.1 to 2.8 fl oz. (0 days) (RUP)

or

* *Warrior* with Zeon Technology, 1.9 to 3.2 fl oz. (5 days) (RUP)

or

Bacillus thuringiensis

Agree, Biobit, Dipel, Javelin, Lepinox. (0 days)

or

Endosulfan 3 EC, 2/3 qt. (2 days)

or

Lannate LV (1 1/2 to 3 pt) or *Lannate SP* (1/2 to 1 lb) (1 day) (RUP)

or

SpinTor 2 SC, 3 to 6 oz. (1 day)

or

Entrust, 1 to 2 oz. (1 day)

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or

Mustang Max, 3.2 to 4.0 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, Proaxis, 1.9 to 3.2 fl oz. (5 days) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (1 day) (RUP)

or

Brigadier, 5.1 to 7.5 oz. (1 day)

TOMATO FRUITWORM: Occasionally a problem after fruit begins to form. Apply if damage is observed.

* *Asana XL*, 5.8 to 9.6 oz. (1 day) (RUP)

or

* *Warrior* with Zeon Technology, 1.3 to 3.8 fl oz. (5 days) (RUP)

or

Avaunt, 3.5 oz. (3 days)

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S (1 1/4 to 2 1/2 lb) or *Sevin XLR Plus* (1 to 2 qt) (3 days)

or

Danitol 2.4 EC, 10 2/3 fl oz. (3 days) (RUP)

or

Endosulfan 3 EC, 2/3 qt. (2 days)

or

Lannate LV (1 1/2 to 3 pt) or *Lannate SP* (1/2 to 1 lb) (1 day) (RUP)

or

SpinTor 2 SC, 3 to 6 oz. (1 day)

or

Entrust, 1 to 2 oz. (1 day)

or

Intrepid 2 F, 4 to 8 fl oz (early-season applications to young, small crops) or 8 to 10 fl oz (mid- to late-season applications). (1 day)

or

Mustang Max, 2.2 to 4.0 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, Proaxis, 2.6 to 3.8 fl oz. (5 days) (RUP)

or

Hero, 4 to 10.3 oz. (7 days) (RUP)

or

Radiant SC, 5 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Bifenthrin

Bifenture EC, 2.1 to 6.4 oz. (1 day) (RUP)

or

Permethrin

Perm-UP 3.2 EC, 2 to 8 oz. (0 days) (RUP)

or

Brigadier, 5.1 to 7.5 oz. (1 day)

FRUIT FLIES: May be a problem on certain varieties during harvest season. Eggs are laid in cracks of ripening fruit. Apply as needed.

Diazinon 50 WP (1 lb) or *Diazinon AG 500* (1 pt) (1 day) (RUP)

or

Malathion 57 EC, 2 1/2 pt. (1 day)

THRIPS:

Assail 30 SG, 4 oz. (7 days)

or

Baythroid XL, 2.1 to 2.8 fl oz. (0 days) (RUP)

or

Venom, 1 to 4 oz. (1 day) Do not use if neonicotinoids were used at planting.

or

Warrior with Zeon Technology, 2.6 to 3.8 fl oz. (5 days) (RUP)

or

Mustang Max, 3.2 to 4.0 oz. (1 day) (RUP)

or

Lambda-cyhalothrin

Lambda-Cy, Proaxis, 2.6 to 3.8 fl oz. (5 days) (RUP)

or

Hero, 10.3 oz. (7 days) (RUP)

or

Agri-Mek 0.15 EC, 8 to 16 fl oz. (7 days) (RUP)

or

Radiant SC, 6 to 10 fl oz. (1 day) Do not make more than 6 applications or exceed 34 fl oz/acre per season.

or

Brigadier, 3.8 to 9.8 oz. (1 day)

WHITEFLIES:

Actara, 3 to 5 oz. (0 days) Do not apply if a neonicotinoid was used at planting. Do not exceed 11 oz/acre per season.

or

Assail 30 SG, 0.8 to 1.2 oz. (7 days)

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Imidacloprid

Nuprid 1.6 F, *Provado* 1.6 F, 3.8-6.2 fl oz. (0 days) Do not use if imidacloprid or thiamethoxam were used at planting. Do not apply more than 19.2 oz per season

or

Venom, 1 to 4 oz. (1 day) Do not use if neonicotinoids were used at planting.

or

Mustang Max, 3.2 to 4.0 oz. (1 day) (RUP)

or

Oberon 2 SC, 7 to 8.5 fl oz. (7 days)

or

Hero, 10.3 oz. (7 days) (RUP)

CUTWORM:

Carbaryl

Sevin XLR Plus, 2 qt. (3 days)

MITES

Usually two-spotted. May become a problem in hot, dry weather.

Agri-Mek 0.15 EC, 8 to 16 fl oz. (7 days) (RUP)

or

Danitol 2.4 EC, 10 2/3 fl oz. (3 days) (RUP)

or

Kelthane MF, 3/4 to 1 1/2 pt. (2 days) Limited to 2 applications per season.

or

Oberon 2 SC, 7 to 8.5 fl oz. (7 days)

or

Hero, 10.3 oz. (1 day) (RUP)

SLUGS

Deadline M-Ps 4% (20 to 40 lb) or *Metaldehyde* 3.5 G (30 to 40 lb) Apply between rows. Avoid contact to edible product.

DISEASES

SEED TREATMENT:

DAMPING OFF, PRE-EMERGENCE (*Pythium* spp., *Rhizoctonia solani*, *Phytophthora* spp.):

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 seed (*Pythium*).

or

Captan

Captan 30-DD, 2 1/3 oz/100 lb seed.

Captan 400, 2 1/2 to 3 oz/100 lb seed.

or

Thiram

42-S Thiram, *Thiram* 50 WP Dyed, 6 oz/100 lb seed. Apply to seed before planting.

GREENHOUSE SOIL DRENCH:

ROOT/STEM ROT (*Rhizoctonia solani*):

PCNB

Terraclor 400, see label for rates specific to soil depth.

PREPLANT SOIL FUMIGATION:

FUSARIUM WILT (*Fusarium oxysporum*), **VERTICILLIUM WILT** (*Verticillium albo-atrum*): Apply to production fields in the spring before planting. **Note:** Most fumigants applied in the soil for control of disease organisms will also control soil insects, nematodes and weed seeds.

Soil sterilization by fumigation is best achieved by proper application of material. Correct soil moisture, temperature, and soil structure is needed for effective control of soil-borne pests. Special care is needed to seal fumigants in target zone for required time periods. This can be achieved by soil packing or immediate tarping.

1,3 Dichloropropene/chloropicrin

Telone C35, 13-35 gal. (RUP)

or

Metam Sodium

Sectagon 42, *Vapam* HL, 37.5-75 gal.

or

Potassium N-methylidithiocarbamate

Sectagon-K54, 30-60 gal.

GREENHOUSE PREPLANT INCORPORATION:

DAMPING OFF (*Pythium* spp.), **ROOT ROT** (*Rhizoctonia* spp.):

Gliocladium virens GL-21

SoilGard 12 G, 1 to 1.5 lb per cubic yard. Biological control product that needs to be applied before disease development. Control may be limited under heavy disease pressure.

PREPLANT INCORPORATED:

DAMPING OFF (*Pythium* spp.):

* Mefenoxam. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7 in. band.

Note: If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1 in. of sprinkler irrigation.

Ridomil Gold GR, 20 lb.

Ridomil Gold SL, 1 pt. (7 days)

Ultra Flourish, 2 to 4 pt.

ROOT and FRUIT ROT (*Pythium* spp., *Phytophthora* spp.):

* Mefenoxam. Apply *Ridomil* 4 to 6 weeks after planting as a surface application or a soil surface spray under vines followed by 1/2 to 1 in. of water or injected based on a 7 in. band. A second application before the last irrigation may be made up to 4 weeks before harvest.

Ridomil Gold GR, 20 lb (4 weeks). (4 weeks) A third application can be made 4 weeks before harvest.

or

Tomatoes

Ridomil Gold SL, 1 pt. (7 days)

Ultra Flourish, 2 to 4 pt (4 weeks). (4 weeks)

Note: Observe limit of active ingredient/crop on label.

or

Mono-, dibasic sodium, potassium and ammonium phosphites

Phostrol, 2.5 to 5 pt every 7 - 14 days. (0 days)

GREENHOUSE TREATMENT:

BACTERIAL CANKER (*Clavibacter michiganensis* subsp.

michiganensis), **BACTERIAL SPOT** (*Xanthomonas vesicatoria*),

BACTERIAL SPECK (*Pseudomonas tomato*): Apply every 7 to 10 days after disease appearance.

