

Cucurbit Crops

Cucurbit Crops — Cantaloupe, Cucumber, Squash, Pumpkin and Watermelon

Types and Varieties

Cantaloupe

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

Melon types with distinctive fruit attributes are referred to as specialty melons. Common specialty melons include honeydew, charentais, galia, ananas, Persian, crenshaw, canary and Asian melon. These melons with unique fruit characteristics attract consumers at local food markets. Some specialty melons (such as galia and ananas) are bred in dry conditions. Their skins tend to crack with excessive water. Greenhouse or high tunnel environments are more suitable for growing these melons in the Midwest.

Cucumber

Several types of cucumbers are grown in the Midwest.

Fresh market slicing cucumbers have thick, dark skin and a few large spines. They are commonly grown in the field with no support.

European greenhouse cucumbers are long with thin skin, no spines, no seeds, and are grown on trellises in greenhouses.

Beit alpha cucumber types are shorter but also have thin skin with no spines, and may be grown in the field or in protected structures.

Pickling cucumbers are short with thin skins and large spines. They are adapted for field production. Pickling cucumbers can also be marketed for fresh use.

Gynoecious cucumber varieties produce mainly female flowers and, unless they are also parthenocarpic, require a pollinizer variety for good fruit set. Pollinizers are usually included when you buy gynoecious seed.

Parthenocarpic varieties will set fruit without pollination and no seeds will develop. Parthenocarpic varieties produce seeds if they get pollinated.

Watermelon

Watermelons are either seedless or seeded. Seedless watermelons are triploid. They produce fruit that has few if any true seeds. For seedless watermelons to set fruit, growers must plant diploid watermelons (non-edible pollenizer plants or seeded watermelons) next to the triploid plants. The general rule is to plant a pollinizer plant for every two to four triploid plants.

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

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

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

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

Cantaloupe or Muskmelon?

Both cantaloupe and muskmelon are acceptable names for fruit from the vines known to scientists as *Cucumis melo* subsp. *Melo* var. *cantalupensis*. In this guide, we use cantaloupe to correspond to USDA standards, which use this term.

Cantaloupe, Cucumber and Watermelon

Spacing

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

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

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

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

Pickles (machine harvest): Rows 18 to 20 inches apart. Plants 5 to 7 inches apart in row.

All cucumbers should be planted after the danger of frost is past because they are not frost-tolerant. For proper germination, soil temperature must be above 60°F. Planting too early (when the soil is too cold and wet) results in poor seedling emergence.

Fertilizing

Lime: To maintain a soil pH of 6.0 to 6.5. Cantaloupe is particularly sensitive to low soil pH and should be limed to 6.3 to 6.8. If your soil test indicates less than 70 ppm magnesium, use dolomitic limestone, or apply 50 pounds per acre Mg broadcast preplant incorporated.

Preplant: N: 40 to 60 pounds per acre. P2O5: 0 to 150 pounds per acre. K2O: 0 to 200 pounds per acre. Adjust according to soil type, previous management, and soil test results for your state. For transplants, a starter solution at the rate of 1 cup (8 ounces) per plant is recommended. If the transplant flat receives a heavy fertilizer feeding just prior to setting, the starter solution can be eliminated.

Sidedress N: Apply 45 pounds N per acre in a band to either side of the row when plants are rapidly vining. For direct seeded watermelon, the preplant N application can be replaced by an early sidedressing of 40 pounds N per acre when plants show the first set of true leaves followed by the 45 pounds N rate at the rapid vining stage of growth. If heavy rains occur in June, 30 pounds N per acre should be applied through the irrigation system at fruit set (late June to early July).

For cantaloupes and cucumbers grown on plastic mulch, the N rate can be reduced because N losses from leaching are greatly reduced. For this culture system, apply 50 pounds N per acre broadcast preplant over the row just

prior to laying the plastic. Sidedress 30 pounds N per acre on either side of the plastic at vining when plant roots have reached the edge of the plastic (mid-June). If you are using trickle irrigation, apply the 50 pounds N per acre preplant and apply 0.5 to 1 pound N per acre daily, or 3 to 6 pounds N weekly through the trickle system until fruit are about 2 inches in diameter.

Irrigation

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

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

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

Harvesting

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

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

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

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

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

Summer Squash and Pumpkin

Summer Squash: Common summer squash types include zucchini, yellow straightneck and yellow crookneck. Many specialty types also perform well, including golden zucchini, Middle-Eastern types, patty pan, and cocozelle.

Winter Squash: Common winter squash types include acorn, buttercup, butternut, hubbard and spaghetti. Japanese types kuri and kabocha are also grown.

Pumpkin: Pumpkins grown for ornamental display or carving range from less than a pound to 30 pounds or more. For giant pumpkins, squash varieties such as Atlantic Giant or Prize Winner are used. Varieties with hull-less or “naked” seed are favored as a source of seeds for eating. Many specialty pumpkins are also edible winter squash, such as fairytale and Cinderella pumpkins. Most of the “pie” pumpkins sold to consumers are used for decorating, but some varieties are still used for home baking. Pumpkins that are processed into pie filling and other products are largely grown under contract to processors, and the varieties are more like winter squash than jack-o-lantern pumpkins.

Spacing and Seeding

Bush Types: Rows 4-6 feet apart. Plant 18-24 inches apart in row. Seed: 4-6 pounds per acre.

Vining Types: Rows 6-8 feet apart. Plant 2-5 feet apart in row. Seed: 2-3 pounds per acre.

Fertilizing

Lime: To maintain a soil pH of 6.0-6.8.

Preplant: N: 50 pounds per acre; P2O5: 0-150 pounds per acre; K2O: 0-200 pounds per acre. Adjust according to soil type, previous management, and soil test results for your state. For summer squash transplants, a starter solution at a rate of 1 cup (8 ounces) per plant is recommended. If the transplant flat receives a heavy fertilizer feeding just prior to setting, the starter solution can be eliminated.

Sidedress N: For soils with more than 3 percent organic matter and following soybeans, alfalfa, or a grass-legume hay crop, no N is needed. For soils with less than 3 percent organic matter with the same rotation or a rotation of corn, rye, oats, wheat, or a vegetable crop, apply 30-40 pounds N per acre when the vines begin to run. For sandy soils, the preplant N application can be replaced by an early sidedressing of 40 pounds N per acre when the plants show the first set of true leaves. Apply the second sidedressing of 45 pounds N per acre at onset of rapid vining.

For crops grown from transplants on plastic mulch, N losses from leaching are greatly reduced. For this culture system, apply 50 pounds N per acre broadcast preplant over the row just before laying the plastic. If sidedress N is recommended (see above), apply up to 30 pounds N per acre on either side of the plastic at vining when the plant roots have reached the edge of the plastic. If you are using trickle irrigation, apply the 50 pounds N per acre preplant, and apply 0.5-1 pound N per acre daily, or 3-6 pounds N weekly through the trickle system if additional N is needed.

Pesticide Use in Greenhouses

Before using any pesticide, always read the product label for mention of greenhouse restrictions. See Selected Information About Recommended Fungicides (page 79), Selected Information About Recommended Herbicides (page 69), and Selected Information About Recommended Insecticides (page 54).

Disease Control

Recommended Controls

Angular Leaf Spot of Cucurbits - Pseudomonas Bacteria

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

Crop rotation *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Rotate to noncucurbit crops at least 2 years. Rotate between crop families to reduce pest and disease inoculum buildup and weeds favored by the management of certain crops.

Variety selection *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Some cucumber varieties may have host resistance. Select crop varieties for competitiveness, disease resistance, and regional adaptability.

copper formulations (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Copper applications in the transplant greenhouse or in the very early season are effective against angular leaf spot. Applying copper tank-mixed with mancozeb products (e.g., Dithane®, Manzate®, Penncozeb®) is more effective than copper alone. REI: see label.

Anthracnose of Cucurbits - Colletotrichum Fungus

Race 1 of the fungal pathogen that causes anthracnose affects mainly cucumber — many watermelon varieties are resistant to Race 1. Race 2 affects mainly watermelon. Lesions of this disease may be observed from transplant stage through harvest on leaves, stems, and fruit.

Winter/Off-season: Rotate crops at least 3 years and practice fall tillage. Rotation with non-cucurbit crops will decrease the threat of anthracnose in future years. May be seedborne.

Greenhouse: Scout for disease. Apply fungicide labeled for greenhouse if disease threatens.

Planting: Inspect seedlings. Avoid planting diseased seedlings.

Vine Touch: Apply contact or systemic fungicides at 7-14 day intervals or according to MELCAST — see Purdue Extension publication BP-67-W, *Foliar Disease Fungicide Control Using MELCAST*, available from the Purdue Extension Education Store, www.edustore.purdue.edu.

Harvest: Inspect fruit. Avoid saving seed.

Crop rotation *Cantaloupe/Muskmelon, Cucumber, Watermelon* Use a crop rotation of 2-3 years of non-cucurbit crops. Rotate between crop families to reduce pest and disease inoculum buildup and weeds favored by the management of certain crops.

Aprovia Top® (difenoconazole, benzovindiflupyr (solatenol)) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 10.5-13.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day.

Cabrio EG® (pyraclostrobin) *Cantaloupe/Muskmelon, Cucumber, Watermelon* 12-16 oz. per acre. See warnings under Alternaria leaf blight. REI: 12-hour.

chlorothalonil formulations (chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* See label. Bravo®, Echo®, Equus®, and Initiate® are labeled for use at various rates. REI: 12-hour. PHI: 0-day.