Copper Ammonium Carbonate

Copper Count N, 4 tablespoons (speck) or 4 to 8 tablespoons (spot) per 1000 sq ft.

or

Copper Hydroxide

Champ DP, *Champ Formula 2 F*, *Kocide 2000*, 1 1/2 to 2 1/4 tablespoons per 1000 sq ft (speck and spot).

or

Champion WP, *Kocide 101*, 4 tablespoons (speck) or 4 to 8 tablespoons (spot) per 1000 sq ft.

or

Kocide 4.5 LF, 1 to 2 tablespoons per 1000 sq ft.

or

Kocide DF, 2 tablespoons (speck) or 2 to 4 tablespoons (spot) per 1000 sq ft.

or

Mancozeb

Dithane DF Rainshield, *Dithane M-45*, 1 1/2 to 3 lb. (5 days) Tank mix 1/2 to full rate of Dithane with a full rate of fixed copper fungicide, and apply at intervals recommended by the copper fungicide label (speck and spot).

or

Dithane F-45 Rainshield, 1.2 to 2.4 qt. Tank mix 1/2 to full rate of Dithane with a full rate of fixed copper fungicide, and apply at intervals recommended by the copper fungicide label (speck and spot)

or

Acibenzolar-S-methyl

Actigard, 1/3 to 3/4 oz per 100 gal of water. (14 days) Do not apply more than 6 oz of Actigard per acre per season.

Note: Most fungicides that protect against bacterial speck and/or spot may provide protection against bacterial canker.

FOLIAR TREATMENT:

ROOT ROT (*Phytophthora* spp.), **DAMPING OFF** (*Pythium* spp.):

Fosetyl-Aluminum

Aliette WDG, 2.5 to 5 lb, 7- to 14-day intervals. (14 days)

Note: Do not tank mix with copper products.

LEAF MOLD (*Cladosporium fulvum*), **WHITE MOLD** (*Sclerotinia sclerotiorum*), **GRAY MOLD** (*Botrytis cinerea*): Apply weekly as a foliar spray. May have reduced efficacy against *Botrytis* gray mold as a result of resistant strains of *B. cinerea*.

* Chlorothalonil

Bravo Ultrex, 1.3 to 1.8 lb. (0 days)

or

Bravo Weather Stik, *Equus 720 SST*, 1 3/8 to 2 pt; 2 to 3 pt (*Botrytis*). (0 days)

or

Echo 720, 2 to 3 pt (*Botrytis*). (0 days)

Echo 90 DF, 1.2 to 1.7 lb; 1.7 to 2.3 lb (*Botrytis*). (0 days)

Equus DF, 1.3 to 2.6 lb (*Botrytis*). (0 days)

or

* Mancozeb

Dithane DF Rainshield, *Dithane M-45*, *Dithane WSP*, 1 1/2 to 3 lb. (5 days)

or

Dithane F-45 Rainshield, 1 1/5 to 2 2/5 qt. (5 days)

Manzate 75 DF, 1 1/2 to 3 lb, 7- to 10-day intervals. (5 days)

or

Penncozeb 75 DF (3/4 to 3 lb (*Cladosporium*)) or *Penncozeb 80 WP* (3/4 to 3 lb (*Cladosporium*)) (5 days)

or

* Maneb

Maneb 75 DF, *Maneb 80 WP*, 1 1/2 to 3 lb. (5 days)

Manex, 1 1/5 to 2 2/5 qt. (5 days)

or

Boscalid

Endura, 9 to 12.5 oz. (0 days)

or

Famoxadone/Cymoxanil

Tanos, 8 oz. (3 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Potassium Bicarbonate

Armcarb 100, 2.5 to 5 lb (*Botrytis*). (0 days)

or

Pyrimethanil

Scala, 7 fl oz. (1 day)

BACTERIAL CANKER (*Clavibacter michiganensis* subsp.

michiganensis), **BACTERIAL SPOT** (*Xanthomonas vesicatoria*),

BACTERIAL SPECK (*Pseudomonas tomato*):

Bacillus subtilis

Serenade, 4 to 8 lb every 7 days. (0 days) Biological control product that needs to be applied before disease development. Control will be limited under heavy disease pressure.

or

Serenade Max, 1 - 3 lb every 7 to 10 days. (0 days)

or

Copper Ammonium Carbonate

Copper Count N, 1 to 3 qt (speck, spot). (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 lb 10 to 30 day intervals (speck) or 1 1/3 to 2 2/3 lb (spot), 7- to 10-day intervals. (0 days)

or

Champ Formula 2 F, 1 1/3 pt (speck), 1 1/3 to 2 2/3 pt (spot). (0 days)

or

Champion WP, 2 to 4 lb (spot) or 2 lb (speck). (0 days)

Kocide 101, *Kocide DF*, 2 to 4 lb (speck, spot). (0 days)

Kocide 2000, 1 1/2 to 3 lb. (0 days)

Kocide 4.5 LF, 1 1/3 to 2 2/3 pt (speck, spot). (0 days)

or

Nu-Cop 3 L, 1 1/3 to 2 2/3 pt, 10- to 30-day intervals (speck) or 1 1/3 to 5 1/3 pt, 7- to 10-day intervals (spot). (0 days)

or

Nu-Cop 50 DF, 2 to 3 lb (speck) or 2 to 4 lb (spot), 7- to 10-day intervals. (0 days)

or

Mancozeb/Copper Hydroxide

ManKocide, 2.5 to 5 lb (speck, spot). (5 days)

or

Copper Oxychloride / Copper Sulfate

C-O-C-S WDG, 2 to 6 lb every 7 days. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt (speck, spot).

or

Copper Sulfate

Basic Copper 53, *Basicop*, 2 to 4 lb (canker, spot). (0 days) May be used through irrigation equipment.

or

Cuprofix Ultra, 1.25 to 3 lb. (0 days)

or

Famoxadone/Cymoxanil

Tanos, 8 oz. (3 days)

Note: Fungicides that protect against bacterial speck and/or spot may provide protection against bacterial canker.

EARLY BLIGHT (*Alternaria solani*):

* Azoxystrobin

Amistar, 1.6 to 2.0 oz every 7 - 21 days. (0 days)

Quadris, 5 to 6.2 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

* Azoxystrobin/Chlorothalonil

Quadris Opti, 1.6 pt every 7 - 21 days. (0 days)

or

* Boscalid

Endura, 2.5 to 3.5 oz. (0 days)

or

* Chlorothalonil

Bravo Ultrex, 1.3 to 1.8 lb (foliage) or 1.8 to 2.7 (fruit) every 7 - 14 days. (0 days)

or

Bravo Weather Stik, *Echo* 720, *Equus* 720 SST, 1 3/8 to 2 pt (foliage) or 2 to 2.75 pt (fruit). (0 days)

or

Echo 90 DF, 1.2 to 1.7 lb. (0 days)

Equus DF, 1.3 to 2.6 lb. (0 days)

or

* Mancozeb

Dithane DF Rainshield, *Dithane* M-45, *Dithane* WSP, 1 1/2 to 3 lb. (5 days)

or

Dithane F-45 Rainshield, 1 1/5 to 2 2/5 qt. (5 days)

Manzate 75 DF, *Manzate* 80 WP, 1 1/2 to 3 lb. (5 days)

Penncozeb 4 F, 0.6 to 2.4 qt. (5 days)

Penncozeb 75 DF, *Penncozeb* 80 WP, 1 1/2 to 3 lb. (5 days)

or

* Maneb

Maneb 75 DF, or *Maneb* 80 WP (1 1/2 to 3 lb) or *Manex* (1 1/5 to 2 2/5 qt) (5 days)

or

* Mandipropamid/Difenoconazole

Revus Top, 5.5-7 fl oz. (1 day)

or

* Pyraclostrobin

Cabrio, 8-12 oz. (0 days) No more than 3 sequential applications should be made before alternating with fungicides having a different mode of action.

or

* Trifloxystrobin

Flint, 2 to 3 oz. (3 days)

or

* Ziram

Ziram 76 DF, 3 to 4 lb, 7- to 14-day intervals. (7 days) Do not use on cherry tomatoes.

or

Bacillus subtilis

Serenade, 4 to 8 lb every 7 days. (0 days) Biological control product that needs to be applied before disease development. Control will be limited under heavy disease pressure.

or

Copper Ammonium Carbonate

Copper Count N, 3 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 to 2 lb. (0 days)

Champ Formula 2 F, 1 1/3 to 2 pt. (0 days)

Champion WP, 2 to 4 lb. (0 days)

Kocide 101, *Kocide* DF, *Nu-Cop* 50 DF, 2 to 3 lb. (0 days)

Kocide 2000, 1 1/2 to 3 lb. (0 days)

Kocide 4.5 LF, 1 1/3 to 2 2/3 pt. (0 days)

Nu-Cop 3 L, 1 1/3 to 4 pt. (0 days)

or

Mancozeb/Copper Hydroxide

ManKocide, 2.5 to 5 lb. (5 days)

or

Copper Sulfate

Basic Copper 53, *Basicop*, 2 to 4 lb. (0 days)

Cuprofix Ultra, 1.25 to 3 lb. (0 days)

or

Famoxadone/Cymoxanil

Tanos, 8 oz. (3 days)

or

Fenamidone

Reason 500 SC, 5.5 to 8.2 fl oz every 5 to 10 days. (14 days)

or

Mancozeb/Copper Sulfate

Cuprofix MZ Disperss, 1.75 - 7.25 lb. (5 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Potassium Bicarbonate

Armcarb 100, 2.5 to 5 lb. (0 days)

or

Tomatoes

Pyrimethanil

Scala, 7 fl oz. (1 day)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

LATE BLIGHT (*Phytophthora infestans*):

* Azoxystrobin/Chlorothalonil

Quadris Opti, 1.6 pt every 7 - 21 days. (0 days)

or

* Chlorothalonil

Bravo Ultrex, 1.3 to 1.8 lb (foliage) or 1.8 to 2.6 lb (fruit).

(0 days)

or

Bravo Weather Stik, *Echo 720*, *Equus 720 SST*, 1 3/8 to 2 pt (foliage) or 2 to 2.75 pt (fruit). (0 days)

or

Echo 90 DF, 1.2 to 1.7 lb. (0 days)

Equus DF, 1.3 to 2.6 lb.

or

* Cyazofamid

Ranman, 2.1 to 2.75 fl oz every 7 to 10 days. (5 days)

or

* Cymoxanil

Curzate 60 DF, 3.2 to 5 oz every 5 - 7 days. (3 days)

or

* Dimethomorph

Acrobat 50 WP, 6.4 oz. (0 days)

Forum, 6 fl oz. (0 days)

or

* Fluopicolide

Presidio, 3-4 fl oz. (2 days)

or

* Mancozeb/Zoxamide

Gavel 75 DF, 1.5-2.0 lb. (5 days)

or

* Mandipropamid/Difenoconazole

Revus Top, 5.5-7 fl oz. (1 day)

or

* Propamocarb

Previcur Flex, 0.7 to 1.5 pt every 7 to 10 days. (5 days)

or

* Pyraclostrobin

Cabrio, 8-12 oz. (0 days) Apply in a strict one-to-one alternation program with fungicides having a different mode of action.

or

* Mefenoxam/Chlorothalonil

Ridomil Gold Bravo, 2 lb, 14-day intervals. (14 days) Maximum 3 applications.

or

* Mefenoxam/Copper Hydroxide

Ridomil Gold Copper, 2 lb, 14-day intervals. (14 days) Maximum 3 applications.

or

* Mefenoxam/Mancozeb

Ridomil Gold MZ, 2.5 lb, 14-day intervals. (14 days) Maximum 3 applications.

or

Azoxystrobin

Amistar, 1.6 to 2.0 oz every 5 - 7 days. (0 days)

Quadris, 5 to 6.2 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action

or

Bacillus subtilis

Serenade, 4 to 8 lb. (0 days) Provides suppression. Biological control product that needs to be applied before disease development. Control may be limited under heavy disease pressure.

or

Copper Ammonium Carbonate

Copper Count N, 1 to 3 qt. (0 days)

or

Copper Hydroxide

Champ DP, 1 1/3 to 2 lb. (0 days)

Champ Formula 2 F, 1 1/3 to 2 pt. (0 days)

Champion WP, 2 to 4 lb. (0 days)

Kocide 101, *Kocide DF*, 2 to 3 lb. (0 days)

Kocide 2000, 1 1/2 to 3 lb. (0 days)

Kocide 4.5 LF, 1 1/3 to 2 2/3 pt. (0 days)

Nu-Cop 3 L, 1 1/3 to 5 1/3 pt, 7- to 10-day intervals. (0 days)

or

Mancozeb/Copper Hydroxide

ManKocide, 2.5 to 5 lb. (5 days)

or

Copper Sulfate

Basic Copper 53, *Basicop*, 2 to 4 lb. (0 days)

Cuprofix Ultra, 1.25 to 3 lb. (0 days)

or

Famoxadone/Cymoxanil

Tanos, 8 oz. (3 days)

or

Fenamidone

Reason 500 SC, 5.5 to 8.2 fl oz every 5 to 10 days. (14 days)

or

Maneb

Maneb 75 DF, *Maneb 80 WP*, 1 1/2 to 3 lb, 7- to 10-day intervals. (5 days)

or

Manex, 1 1/5 to 2 2/5 qt. (0 days)

or

Mancozeb

Dithane DF Rainshield, *Dithane M-45*, *Dithane WSP*, 1 1/2 to 3 lb. (5 days)

or

Manzate 75 DF, 1 1/2 to 3 lb. Maximum 22.4 lb/season. (5 days)

or

Dithane F-45 Rainshield, 1 1/5 to 2 2/5 qt. (5 days)

Penncozeb 4 F, 0.6 to 2.4 qt. (5 days)

Penncozeb 75 DF, *Penncozeb 80 WP*, 1 1/2 to 3 lb. (5 days)

or

Mancozeb/Copper Sulfate

Cuprofix MZ Disperss, 1.75 - 7.25 lb. (5 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Potassium Bicarbonate

Armcarb 100, 2.5 to 5 lb. (0 days)

or

Trifloxystrobin

Flint, 4 oz. (3 days)

or

Mono-, dibasic sodium salts of phosphorous acid

Fosphite, 3 to 5 qt per 20 gal (ground) or 10 gal (aerial) of water. (0 days)

Note: Most fungicides that protect against early blight also provide limited late blight protection.

SEPTORIA LEAF SPOT (*Septoria lycopersici*):*** Azoxytrobin**

Amistar, 1.6 to 2.0 oz every 7 - 21 days.

Quadris, 5 to 6.2 fl oz.

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

*** Azoxytrobin/Chlorothalonil**

Quadris Opti, 1.6 pt every 7 - 21 days. (0 days)

or

*** Chlorothalonil**

Bravo Ultrex, 1.3 to 1.8 lb. (0 days)

Echo 90 DF, 1.2 to 1.7 lb. (0 days)

Equus DF, 1.3 to 2.6 lb. (0 days)

or

Bravo Weather Stik, *Echo 720*, *Equus 720 SST*, 1 3/8 to 2 pt. (0 days)

or

*** Mancozeb**

Dithane DF Rainshield, *Dithane M-45*, *Dithane WSP*, 1 1/2 to 3 lb. (5 days)

or

Manzate 75 DF, 1 1/2 to 3 lb. Maximum 22.4 lb/season. (5 days)

or

Dithane F-45 Rainshield, 1 1/5 to 2 2/5 qt. (5 days)

Penncozeb 75 DF, *Penncozeb 80 WP*, 1 1/2 to 3 lb. (5 days)

or

*** Maneb**

Maneb 75 DF, *Maneb 80 WP*, 1 1/2 to 3 lb. (5 days)

Manex, 1 1/5 to 2 2/5 qt. (5 days)

or

*** Pyraclostrobin**

Cabrio, 8-12 oz. (0 days) No more than 3 sequential applications should be made before alternating with fungicides having a different mode of action.

or

*** Trifloxystrobin**

Flint, 3 to 4 oz suppressed. (3 days)

or

*** Ziram**

Ziram 76 DF, 3 to 4 lb, 7- to 14-day intervals. (7 days) Do not use on cherry tomatoes.

or

Copper Hydroxide

Champ DP, 1 1/3 to 2 2/3 lb. (0 days)

Kocide 2000, 1 1/2 to 3 lb. (0 days)

or

Champ Formula 2 F, *Kocide 4.5 LF*, 1 1/3 to 2 2/3 pt, 7- to 10-day intervals. (0 days)

or

Champion WP, *Kocide 101*, *Kocide DF*, 2 to 4 lb, 7- to 10-day intervals. (0 days)

or

Mancozeb/Copper Hydroxide

ManKocide, 2.5 to 5 lb. (5 days)

or

Copper Sulfate

Basic Copper 53, *Basicop*, 2 to 4 lb. (0 days)

Cuprofix Ultra, 1.25 to 3 lb. (0 days)

or

Fenamidon

Reason 500 SC, 5.5 to 8.2 fl oz every 5 to 10 days. (14 days)

or

Mancozeb/Copper Sulfate

Cuprofix MZ Disperss, 1.75 - 7.25 lb. (5 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

or

Mandipropamid/Difenoconazole

Revus Top, 5.5-7 fl oz. (1 day)