Inspire Super® (difenoconazole, cyprodinil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

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

mancozeb formulations (mancozeb) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Dithane®, Manzate®, Penncozeb®, and Roper® are labeled for use at various rates. REI: 24-hour. PHI: 5-day PHI.

mancozeb formulations (mancozeb) *Cantaloupe/Muskmelon, Cucumber, Watermelon* See label. Dithane®, Manzate®, and Penncozeb® are available for use at various rates. REI: 24-hour. PHI: 5-day.

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

Orondis Opti Premix® (oxathiapiprolin, chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 1.75-2.5 pts. per acre. See label. REI: 12-hour. PHI: 0-day.

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

Quadris 2.08SC® (azoxystrobin) *Cantaloupe/Muskmelon, Cucumber, Watermelon* 11-15.4 fl. oz. per acre. REI: 4-hour. PHI: 1-day.

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

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

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

Topsin 4.5FL® (thiophanate-methyl) *Cantaloupe/Muskmelon, Cucumber, Watermelon* 10 fl. oz. per acre. REI: see label. PHI: 1-day.

Topsin M WSB® (thiophanate-methyl) *Cantaloupe/Muskmelon, Cucumber, Watermelon* 0.5 lb. per acre. REI: see label. PHI: 1-day.

Bacterial Fruit Blotch of Cucurbits - *Acidovorax Bacteria*

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

copper formulations (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* See label. Several fixed copper products are labeled at various rates. Apply fixed copper 2 weeks prior to the opening of the first female bloom, at first female bloom, and 2 weeks after the first female bloom. Later in the season, fixed copper products may be applied to help reduce disease spread. No more than 6 applications per season. REI: see label. PHI: See label.

Bacterial Wilt of Cucurbits - *Erwinia Bacteria*

This disease affects pumpkins and squash only when striped and spotted beetles feed on the plants before the 5 true leaf stage. Disease control depends on control of striped and spotted cucumber beetles. Regularly scout fields for beetles.

Winter/Off-season: The disease is unaffected by crop rotation.

Planting: Apply systemic insecticides such as Admire® or Platinum® (see Insect Control section) at transplant. Apply contact insecticides after systemic insecticides lose effectiveness (2-3 weeks). Apply foliar insecticides only when beetles are present. When large numbers are present, treatments may be required twice weekly. Scout fields regularly for cucumber beetles.

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

Crown and Root Rot of Multiple Crops - *Phytophthora Oomycete*

Phytophthora is often associated with heavy rains and fields with poor drainage. Raised beds may help lessen

disease severity. The first symptoms are usually observed in low areas. No resistant varieties are available.

Winter/Off-season: Use crop rotations of 4 years or more that do not include solanaceous crops. Avoid fields with a history of a disease.

Planting: Direct-seeded crops benefit from fungicide-treated seed (see discussion of fungicide seed treatment under Damping-off). Treat seed with Apron XL LS® to help prevent *Phytophthora* infection for 5 weeks from time of seeding. Ponds with run-off water from infested soil may be contaminated with *Phytophthora*. Use crop rotations of at least three years with non-cucurbits and non-solanaceous crops and effective weed management (nightshade and velvet leaf are hosts of this pathogen).

Vine Touch: Apply contact or systemic fungicides at first sign of the disease. Systemic fungicides are available.

Harvest: Identify fruit problems. Sanitation is very important to prevent the spread of the disease.

Crop rotation *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Use crop rotations that avoid eggplant, pepper, snap beans and cucurbit crops for at least 4 years. Rotate between crop families to reduce pest and disease inoculum buildup and weeds favored by the management of certain crops.

Apron XL® (mefenoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Seed treatment. Only for direct-seeded plants. REI: 48-hour.

Elumin® (ethaboxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 8 fl. oz. per acre. Tank-mixing this product with a contact fungicide such as chlorothalonil or mancozeb will help reduce resistance concerns. See label for drip irrigation instructions. REI: 12-hour. PHI: 2-day.

Forum 4.18SC® (dimethomorph) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 6 fl. oz. per acre. REI: 12-hour. PHI: 0-day.

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

Orondis Gold® (oxathiapiprolin, mefenoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 4.8-9.6 fl. oz. per acre. Soil application. See label for details. REI: 4-hour. PHI: 0-day.

Orondis Ultra Premix® (oxathiapiprolin, mandipropamid) *Cantaloupe/Muskmelon,*

Cucumber, Pumpkin, Squash, Watermelon 5.5-8.0 fl. oz. per acre. See label for details. REI: 4-hour. PHI: 0-day.

phosphite and phosphorous acid formulations

(phosphorous acid, potassium phosphite, mono-dipotassium salts of phosphorous acid, mono- and dibasic sodium, potassium, and ammonium phosphites, fosetyl-aluminum) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Several phosphite or phosphorous acid products (Agri-Fos®, Phostrol®, Prophyt®, Rampart®) are labeled at various rates. Label includes different crops, PHIs, resistance instructions, and other important information. Some manufacturers recommend tank-mixing. These products may be used in a preventative program until Phytophthora blight is observed. REI: see label.