ANTHRACNOSE (*Colletotrichum coccodes*):*** Azoxytrobin**

Amistar, 1.6 to 2.0 oz every 7 - 21 days. (0 days)

Quadris, 5 to 6.2 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

*** Chlorothalonil**

Bravo Ultrex, 1.8 to 2.6 lb. (0 days)

Echo 90 DF, 1.7 to 2.3 lb. (0 days)

Equus DF, 1.3 to 2.6 lb. (0 days)

or

Bravo Weather Stik, *Echo 720*, *Equus 720 SST*, 2 to 2.75 pt. (0 days)

or

*** Mancozeb**

Dithane DF Rainshield, *Dithane M-45*, *Dithane WSP*, 1 1/2 to 3 lb. (5 days)

or

Dithane F-45 Rainshield, 1 1/5 to 2 2/5 qt. (5 days)

Penncozeb 4 F, 0.6 to 2.4 qt. (5 days)

Penncozeb 75 DF, *Penncozeb 80 WP*, 1 1/2 to 3 lb. (5 days)

or

Manzate 75 DF, 1 1/2 to 3 lb. Maximum 22.4 lb/season. (5 days)

or

*** Maneb**

Maneb 75 DF, *Maneb 80 WP*, 1 1/2 to 3 lb. (5 days)

or

Turnips

Manex 4 F, 1 1/5 to 2 2/5 qt. Maximum of 16.8 qt/season. (5 days)

or

* Pyraclostrobin

Cabrio, 8-12 oz. (0 days) No more than 3 sequential applications should be made before alternating with fungicides having a different mode of action.

or

* Ziram

Ziram 76 DF, 3 to 4 lb, 7- to 14-day intervals. (7 days) Do not use on cherry tomatoes.

or

Mancozeb/Copper Hydroxide

ManKocide, 2.5 to 5 lb. (5 days)

or

Copper Hydroxide

Champ DP, 1 1/3 to 2 2/3 lb. (0 days)

or

Champ Formula 2 F, *Kocide* 4.5 LF, 1 1/3 to 2 2/3 pt, 7- to 10-day intervals. (0 days)

or

Champion WP, *Kocide* 101, *Kocide* DF, 2 to 4 lb, 7- to 10-day intervals. (0 days)

or

Kocide 2000, 1 1/2 to 3 lb. (0 days)

Nu-Cop 3 L, 1 1/3 to 5 1/3 pt, 7- to 10-day intervals. (0 days)

Nu-Cop 50 DF, 2 to 3 lb, 7- to 10-day intervals. (0 days)

or

Copper Sulfate

Basic Copper 53, *Basicop*, 2 to 4 lb. (0 days)

Cuprofix Ultra, 1.25 to 3 lb. (0 days)

or

Famoxadone/Cymoxanil

Tanos, 8 oz. (3 days)

Or

Mancozeb/Copper Sulfate

Cuprofix MZ Disperss, 1.75 - 7.25 lb. (0 days)

or

Neem Oil

Trilogy, 2 pt. (0 days)

or

Potassium Bicarbonate

Armicarb 100, 2.5 to 5 lb. (0 days)

or

Copper Resinate

Tenn-Cop 5 E, 3 pt. (0 days)

or

Mandipropamid/Difenoconazole

Revus Top, 5.5-7 fl oz. (1 day)

BUCKEYE FRUIT ROT (*Phytophthora parasitica*):

* Trifloxystrobin

Flint, 3 to 4 oz suppressed. (3 days) Suppressed.

or

* Fluopicolide

Presidio, 3-4 fl oz. (2 days)

or

* Mefenoxam/Copper Hydroxide

Ridomil Gold Copper, 2 lb, 14-day intervals. (14 days) Maximum 3 applications.

or

* Mefenoxam/Chlorothalonil

Flouronil, 2 lb, 14-day intervals. (14 days) Maximum 3 applications.

or

Ridomil Gold Bravo, 2 lb, 14-day intervals. (14 days) 3 applications maximum.

or

Azoxystrobin

Amistar, 1.6 to 2.0 oz every 7 - 21 days. (0 days)

Quadris, 5 to 6.2 fl oz. (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Azoxystrobin/Chlorothalonil

Quadris Opti, 1.6 pt every 7 - 21 days. (0 days)

Turnips

Amount of chemical formulation to apply per acre (unless otherwise directed). Apply no closer to harvest than number of days given in parentheses. (RUP) = Restricted Use Pesticide. Consult bulletin E-959 for pictures of insects, life history and damage. See current Vegetable Crop Advisory Team Newsletter for up-to-date information on pest status and control. (Visit www.ipm.msu.edu/vegCAT.htm or use the order form in the back of the book to subscribe.)

INSECTS

SOIL TREATMENT:

CABBAGE MAGGOT:

Lorsban 15 G (4.6 to 9.2 oz/1,000 ft of row) or *Lorsban* 4 E / *Lorsban* Advanced (1.6 to 2.75 fl oz / 1,000 ft of row) Apply in a 4-inch band over row at time of seeding. (RUP)

APHIDS, FLEA BEETLE:

 See label for application methods.

Imidacloprid

Admire Pro, 4.4 - 10.5 fl oz. (21 days) See label for application methods.

or

Nuprid 2 F, 10 to 24 fl oz. (21 days) Apply preplant, in furrow, or as a post-planting drench.

or

Platinum, 5 to 12 fl oz. (30 days) See label for application methods.

FOLIAR TREATMENT:

FLEA BEETLE: Apply if foliar injury is observed to prevent larval injury to roots.

Actara, 1.5 to 3 oz. (7 days)

or

Baythroid XL, 1.6 to 2.8 fl oz. (0 days) (RUP)

or

Carbaryl

Sevin 80 S, 1 1/4 lb. (7 days; 14 days if tops are eaten)

or

Imidacloprid

Nuprid 1.6 F, Provado 1.6 F, 3.5 fl oz. (7 days) Do not exceed 10.5 oz/Acre per season.

CABBAGE "WORM": Apply if needed.

Bacillus thuringiensis

Agree, Biobit, Dipel, Javelin, Xentari. (0 days)

or

Malathion 57 EC, 2 pt. (7 days)

or

Permethrin

Perm-UP 3.2 EC, 2 to 4 oz. (1 day) (RUP)

APHIDS: Apply as needed to prevent population buildup.

Actara, 1.5 to 3 oz. (7 days)

or

Malathion 57 EC, 2 pt. (3 days)

or

Imidacloprid

Nuprid 1.6 F, Provado 1.6 F, 3.5 fl oz. (7 days) Do not exceed 10.5 oz/Acre per season.

DISEASES

SEED TREATMENT:

DAMPING OFF (*Pythium* spp., *Rhizoctonia solani*): Apply treatment as dust or slurry.

Bacillus subtilis GB03

Kodiak, 0.1 to 0.5 oz/100 lb seed (*Pythium*).

or

Fludioxinil

Maxim 4 FS, 0.08 to 0.16 fl oz/100 lb seed (*Rhizoctonia*).

Commercial seed treatment plants only.

or

Captan

Captan 30-DD, 1 1/4 oz/100 lb seed.

Captan 400, 1 to 2 oz/100 lb seed.

or

Thiram

42-S Thiram, Thiram 50 WP Dyed, 8 oz/100 lb seed.

PREPLANT INCORPORATED:

DAMPING OFF (*Pythium* and *Phytophthora* spp.):

* Mefenoxam. Apply as a broadcast preplant incorporation or a surface application. For banded applications use a 7" band. **Note:** If natural rainfall is not expected before seeds germinate, incorporate mechanically before planting or water into the seed zone after planting with 1/2 to 1" of sprinkler irrigation.

Ridomil Gold SL, 1-2 pt.

FOLIAR TREATMENT:

ALTERNARIA LEAF SPOT (*Alternaria* spp.), **DOWNY MILDEW**

(*Peronospora parasitica*):

Azoxystrobin

Amistar (2 to 5 oz (*Alternaria*)) or Quadris (6.2 to 15.4 fl oz (*Alternaria*)) (0 days)

Do not apply more than one foliar application of Amistar and Quadris or other strobilurin fungicide before alternating with a fungicide that has a different mode of action.

or

Pyraclostrobin

Cabrio, 8 to 12 oz. (0 days)

or

Trifloxystrobin

Flint, 2 to 3 oz. (7 days) Do not apply more than three sequential foliar applications of strobilurin fungicides before alternating with a fungicide that has a different mode of action.

or

Acibenzolar-S-methyl

Actigard, 1 oz per 20 gal (ground) or 10 gal (aerial) of water. (7 days) Do not apply more than 4 applications / crop per year.

CERCOSPORA LEAF SPOT (*Cercospora* spp.):

Tebuconazole

Folicur 3.6F, 4-7.2 fl oz. (7 days) Maximum 28.8 fl oz/acre/season. 12 hr REI.

APPENDIX A

Seedbed Preparation

SEEDBED PREPARATION

Clean soil is necessary for good seedbed production. Organisms that cause damage to vegetable seedlings may be present in any soil or growing mixture. Soils may be sterilized by a number of chemical or physical techniques, such as steam or dry heat.

Warnings: All the listed fumigants may be used both in the seedbeds and to treat soils in which vegetables are grown to maturity, with the following exceptions: 1) METHYL BROMIDE and FORMALDEHYDE can be used only for seedbeds. 2) None of the materials can be used where living plants are growing. Carefully read the directions in the table below, and especially those of manufacturers, to avoid danger and to obtain successful results.

SEED TREATMENT

Dust method—place the seed and suggested wettable powders in a closed container and agitate vigorously for several minutes or until seed is coated with dust. For best results, use a container with twice the capacity of the seed treated.

Slurry method—to suggested wettable powders, add enough water to make a sloppy paste or slurry. Treat by stirring or swirling seed in the slurry until thoroughly coated. Dry the seed before planting. Slurries are preferred to dusts because they adhere to the seed better and are less irritating to use.

CHEMICALS SUGGESTED FOR SEEDBED STERILIZATION

CHLOROPICRIN
(E.G. CHLOR-O-PIC, PICFUME)

Warnings: Fumes are very irritating to eyes and are poisonous to growing plants. Wear full coverage protective clothing and a MSHA/NIOSH-approved respirator with the proper carbon filter.

Rate and Method of Application

Inject 1.6 to 2.3 cc of material 6 inches deep and at 8-inch intervals using a hand operated fumigation gun. Treat only when soil temperature 6 inches deep is above 65°F. Pack treated soil and apply water seal (wet to a depth of several inches) or cover with plastic for 48 hours. Cultivate to speed aeration and avoid planting for 2 weeks, or until odor of fumigant is no longer detectable.

FORMALDEHYDE

NOTE: Not effective for nematodes. Especially suited for cabbage and cauliflower.

Warnings: Fumes are irritating to eyes and nasal passages and poisonous to growing plants. Avoid prolonged contact with skin. Wash off with soap and water. Wear goggles, rubber footwear and rubber gloves when handling. Wear full coverage protective clothing and a MSHA/NIOSH-approved respirator with the proper carbon filter. Ventilate when treating a confined area. Rate of Method of Application

Mix 1 pt (37% to 40% strength) with 5 gallons of water and apply with a sprinkling can at the rate of 1/2 gal/sq ft of soil surface. Treat only if soil temperature 6 inches deep is above 60°F. Cover treated soil with a plastic cover. Leave undisturbed for 48 hours, then cultivate one or more times. Avoid planting for 2 weeks or until odor of fumigant is no longer detectable. Do not use near living plants. As a disinfectant for equipment and storage interiors or greenhouses, spray surfaces with a mixture of 1 pt (37% to 40% strength) in 5 gallons of water. Cover equipment with plastic and keep storage or greenhouse closed for 24 to 48 hours after treatment, then air out well before planting.

1,3-D (DICHLOROPROPENE; TELONE II)

Warnings: Fumes are irritating to eyes and nasal passages. Prolonged inhalation is dangerous; poisonous to growing plants. Avoid contact with skin. Wash off with soap and water. Wear goggles, rubber footwear and rubber gloves when handling. Wear full coverage protective clothing and a MSHA/NIOSH-approved respirator with the proper carbon filter.

Rate and Method of Application

Apply as a preplant broadcast treatment at least 14 to 21 days prior to planting. Late summer or early autumn is usually best for applying fumigants in Michigan. Inject at 8 inches deep with chisels spaced 10 to 12 inches apart when soil temperature is between 50° and 80°F. Seal immediately after application. If soil is waterlogged or temperature is below 60°F, allow additional time before planting. Use only on crops listed on the respective label.

1,3-D AND CHLOROPICRIN (E.G., TELONE C-17)

Warnings: Fumes are irritating to eyes and nasal passages. Prolonged inhalation is dangerous; poisonous to growing plants. Avoid contact with skin. Wash off with soap and water. Wear goggles, rubber footwear and rub-

ber gloves when handling. Wear full coverage protective clothing and a MSHA/NIOSH-approved respirator with the proper carbon filter.

Rate and Method of Application

Apply as a preplant broadcast treatment at least 14 to 21 days prior to planting. Late summer or early autumn is usually best for applying soil fumigants in Michigan. Inject 8 inches deep with chisels spaced 10 to 12 inches apart when soil temperature is between 50° and 80°F. Seal immediately after application. If soil is waterlogged or temperature is below 60°F, allow additional time before planting. Use only on crops listed on the respective label.

SODIUM METHYLDITHIOCARBAMATE
(METHAM) (E.G., VAPAM OR VAPAM HL)

Warnings: Avoid breathing vapor or spray mist. Do not get in eyes, on skin, or clothing. Causes skin irritation. May be fatal if absorbed through skin. Wash with soap and water. Wear full coverage protective clothing and a MSHA/NIOSH-approved respirator to reduce exposure.

Rate and Method of Application

With a sprinkling can, fill with 1 to 1 1/2 pt metham and water and sprinkle uniformly over 50 sq ft of well-prepared soil. Sprinkle immediately with water until soil is sealed, or tarp for 48 hours. Seven days after treatment cultivate area to a depth of 2 inches to aerate soil. Do not seed earlier than 21 days after application if tarp is used. For soil injection, space injectors 5 inches apart and inject metham 4 inches into well-prepared soil. Follow immediately with a roller to smooth and compact the soil surface. Light watering or a tarp after rolling helps to prevent gas escape. For seedbeds, 75 to 100 gal/A (1 1/2 pt to 2 pt per 100 sq ft) is recommended.

APPENDIX B

Nematodes and Michigan Vegetable Production

George W. Bird, Professor
Michigan State University
East Lansing, MI 48824

Nematodes are believed to be the most common animals on our planet. They inhabit most soil, fresh water and marine environments. At least 12 types of nematodes are known to parasitize or cause infectious diseases of Michigan vegetable crops. Hundreds of other species are involved in making nutrients available for plant growth. The objectives of this article are to: 1) provide an overview of the nematode problems associated with vegetable production in Michigan, 2) discuss the management options for plant-parasitic nematodes, 3) describe how nematodes are involved in nitrogen mineralization and 4) provide some recommendations on how to enhance the role of nematodes in making nutrients available for plant growth.

The 12 types of plant parasitic nematodes that feed on vegetable crops in Michigan cause diverse symptoms, attack a wide variety of crops and have different behaviors.

ROOT-KNOT NEMATODES

Only one species, the Northern Root-Knot Nematode is known to over-winter under Michigan conditions. Other species can be brought into the state on transplants produced in the south.

Crop Symptoms -Root galls, yellowing, wilting, stunted top growth, stunted root growth, low crop yield and poor crop quality.

Crops Attacked -Beets, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Cucumber, Eggplant, Garlic, Leeks, Lettuce, Melons, Onions, Parsnips, Peppers, Potatoes, Pumpkins, Squash, Tomatoes.

Nematode Behavior -Second-stage juveniles invade root tissue a short distance behind the root tip. They migrate towards the root tip, stop, turn and then migrate to where the vascular cylinder is being formed. Here, the plant forms nurse cells for use by the nematodes for their

growth and development. The plant also forms root galls for protection of the hundreds of eggs in each egg mass. Extensive amounts of plant matter and energy are used in this process, resulting in unsatisfactory crop growth and development. A close relative, the False Root-Knot Nematode, has been found associated with sugar beets in Michigan and has the potential to feed on beets and potato. This species, however, has not been detected in Michigan during the last 25 years.

CYST NEMATODES

Michigan is the home to nine different species of cyst nematodes. Three of them, Carrot Cyst Nematode, Soybean Cyst Nematode and Sugar Beet Cyst Nematode can be serious problems in Michigan vegetable production.

Crop Symptoms -Yellowing, stunted top growth, stunted root growth, poor nodulation, pinhead size white females on root tissue, poor crop yield and poor crop quality.

Crops Attacked -Carrot Cyst Nematode (carrots), Soybean Cyst Nematode (Snap Beans, Peas) and Sugar Beet Cyst Nematode (Beets, Broccoli, Brussels Sprouts, Cabbage).