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

Ranman 400SC® (cyazofamid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2.75 fl. oz. per acre. REI: 12-hour. PHI: 0-day.

Revus® (mandipropamid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 8 fl. oz. per acre. Suppression only. REI: 4-hour. PHI: 0-day.

Tanos® (famoxadone, cymoxanil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 8-10 oz. per acre. Suppression only. REI: 12-hour. PHI: 3-day.

Zampro® (ametocradin, dimethomorph) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 14 fl. oz. per acre. REI: 12-hour. PHI: 0-day.

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

Practice good greenhouse sanitation. The best way to prevent damping-off of seedlings in the greenhouse is to keep the greenhouse area clean. See section on Transplant Production, page 23.

Plant in warm field soils. The fungi responsible for damping-off in field soils cause more loss when the seedling is slow to emerge.

Using treated seed may help reduce the severity of damping-off if used with the cultural methods discussed above. Seed treated with contact fungicides with the active ingredients thiram or captan may help reduce the decay of the seed prior to emergence. Systemic products are designed to move into the seedling and help manage

damping-off in the first two to three weeks. Examples of systemic products include Apron XL®, Dynasty®, and Maxim 4FS®. Seed that is treated with all three of these systemic products is available with the trade name Farmore 300®. Vegetable seed that is usually transplanted (such as muskmelon and watermelon) are less likely to benefit from fungicide seed treatments than crops that are direct seeded (such as pumpkin).

Apron XL® (mefenoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* See label. Seed treatment will help prevent damping-off caused by Phytophthora and Pythium. REI: 48-hour. PHI: See label.

Dynasty® (azoxystrobin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* See label. Seed treatment will help prevent damping-off caused by Rhizoctonia spp. REI: 4-hour. PHI: See label.

Maxim 4FS® (fludioxonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* See label. See treatment will help prevent damping-off caused by Rhizoctonia spp. REI: 12-hour. PHI: See label.

Previcur Flex® (propamocarb) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* See label. See label for greenhouse uses and details about managing damping-off caused by Pythium species. REI: 12-hour. PHI: See label.

Ridomil Gold SL® (mefenoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 1-2 pts. per acre. For use on damping-off caused by Pythium species. REI: 48-hour. PHI: See label.

Downy Mildew of Cucurbits - Pseudoperonospora Oomycete

The fungus-like organism that causes downy mildew, *Pseudoperonospora cubensis*, does not survive Midwest winters because it requires green, living plant tissues. That means the fungus-like organism only overwinters in south Florida or in greenhouses in northern U.S and Canada. The wind carries downy mildew spores to new, living hosts, but, depending on conditions, it can be quite late in the growing season before the spores reach the Midwest. Downy mildew of cucurbits may occur as early as mid-July or may not show up in at all in a particular growing season. Since pumpkins are grown until relatively late in the growing season, this crop is often affected more than other cucurbits.

Strains of the downy mildew pathogen are known to exist that are resistant to some fungicides. Strobilurin fungicides (such as Cabrio®, Flint®, Merivon®, Pristine®, Quadris®, Reason®, Satori®) and fungicides with the

active ingredient mefenoxam (such as Ridomil®) are particularly prone to resistance. In addition, Revus® and Previcur Flex® have occasionally been ineffective for management of downy mildew. See Selected Information About Recommended Fungicides (page 79) for more information.

Catamaran® (potassium phosphite, chlorothalonil)

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon 6 pts. per acre. REI: 12-hour. PHI: 1-day.

chlorothalonil formulations (chlorothalonil)

Cantaloupe/Muskmelon, Cucumber, Watermelon See label. Bravo®, Echo®, Equus®, and Initiate® are labeled for use at various rates. REI: 12-hour. PHI: 0-day.

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

Forum 4.18SC® (dimethomorph) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 6 fl. oz. per acre. REI: 12-hour. PHI: 0-day PHI.

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

mancozeb formulations (mancozeb) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Dithane®, Manzate®, Penncozeb®, and Roper® are labeled for use at various rates. REI: 24-hour. PHI: 5-day PHI.

Omega 500F® (fluazinam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 0.75-1.5 pts. per acre. REI: see label. PHI: 30-day PHI.

Orondis Opti Premix® (oxathiapiprolin, chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 1.75-2.5 pts. per acre. See label. REI: 12-hour. PHI: 0-day.

Orondis Ultra Premix® (oxathiapiprolin, mandipropamid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* See label. May be available as a co-pack. Apply according to rates on each container. REI: 4-hour. PHI: 0-day PHI.

phosphite and phosphorous acid formulations (phosphorous acid, potassium phosphite, mono-dipotassium salts of phosphorous acid, mono- and dibasic sodium, potassium, and

ammonium phosphites, fosetyl-aluminum) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Various. Several phosphite or phosphorus acid products are labeled at various rates such as (AgriFos®, Phostrol®, Prophyte®, Rampart®). Label includes several different crops, PHIs, resistance instructions, and other important information. Some manufactures recommend tank-mixing. These products may be used in a preventative program until downy mildew is observed. REI: see label. PHI: 0-day PHI.

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

Ranman 400SC® (cyazofamid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2.1-2.75 fl. oz. per acre. REI: 12-hour. PHI: 0-day PHI.

Revus® (mandipropamid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 8.0 fl. oz. per acre. REI: 4-hour. PHI: 0-day PHI.

Tanos® (famoxadone, cymoxanil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 8.0 oz. per acre. REI: 12-hour. PHI: 3-day PHI.

Fruit Rot of Cucurbits - Fusarium Fungus

No resistant varieties are available. Fruit with Fusarium fruit rot are often observed from fields where other disease or cultural problems are present.

Winter/Off-season: Rotate with noncucurbit crops at least 4 years. Avoid fields with a history of disease. May be seedborne.

Planting: Manage foliar diseases for better fruit health. Avoid other fruit diseases, such as bacterial fruit spot or Phytophthora blight.

Harvest: Identify fruit problems.

Crop rotation *Cantaloupe/Muskmelon, Pumpkin* Rotate between crop families to reduce pest and disease inoculum buildup and weeds favored by the management of certain crops.

Fusarium Wilt of Vine Crops - Fusarium Fungus

Plant watermelon cultivars with partial resistance. See table on page in this section. Rotate with noncucurbit crops to decrease incidence of wilt.

Crop rotation *Watermelon* Rotate with noncucurbit crops to decrease disease severity. Rotate between crop families to reduce pest and disease inoculum buildup and weeds favored by the management of certain crops.

Variety selection *Cantaloupe/Muskmelon* Plant resistant cantaloupe cultivars. Several cultivars have good resistance to strains of *Fusarium*. Select crop varieties for competitiveness, disease resistance, and regional adaptability.

Variety selection *Watermelon* Plant watermelon varieties with partial resistance. Select crop varieties for competitiveness, disease resistance, and regional adaptability.

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

Gummy Stem Blight/Black Rot of Cucurbits - *Didymella Fungus*

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

Strains of the gummy stem blight fungus are known to exist in the Midwest that are resistant to some fungicides. Strobilurin fungicides in Group 11 (such as Cabrio®, Flint®, Merivon®, Pristine®, Quadris®, Satori®) and fungicides with the active ingredient boscalid Group 7 (such as Fontelis® and Pristine®) are particularly susceptible to resistance: for this reason, these products are not listed here. See Selected Information About Recommended Fungicides, page 79. Tank-mix these products with products that have a different mode of action in situations where resistance may be a factor.

Winter/Off-season: Rotate crops at least 3 years and practice fall tillage. May be seedborne.

Greenhouse: Scout for disease. Apply fungicide labeled for greenhouse if necessary.

Planting: Avoid planting diseased seedlings in the field.

Vine Touch: Apply contact or systemic fungicides at 7-14 day intervals or according to MELCAST — see Purdue Extension publication BP-67-W, *Foliar Disease Fungicide Control Using MELCAST*, available from the Purdue Extension Education Store, www.edustore.purdue.edu.

Harvest: Identify fruit problems.

Crop rotation *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Rotate to noncucurbit crops for at least 3 years. Rotate between crop families to reduce pest and disease inoculum buildup and weeds favored by the management of certain crops.

chlorothalonil formulations (chlorothalonil)

Cantaloupe/Muskmelon, Cucumber, Watermelon See label. Bravo®, Echo®, Equus®, and Initiate® are labeled for use at various rates. REI: 12-hour. PHI: 0-day.

Inspire Super® (difenoconazole, cyprodinil)

Cantaloupe/Muskmelon, Cucumber, Watermelon 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

Luna Experience® (fluopyram, tebuconazole)

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon 10-17 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

mancozeb formulations (mancozeb)

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon Dithane®, Manzate®, Penncozeb®, and Roper® are labeled for use at various rates. REI: 24-hour. PHI: 5-day PHI.

Merivon® (fluxapyroxad, pyraclostrobin)

Cantaloupe/Muskmelon, Cucumber, Watermelon 5.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day.

Miravis Prime® (pydiflumetofen, fludioxonil)

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon 9.2-11.4 fl. oz. per acre. An adjuvant may be added at recommended rates. REI: 12-hour. PHI: 1-day.

Orondis Opti Premix® (oxathiapiprolin,

chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 1.75-2.5 pts. per acre. See label. REI: 12-hour. PHI: 0-day.