Nematode Behavior -Second-stage juveniles invade root tissue about one half of an inch behind the root tip. They burrow to where the vascular cylinder is being formed and induce the plant to form nurse cells for nematode feeding. The female swells and breaks through the root tissue. When she has filled her body with eggs, she dies and drops from the root. Her body hardens to become a protective cyst that can survive in soil in the absence of a host for up to 12 years. Extensive amounts of plant matter and energy are used in this process, resulting in poor crop growth and development.

ROOT-LESION NEMATODES

The Penetrans Root-Lesion Nematode is the most common plant parasitic nematode in Michigan and feeds on the root systems of many crops. A second nematode, the False Root-Lesion Nematode causes damage to mint grown in muck soil.

Crop Symptoms -Yellowing, stunted top growth, stunted root growth, root lesions, poor crop yield and poor crop quality.

Crops Attacked -Beets, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Corn, Cucumber, Eggplant, Garlic, Leeks, Lettuce, Melons, Mint, Onions, Parsnips, Peppers, Potatoes, Pumpkins, Squash, and Tomatoes.

Nematode Behavior -All stages of root-lesion nematodes are mobile and penetrate root tissue as endoparasites. After root penetration, the nematodes migrate throughout the root cortex, where females deposit their eggs. This migration, combined with chemical exudates,

results in reduced uptake and transport of water and nutrients throughout the plant. Root-lesion nematodes are known to interact with soil-borne fungi to cause disease complexes. The best known of these is the Potato Early-Die Disease Complex.

NEEDLE NEMATODES

There are two types of Needle Nematodes in Michigan, the Common Needle Nematode and the Corn Needle Nematode. They can exist in both muck and mineral soil.

Crop Symptoms -Greatly stunted top growth, barren areas, swollen root-tips, reduced crop yield and poor crop quality.

Crops Attacked -Celery, Corn, Garlic, Onions.

Nematode Behavior -Needle nematodes are large ectoparasites and only the nematodes' stylets penetrate root tissue. The Corn Needle Nematode feeds early in the growing season and then migrates deep into the soil. Its distribution is limited to very coarse textured sandy soils. The Corn Needle Nematode has a narrow host range and can easily be managed through crop rotation. Needle nematodes have the ability to vector viruses.

BULB AND STEM NEMATODES

Bulb and Stem Nematodes feed on shoot and not root tissue. There are two very different species associated with Michigan vegetable production systems. One attacks onion and celery, and the other feeds in potato tubers. Both are rarely detected in vegetable fields in Michigan.

Crop Symptoms -Yellowing, stunted top growth, a highly characteristic odor, bloated leaves and bulbs or tuber rot, reduced yields and unsatisfactory crop quality.

Crops Attacked -Onions, Garlic and Potato.

Nematode Behavior -The Bulb and Stem Nematode is a migratory endoparasite of shoot tissue. Fourth-stage juveniles penetrate onion tissue at the junction of the root and shoot system. They migrate through leaf and bulb tissue resulting in greatly deformed growth.

PIN NEMATODES

There are two types of Pin Nematodes associated with Michigan vegetable production, one limited to muck vegetable production and the other associated with mineral soil production systems. Crop Symptoms -Stunted top growth, no feeder roots (witches-broom), reduced yield.

Crops Attacked -Carrots, Celery and Corn.

Nematode Behavior -Pin Nematodes are small ectoparasites that feed only from the outside of root tissue. These nematodes have a long stylet that can be inserted into the central vascular system of roots.

STUBBY-ROOT NEMATODES

Although several species of Stubby-Root Nematodes are known to exist in Michigan, they have not been detected as often recently as in the past. Crop Symptoms - Yellowing, stunted tops, stubby roots and poor yields. Crops Attacked - Corn and Onions. Nematode Behavior - Stubby-Root Nematodes are small ectoparasites. They feed close to the root-tip and prevent cell division and root elongation.

MANAGEMENT OF PLANT PARASITIC NEMATODES IN MICHIGAN VEGETABLE PRODUCTION

The first part of any pest management program is proper identification of the problem. While the cause of some nematode problems can be confirmed under field conditions, a laboratory analysis is usually needed. Michigan growers are encouraged to submit soil and plant tissue samples to MSU Diagnostic Services for confirmation of the cause of an existing problem or information for use in problem avoidance. MSU has two Nematode Diagnosticians responsible for nematode analyses. Additional details about this service can be obtained by contacting www.cips.msu.edu/diagnostics or the County Office of MSU Extension.

As with all pest issues, problem avoidance is always the first-line defense and best strategy. This can be achieved by growing or purchasing high-quality nematode-free transplants or propagation material. Most of the other tactics related to problem avoidance or exclusion are based on common sense. For example, a field with a documented nematode infestation should not be worked immediately before moving equipment to a high quality nematode-free site. With proper planning, it is often possible to isolate or contain a nematode problem to a single field without infesting the rest of the farm. When this fails, control or nematode population reduction is usually required. In many cases this is expensive and results in a significant reduction in potential profits.

Once a Michigan vegetable production site is infested, crop rotation is the first control tactic that should be considered. For example, corn and wheat are not hosts for the Northern Root-Knot Nematode and can be used to reduce population densities of this species below its damage threshold. Crop rotation with agronomic crops is the main reason that current Michigan mineral soil carrot producers have very few nematode problems. In general, muck soil carrot growers have not had this option and have had to contend with serious nematode problems. Although the only known host in Michigan for the Carrot Cyst Nematode is carrots, this species can survive for up to a decade in the absence of a host, making the use of crop rotation impractical. Corn Needle Nematode prob-

lems can be resolved with a year or two of a non-host crop. Cover, trap and green manure crops that produce decomposition chemicals with nematicidal properties have been used in Michigan vegetable production. Cover crops, however, are variety specific in relation to their suitability for use in nematode management systems. For example, Adagio or Colonel oil seed radish are excellent trap crops for control of the sugar beet cyst nematode, but are good hosts of the Northern Root-Knot and Root-Lesion nematodes. Because of this complexity, it is often necessary to interact with a consultant or MSU Diagnostic Services for assistance in designing of the best possible nematode management program.

Nematode population reduction can also be achieved through the use of nematicides. There are basically two types, fumigant and non-fumigant nematicides. Telone II and metham are the most commonly used soil fumigants in Michigan vegetable production. Telone II must be injected into the soil; whereas, metham (Vapam and others) can be injected or applied as a chemigant in irrigation water. Methyl bromide, Telone C-17, Telone C-35 and chloropicrin can also be used under special circumstances. The non-fumigant options are organophosphates or organocarbamates. Vydate, Nemacur, Mocap, Counter and Furadan are the most commonly used non-fumigant nematicides. These materials are all very different in relation to the best methods of application and suitability for specific nematode species. Information about the use of nematicides is present in this MSU Extension Bulletin (E-312).

ROLE OF NEMATODES IN NITROGEN MINERALIZATION

Plants take-up inorganic forms of nitrogen from soil for use in their growth and development. While we often think that the fertilizers applied serves this role, the situation is often more indirect and complex. Fertilizers often feed microbes and subsequently the microbes feed the plants. Bacterial and fungal feeding nematodes play important roles in this process. For example, plant root-exudates or decomposing organic matter serve as food for bacteria. The bacteria serve as food for bacterial feeding nematodes which receive excess organic nitrogen from this process. The excess nitrogen is transformed into an inorganic form and excreted from the nematode into the area immediately adjacent to the root surface when it is taken-up by the plant for use in the growth and development process. It is important to maintain high population densities of bacterial and fungal feeding nematodes. Most of these species have relatively short life cycles (72 hours); whereas, life cycles of plant-parasitic nematode range from 30 days to two years, with the exception of the cysts which may remain viable in the absence of a host for up to 12 years.

NEMATODES AND SOIL QUALITY

Soil quality can be defined as the ability of a soil to resist degradation and respond to management. Soils with nematode problems are not high quality soils. Anything that can be done to increase quality soil organic matter (SOM) will decrease risk to plant parasitic nematodes and enhance soil quality. What is quality organic matter? Quality SOM is composed of active soil carbon and active soil nitrogen. The term active refers to the ability of the SOM to mineralize soil carbon and soil nitrogen, respectively. Much of this is done by microbes and soil fauna such as bacterial and fungal feeding nematodes. The best way to create an appropriate environment for these organisms

and their essential functions is to maintain a diversity of plants and organic amendments in the system. Mixtures of grass and legume cover crops supplemented with manure or compost can be used to create a biologically active soil that is highly productive and devoid of problems caused by plant parasitic nematodes. Do not hesitate to contact me at birdg@msu.edu or (517) 353-3890 if you have any questions about nematodes and their relationship to soil quality. The MSU Nematode Diagnosticians, Fred Warner (517-432-1333) and Angela Tenney (517-353-8563) are available to provide information about management of plant-parasitic nematodes.