Switch 62.5WG® (cyprodinil, fludioxonil)

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon 11-14 oz. per acre. REI: 12-hour. PHI: 1-day.

tebuconazole formulations (tebuconazole)

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon 8 fl. oz. per acre. REI: see label. PHI: 7-day.

Leaf Blight of Cucurbits - *Alternaria Fungus*

Alternaria leaf blight (ALB) primarily affects cantaloupe. ALB symptoms may occur on leaves from May through harvest.

Winter/Off-season: Rotate crops at least 2 years and practice fall tillage.

Vine Touch: Apply contact or systemic fungicides at 7-14 day intervals or according to MELCAST — see Purdue Extension publication BP-67-W, *Foliar Disease Fungicide Control Using MELCAST*, available from the Purdue Extension Education Store, www.edustore.purdue.edu.

Harvest: Fungicide applications are unnecessary within 2-3 weeks of final harvest.

Crop rotation *Cantaloupe/Muskmelon* Use a crop rotation of noncucurbit crops for 2-3 years. Rotate between crop families to reduce pest and disease inoculum buildup and weeds favored by the management of certain crops.

Aprovia Top® (difenoconazole, benzovindiflupyr (solatenol)) *Cantaloupe/Muskmelon* 10.5-13.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day.

Cabrio EG® (pyraclostrobin) *Cantaloupe/Muskmelon, Cucumber, Watermelon* 12-16 oz. per acre. See warnings under *Alternaria* leaf blight. REI: 12-hour.

chlorothalonil formulations (chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* See label. Bravo®, Echo®, Equus®, and Initiate® are labeled for use at various rates. REI: 12-hour. PHI: 0-day.

Fontelis® (penthiopyrad) *Cantaloupe/Muskmelon* 12-16 fl. oz. per acre. See label for greenhouse uses. REI: 12-hour. PHI: 1-day.

Gavel 75DF® (zoxamide, mancozeb) *Cantaloupe/Muskmelon* 1.5-2 lbs. per acre. REI: 48-hour. PHI: 5-day.

Inspire Super® (difenoconazole, cyprodinil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

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

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

mancozeb formulations (mancozeb) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Dithane®, Manzate®, Penncozeb®, and Roper® are labeled for use at various rates. REI: 24-hour. PHI: 5-day PHI.

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

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

Orondis Opti Premix® (oxathiapiprolin, chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 1.75-2.5 pts. per acre. See label. REI: 12-hour. PHI: 0-day.

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

Quadris 2.08SC® (azoxystrobin) *Cantaloupe/Muskmelon* 11-15.5 fl. oz. per acre. REI: 4-hour. PHI: 1-day.

Quadris Opti® (azoxystrobin, chlorothalonil) *Cantaloupe/Muskmelon* 3.2 pts. per acre. REI: 12-hour. PHI: 1-day.

Quadris Top® (azoxystrobin, difenoconazole) *Cantaloupe/Muskmelon* 12-14 fl. oz. per acre. REI: 12-hour. PHI: 1-day.

Satori® (azoxystrobin) *Cantaloupe/Muskmelon* 11-15.5 fl. oz. per acre. REI: 4-hour. PHI: 1-day.

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

Tanos® (famoxadone, cymoxanil) *Cantaloupe/Muskmelon* 8 oz. per acre. REI: 12-hour. PHI: 3-day.

Leaf Blight of Cucurbits - *Plectosporium Fungus*

Plectosporium blight primarily affects pumpkin. Leaves, stems, and occasionally fruit can be affected.

Winter/Off-season: Rotate cucurbit crops 3-4 years and practice fall tillage. Choose fields with well-drained soil.

Vine Touch: Start applying contact/systemic fungicide applications and continue at 7-14 day intervals.

Harvest: Identify fruit problems.

Crop rotation *Pumpkin, Squash* Crop rotations of 3-4 years in a noncucurbit crops should help to lessen disease severity. Rotate between crop families to reduce pest and disease inoculum buildup and weeds favored by the management of certain crops.

Cabrio EG® (pyraclostrobin) *Cantaloupe/Muskmelon, Cucumber, Watermelon* 12-16 oz. per acre. See warnings under *Alternaria* leaf blight. REI: 12-hour.

Flint® (trifloxystrobin) *Pumpkin, Squash* 1.5-2.0 oz. per acre. REI: 12-hour. PHI: 0-day.

Inspire Super® (difenoconazole, cyprodinil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

mancozeb formulations (mancozeb) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Dithane®, Manzate®, Penncozeb®, and

OMRI-listed indicates that the product is listed by the Organic Materials Review Institute (OMRI.org) and therefore may be acceptable for use in organic production. Check with your certifier before use.

Roper® are labeled for use at various rates. REI: 24-hour. PHI: 5-day PHI.

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

Quadris 2.08SC® (azoxystrobin) *Pumpkin, Squash* 11-15.4 fl. oz. per acre. REI: 4-hour. PHI: 1-day.