Appendix C

Detecting and Avoiding Nematode Problems

Plant-parasitic nematodes are microscopic round-worms that live in soil and feed on roots or foliage of economically important plants. Nematode feeding can result in diseased plants with symptoms such as stunting, yellowing, wilting, yield reduction, root galling and the formation of root lesions. Although damage from plant parasitic nematodes costs Michigan vegetable growers millions of dollars annually, many of these losses are never correctly diagnosed. This appendix provides instructions for the nematode detection methods necessary to avoid or diagnose nematode problems.

A laboratory analysis of soil and root or shoot system tissue is usually necessary for diagnosis or long-term avoidance of plant-parasitic nematode problems. In Michigan, this service is provided by the Michigan State University Nematode Laboratory within Diagnostic Services. There are also private sector laboratories that provide nematode detection services. A \$25 fee is charged by MSU for analyzing each combined soil and root sample.

Samples for nematode analysis should be forwarded to:

Diagnostic Services
101 CIPS
Michigan State University
East Lansing, MI 48824-1311

Samples taken directly to MSU should be delivered to Room 101 in the Center for Integrated Plant Systems (formerly the Pesticide Research Center). All samples must be submitted with a completed sample information form. These forms are available at county MSU Extension

offices or can be downloaded from the Diagnostic Services web site at www.pestid.msu.edu.

Sample objective

The results from the samples are used to decide how to deal with nematode problems and how to avoid problems.

Diagnosing problems

When plants exhibit symptoms such as stunting, yellowing, wilting, early-die, yield reduction, root-galling, root-lesions or plant mortality that cannot be attributed to other causes, take samples of appropriate soil, root system, or shoot systems, and submit them for nematode analysis.

Avoiding nematode problems

Generally soil from Michigan agricultural sites should be analyzed for nematodes every 3-5 years at the minimum. If nematodes are a major limiting factor in the production of particular crops (e.g. northern root-knot nematodes on carrot), sites should be sampled every fall or spring prior to the growing of these crops. The test results are used to make decisions for avoiding nematode problems.

When to sample

Generally, soil and root samples can be taken, submitted and reliably processed whenever the soil is not frozen. For the best possible results, however, do not take samples until 45 days after annual root growth, and not

after the soil is frozen in late fall or winter. When considering fall soil fumigation, collect and submit samples between August and November. To determine if non-fumigant nematicide use is warranted, sample between March and May.

How to sample

Sampling instrument: Take samples with a soil sampling tube, trowel, or narrow-bladed shovel at a 2-to 12-inch depth. Include as many feeder roots as possible.

Feeder roots or shoot tissue must always be included for samples submitted for best assessing the population densities of endoparasitic nematodes.

Sample size: Each sample should consist of a pint to a quart of soil taken from a larger sample composed of 10 or more subsamples. The number of samples needed depends on the size, history, and uniform soil texture of the area being investigated.

- Small area (less than 5,000 sq. ft.), take at least 10 subsamples (soil cores or borings).
- Medium area (5,000 sq. ft. to 1 acre), take at least 25 subsamples.
- Large area (1 to 80 acres), take at least 50 subsamples. In Michigan, no one sample should represent more than 80 acres, and each sample should be from an area of uniform soil texture.

The sampling pattern depends on the commodity and field history. Mix subsamples in a clean pail or a plastic bag and submit one pint to a quart for nematode analysis.

Subsamples from problem area: Plant-parasitic nematodes feed only on living tissues and are rarely found in dead roots. Therefore, take samples from the margin of the problem areas where the plants are still living.

Sampling container: A plastic bag can be used for nematode samples. Place samples in plastic bags as soon as possible. Nematodes will be killed if the sample is allowed to dry, and it is important that nematodes are living when the sample arrives at the laboratory.

Sample storage: Soil and root samples should be regarded as perishable. Handle accordingly, and process as quickly as possible. Ideally, they should be stored at 10-15C (50-58F). Do not expose them to direct sunlight or store them in hot areas, such as the trunk of your car. Temperatures greater than 40C (100F) will kill nematodes.

How to submit samples

Samples are usually submitted to the MSU Nematode Laboratory through the local extension office, accompanied by a completed form. The information required on the form is essential for diagnosing nematode problems and proper recommendations for nematode population management.

It generally takes two weeks from the time a sample is taken until the results are returned to the grower. The results may be returned through the local extension agent, a private consultant, or directly. The rapid root and soil assays used for mineral soils, however, are not always satisfactory for analysis of organic soils. In a few cases, a bioassay that requires a 45-day incubation period is used to analyze organic soils. When this procedure is recommended, the grower will be immediately notified of the delay and will receive the results within two months after the sample was received.

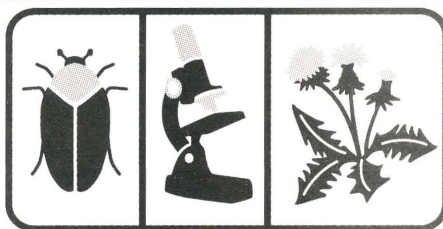
Results and recommendations

The types and numbers of nematodes will be recorded on the assay form along with an indication of whether or not nematodes are a problem. If nematodes appear to be a problem, you will be occasionally referred to an appropriate extension bulletin for a recommendation. The recommendation should be discussed in detail with the local extension agent or private consultant.

MICHIGAN STATE UNIVERSITY EXTENSION

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How to submit a sample to MSU Diagnostic Services



Diagnostic Services

Sample Submission

Accurate diagnosis depends on the rapid receipt of fresh and representative samples along with pertinent information relating to the problem. A completed submittal form should accompany all samples. Submittal forms are available at MSU Diagnostic Services or your local Extension office. Submittal forms can also be downloaded from www.pestid.msu.edu. Samples can be dropped off at our reception area between 8 a.m. and 5 p.m. or shipped overnight delivery by U.S. mail, FedEx, or UPS. To preserve the quality of the sample, do not package samples in envelopes. Also avoid mailing samples on Friday.

Submit samples to:

Michigan State University
Diagnostic Services
101 Center for Integrated Plant Systems
East Lansing, MI 48824-1311
Phone: (517) 355-4536 Fax: (517) 432-0899

Plant Health Analysis Samples:

Herbaceous Plants: Send whole plants, including roots and soil. Roots and soil should be in a plastic bag tied off at the soil line to prevent soil from touching foliage.

Tree Decline/Wilt: Send 6 to 12 branch sections .5 inch to 1 inch diameter and ~ 8 inches long. Samples should be taken from live areas of tree with symptoms, not from completely dead branches. Seal branches in plastic to retain moisture.

Seedlings: Leave plants in plug sheets or trays if possible. Send a minimum of 12 seedlings.

Turf: Include a 6" square of turf from the margin of the diseased area so that both healthy and diseased turf is included. An intact layer of soil should be included. Wrap sample in newspaper and pack in a box for shipment. Include a detailed description of cultural practices. Do not add moisture to the turf prior to shipment.

Leaf spot and Fruit Rot: Send several affected samples representing the early and moderate stages of the symptom progression.

Herbicide Injury: Submit both injured and apparently healthy crop plants. Plants should be dug carefully from the soil so roots, if injured, will remain intact. Roots and soil should be placed in a plastic bag, pot, or small bucket to prevent soil from touching the foliage. A pint of soil from both "good" and "bad" area should also be submitted. Any patterns in the field should be noted on the submittal form, along with past crop and pesticide history.

Weed/Plant Samples:

Herbaceous Plant Identification: Submit whole plants, including roots, vegetative structures, and flowers. Plants may be pressed flat between paper or cardboard to prevent leaf crinkling. For best results, plants should be submitted immediately after digging. Roots and soil should be in a plastic bag to prevent soil from touching the foliage.

Woody Plant Identification: Submit a large section of the terminal end of the stem or branch. Where possible, include any flower or fruiting structures, roots, and leaves. Leaves may be pressed flat between paper or cardboard to prevent crinkling. Woody plants may be wrapped in plastic to retain moisture.

Herbicide Resistance: Weeds will be screened for herbicide resistance using one of several techniques. Typically, a whole plant pot assay established from seed will be our standard test for resistance confirmation. Mature, high quality seed or seedheads should be collected from suspicious plants in late summer or fall and submitted in a paper bag. Do not seal in plastic. Screens will be designed by herbicide site of action (ie: ACCase inhibitors, ALS inhibitors, Photosynthesis inhibitors). Other resistance confirmation tests may be utilized but will depend upon weed species, herbicide, and mechanism of resistance. Extensive tests include but are not limited to: petri-dish germination, chlorophyll fluorescence, leaf disc flotation, and enzyme sensitivity assays, as well as molecular diagnostic testing.