Leaf Spot and Fruit Spot of Cucurbits - Xanthomonas Bacteria

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

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

Winter/Off-season: Rotate crops at least 3 years with noncucurbit crops, and practice fall tillage. Bacteria in and on the seeds can be eradicated by hot-water at 55 C for 15 min.

Planting: Treat with fixed copper compounds mixed with mancozeb products if symptoms are present.

Vine Touch: Apply fixed copper mixed with mancozeb when fruit is softball-sized. Continue applications until fruit set is complete. *Harvest:* Do not save seed from affected fields. Identify fruit problems.

copper formulations (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) *Pumpkin, Squash* Copper applications at 7-day intervals beginning when fruit are 4-5 inches in diameter. Applying copper tank-mixed with mancozeb products (e.g., Dithane®, Manzate®, Penncozeb®) is more effective than copper alone. REI: see label.

Powdery Mildew of Cucurbits - Podosphaera Fungus

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

Some pumpkin varieties have partial resistance to powdery mildew. Fungicide resistance has been detected in the Midwest. Fungicides in Groups 1 and 11 may not be effective. Fungicides that are affected include Cabrio®, Flint®, Quadris®, Satori®, Sovran®, and Topsin®. Alternate fungicides between MOA groups. See Selected Information About Recommended Fungicides (page 79).

Winter/Off-season: Crop rotation and fall tillage are moderately important. Resistant or partially resistant pumpkin cultivars are available.

Vine Touch: Begin systemic fungicide applications at “bush” stage of pumpkin growth. Protect pumpkin vines until approximately 21 days from last harvest.

Variety selection *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Some varieties of cantaloupe, cucumber and pumpkin have partial resistance. Select crop varieties for competitiveness, disease resistance, and regional adaptability.

Aprovia Top® (difenoconazole, benzovindiflupyr (solatenol)) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 10.5-13.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day.

Fontelis® (penthiopyrad) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 12-16 fl. oz. per acre. REI: 12-hour. PHI: 1-day.

Inspire Super® (difenoconazole, cyprodinil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

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

Luna Sensation® (fluopyram, trifloxystrobin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 4-7.6 fl. oz. per acre. REI: 12-hour. PHI: 0-day.

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

Microthiol Dispers® (sulfur) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 5-10 lbs. per acre. REI: 24-hour. PHI: 0-day. OMRI-listed.

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

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

Product/Disease Ratings for All Cucurbits¹

Product (REI/PHI) ²	Common name MOA or FRAC code: fungicides with a number as the MOA code should be tank-mixed or alternated with a different MOA code according to the label.	Alternaria leaf blight	Anthraxnose	Bacterial leaf & fruit blotch	Bacterial leaf and fruit spot	Downy mildew	Gummy stem blight/black rot	Plectosporium blight	Phytophthora blight	Powdery mildew	Scab	Comments
Actigard® (12/0)	acibenzolar-S-methyl (P01)			F	P	P				P	P	Use with copper applications for bacterial fruit blotch (see page 123).
Agri-Fos®, Phostrol®, Prophyt®, Rampart® (4/0)	acid/phosphite (33)					F	F		F			Use early and in tank mixes.
Aprovia Top (12/0)	difenoconazole (3), benzovindiflupyr (7)	ID	F				F	ID		G	ID	
Bravo®, Echo®, Equus®, Initiate® (12/0)	chlorothalonil (M)	G	G			F	G	G	P	F	G	
Cabrio® (12/0)	pyraclostrobin (11)	G	G			P	P	G		P		There may be resistance issues with downy mildew and gummy stem blight.
copper (active ingredient) (24/0)	copper (M)	P	P	F	F	P	P					
Dithane®, Manzate®, Penncozeb® (24/5)	mancozeb (M) phosphorus	G	G			F	G	G			G	
Elumin® (12/2)	ethaboxam (22)					G			G			Do not alternate with Gavel® or Zing!®. See tank-mix recommendation on page 123.
Flint® (12/0)	trifloxystrobin (11)					P		F		P		There may be resistance issues with powdery mildew.
Fontelis® (12/1)	penthiopyrad (7)	G					P			F		There may be resistance issues with gummy stem blight.
Forum 4.18SC® (12/0)	dimethomorph (40)					G			F			Do not alternate with Revus®. Use early and in tank mixes.
Gavel® (48/5)	mancozeb (M), zoxamide (22)	G				G			F			
Inspire Super® (12/7)	difenoconazole (3), cyprodinil (9)	G	G				G	G		G		
Luna Experience® (12/7)	fluopyram (7), tebuconazole (3)	G	F				G			G		
Luna Sensation® (12/0)	trifloxystrobin (11), fluopyram (7)	G	G				F			F		
Miravis Prime (12/7)	pydiflumetofen (7), fludioxonil (12)	ID					G		ID			F
Merivon® (12/0)	fluxapyroxad (7), pyraclostrobin (11)	G	G			P	P			F		
Monsoon®, Onset®, Toledo®, Vibe® (12/7)	tebuconazole (3)						G			F		
Orondis Opti® (4/0)	oxathiapropilin (U15), chlorothalonil (M)					G			G			
Orondis Ridomil Gold SL® (48/5)	oxathiapropilin (U15), mefenoxam (4)								G			Soil-applied product.
Orondis Ultra® (4/0)	oxathiapropilin (U15), mandipropamid (40)					G			G			
Presidio 4SC® (12/2)	fluopicolide (43)					G			G			Primary use will be for Phytophthora blight in rotation with Revus®.
Previcur Flex® (12/2)	propamocarb (28)					P						Has greenhouse label for damping-off
Pristine® (12/0)	boscalid (7), pyraclostrobin (11)	G	G			P	P			P		There may be resistance issues with downy mildew and gummy stem blight.
Procure® (12/0)	triflumizole (3)									G		
Quadris®, Satori® (4/1)	azoxystrobin (11)	G	G			P	P	G		P		There may be resistance issues with downy mildew and gummy stem blight.
Quadris Opti® (12/1)	azoxystrobin (11), chlorothalonil (M)	G	G			P	P			F		
Quadris Top® (12/1)	azoxystrobin (11), difenoconazole (3)	G	G				G			P		
Quintec® (12/3)	quinoxifen (13)									G		Contact fungicide with single mode of action
Rally® (24/0)	myclobutanil (3)									G		
Ranman® (12/0)	cyazofamid (21)					G			G			
Revus® (4/0)	mandipropamid (40)					P			G			Primary use will be for Phytophthora blight in rotation with Presidio®.
Switch 62.5WB® (12/1)	cyprodinil (9), fludioxonil (12)	G					G			F		
Tanos® (12/3)	cymoxanil (27), famoxadone (11)	G	G	S		F			S			
Topsin M® (12/0)	thiophanate-methyl (1)		G				F			P		
Torino® (4/0)	cyflufenamid (U6)									F		
Velum Prime (12/0)	Fluopyram (7)									ID		Also labeled for root-knot nematode.
Vivando® (12/0)	metrafenone (U8)									G		
Zampro® (12/0)	ametocetradin (45), dimethomorph (40)					G			G			See label for directions for at planting drench.
Zing® (12/0)	zoxamide (22), chlorothalonil (M)	G	G			G						