How to submit a sample to MSU Diagnostic Services (continued)

Nematode Samples:

Refer to MSU Extension Bulletin E-2199, "Detecting and Avoiding Nematode Problems."

Always store nematode samples in plastic bags or other containers that retain moisture. Submit a pint to a quart of soil.

Problem Diagnosis: Collect soil & roots (or foliage) from the margins of diseased areas. Submit samples of diseased plants and apparently healthy ones.

Problem Avoidance: Collect soil & roots (if available) by walking a zigzag or w-shaped pattern. The more sub-samples (soil, cores, probes, etc.) collected the "better" the sample.

Insect/Arthropod Samples:

Precise identification of insects or other arthropods requires specimens to be undamaged upon arrival. It is very important to kill and ship the specimens in a manner that will not damage the delicate structures that facilitate their identification. Dried and unprotected insects crumble easily during mail processing. Kill and ship specimens in a small, leak proof vial filled with rubbing alcohol.

Moths/Butterflies: Place specimens in the freezer for half an hour to kill them and gently pack in a small box or vial with tissue paper.

Ants/Other Adult Arthropods: Ant specimens should only include worker ants (i.e. those without wings). Submit all specimens in alcohol. Other adult and hard-bodied specimens: Submit in alcohol.

Larvae (Caterpillar, grub, maggot, etc.): Whenever possible, soft-bodied larvae should be lightly boiled for a few minutes before placing them in alcohol. This prevents the specimens from shriveling and becoming discolored, however it only works if the larvae are alive when dropped in the boiling water.

Pesticide Analysis Samples:

Soil, water, and plant vegetation can be tested for the presence of pesticides using appropriate analytical instruments and techniques. Pesticides will be tested on an individual basis or, if available, in multi-pesticide screens. Samples should be submitted in leak-proof, glass containers and kept cold or frozen until arrival.

Services and Fees for MSU Diagnostic Services

Note: Fees for out-of-state samples are higher. Contact laboratory for pricing.

Plant Health Analysis

- Visual inspection for infectious and non-infectious diseases, insect injury and herbicide injury; pathogen culturing; pH and soluble salts: \$20.00
- INSV / TSWV ELISA tests: \$20.00
- Bacterial ID (BIOLOG™): \$25.00
- Special laboratory analysis: *

Weeds/Plants

- Common plant ID: N/C
- Keyout plant ID: \$10.00
- Herbicide resistance in weeds
 - Standard test:
 - Single site of action: \$50.00
 - Each additional site of action: \$20.00
 - Extensive test: *
- Special identification/diagnosis: *

Nematodes

- Basic nematode analysis: \$25.00
- Total nematode community analysis: \$50.00
- HG Type testing: \$50.00
- *Verticillium* analysis
 - Wet sieving: \$25.00
 - Dilution plating: \$20.00

Insects/Arthropods

- Common insect ID: N/C
- Keyout insect ID: \$10.00
- Special identification/diagnosis: *

Pesticide Analysis

- Individual pesticide tests/
multi-pesticide tests
 - Water: \$90.00 / \$125.00
 - Vegetation: \$100.00 / \$150.00
 - Soil: \$125.00 / \$175.00

* Variable costs requiring client approval. Contact laboratory for pricing.

DIAGNOSTIC SERVICES
 101 Center for Integrated Plant Systems
 East Lansing, MI 48824-1311
 Office: 517-355-4536 FAX: 517-432-0899
 www.pestid.msu.edu



Case No.: _____
 Date Received: _____
 Amount Paid: _____
 Check/Receipt No.: _____
 MSU Account #: _____
 Diagnostic Fee: _____

Name: _____
 Business Name: _____
 Address: _____
 City/State/Zip: _____
 Work: _____ FAX: _____ Home: _____
 Email: _____ Cell: _____
 Sample Reference: _____

Plant Disease Diagnosis Fees
 Plant health analysis: \$20
 INSV / TSW V ELISA tests: \$20
 Bacterial ID (BIOL OGI™): \$25

Insect / Plant Identification Fees
 Common ID: N/C
 Keyout ID: \$10

Herbicide Resistance/ Pesticide Analysis: contact lab
Nematode Sample Fees (see below)
 Out of State Fees Triple
 Fees subject to change

SEND RESULTS TO: CLIENT COUNTY AGENT KEEP RESULTS CONFIDENTIAL Fax: _____
 MSU Extension Agent: _____ County: _____ Email: _____

SAMPLE (ex. Tomato, Insect, Pine, etc.): _____

GENERAL INFORMATION (indicate all that apply)

PLANT PARTS AFFECTED	TYPE OF PLANTING	Good	Fair	Poor	Sunny or Shaded?
Entire Plant	Stems	Field	Garden		
Leaves/Needles	Trunk	Nursery	House Plant	PROBLEM DISTRIBUTION	HERBICIDE HISTORY
Roots	Twigs/Limbs	Greenhouse	Pasture	Upland	Near Drive/Road
Fruit	Flowers	Orchard	Natural Area	Slopes	Edge of Field
		Turf/Lawn		Low Areas	Near a Residence
		City/Recreation			
NATURE OF THE INJURY				OTHER BACKGROUND	
Poor or Abnormal Growth				How long at site?	INSECTICIDE HISTORY
Spots	Yellowing			Height of plant?	This year: _____
Wilting	Boring	PREVALENCE		How many plants affected?	_____
Plant Death	Cupping	Entire Planting		How often watered?	FUNGICIDE HISTORY
Chewing	Dieback	Single Localized Area		How fertilized?	This year: _____
Galls/Cankers	Rot	Several Localized Areas			CROP HISTORY
Leaf/Needle Drop		Few Scattered Plants			Last year: _____
					This year: _____
SOIL TYPE		EXTENT OF THE DAMAGE			
Sandy	Clay	Light	Moderate	Severe	
Muck	Silt Loam				
		DRAINAGE			

INSECT / ARTHROPOD ID SAMPLES ONLY (indicate all that apply)

Where was the insect found? _____ What was the insect doing there? _____
 How many insects are there? One Few Several Hundreds Do you have small children living with you? _____

PLANT / WEED ID SAMPLES ONLY (indicate all that apply)

PLANT TYPE	PLANT SIZE	GROWTH HABIT	FLOWERS	PLANT AGE
Tree	Groundcover	Height: _____	Upright/Erect	Color: _____
Shrub	Herbaceous	Width: _____	Prostrate/Low-Growing	Size: _____
Vine	Aquatic	Few Leaves Many Leaves	Climbing	List any unique features: _____
				Annual: _____
				Perennial: _____

NEMATODE SAMPLES ONLY (indicate type of analysis requested)

Soil and root analysis (\$25/sample) Foliar nematode analysis (\$25/sample) No. of samples: _____
 Total nematode community structure analysis (\$50/sample) Sample/Field ID: _____
 Hg Type test (\$50/sample)
Verticillium dahliae analysis (potato soil/ stem only) Dilution (\$20/sample) Wet-sieving (\$25/sample) Both (\$40/sample)



PESTICIDE EMERGENCY INFORMATION



For any type of an emergency involving a pesticide, immediately contact the following emergency information centers for assistance.

Current as of November 2008

Human Pesticide Poisoning

POISON CONTROL

From anywhere in the United States, call

1 - 8 0 0 - 2 2 2 - 1 2 2 2

Special Pesticide Emergencies

Animal Poisoning

.....
Your veterinarian:

Phone No.

or

Animal Poison Control
Center (\$55 consultation
fee per case)

***1-888-426-4435**

www.aspca.org

*** Telephone Number Operated 24 Hours**

Pesticide Fire

.....
Local fire department:

Phone No.

and

***911**

Traffic Accident

.....
Local police department or
sheriff's department:

Phone No.

and

***911**

Environmental Pollution

.....
District Michigan
Department of
Environmental Quality
(MDEQ) Office Phone No.

Phone No.

and

MDEQ Pollution
Emergency Alerting System
(PEAS):

***1-800-292-4706**

also

***1-800-405-0101**

Michigan Department of
Agriculture Spill Response
(for fertilizer, pesticide,
and manure spills)

Pesticide Disposal Information

.....
Michigan Clean Sweep, Michigan
Department of Agriculture Environmental
Stewardship Division.

Monday - Friday: 8 a.m. - 5 p.m.

(517) 335-2874

National Pesticide Information Center

Provides advice on recognizing
and managing pesticide poisoning,
toxicology, general pesticide
information and emergency response
assistance. Funded by EPA, based at
Oregon State University

7 days a week; excluding holidays
6:30 a.m. - 4:30 p.m. Pacific Time Zone

1-800-858-7378

FAX: 1-541-737-0761

Web: npic.orst.edu