¹Fungicide rating code: G=good. F=fair. P=poor. S=suppression only. ID=labeled, but insufficient data to allow rating. Based on research and experience of the authors.

²REI (re-entry interval) in hours: do not enter or allow workers to enter areas treated during the REI period. PHI (pre-harvest interval) in days: the minimum time that must pass between the last pesticide application and crop harvest.

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

Rally 40WSP® (myclobutanil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2.5-5.0 oz. per acre. REI: 24-hour. PHI: 0-day.

tebuconazole formulations (tebuconazole) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 4-6 fl. oz. per acre. Trade names of labeled products include Monsoon®, Onset®, and Toledo®. REI: see label. PHI: 7-day.

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

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

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

Root-Knot Nematode

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

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

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

InLine® (1,3-dichloropropene) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* See label. REI: See label. PHI: See label. RUP.

Nimitz® (fluensulfone) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 3.5-7 pts. per acre. Do not use on direct-seeded plants. May be broadcast, banded, or drip-applied. 7-day plant back interval. REI: see label. PHI: See label.

Telone C-17® (1,3-dichloropropene, chloropicrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* See label. REI: see label. PHI: See label. RUP.

Telone C-35® (1,3-dichloropropene, chloropicrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin,*

Squash, Watermelon See label. REI: see label. PHI: See label. RUP.

Telone II® (1,3-dichloropropene) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* See label. REI: see label. PHI: See label. RUP.

Vapam HL® (metam sodium) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* See label. REI: see label. PHI: See label. RUP.

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

Vydate L® (oxamyl) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* See label. Use in 20 gals. of water per acre broadcast. Incorporate 2-4 inches. REI: 48-hour. PHI: 1-day. RUP.

Scab of Cucurbits - Cladosporium Fungus

Scab lesions may be observed on the fruit of most cucurbit crops. Fungicides used for gummy stem blight control may help. Fungicides may be ineffective when temperatures of less than 57°F persist for longer than 9 hours.

Winter/Off-season: Rotate crops 3-4 years and practice fall tillage. Use disease-free seed.

Planting: Fungicides may help to reduce the severity of scab if applied before fruit development.

Harvest: Inspect fruit for symptoms of scab.

Crop rotation *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Use a crop rotation that avoids cucurbits for 2-3 years. Rotate between crop families to reduce pest and disease inoculum buildup and weeds favored by the management of certain crops.

Variety selection *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Use cucumber varieties with host resistance to scab. Select crop varieties for competitiveness, disease resistance, and regional adaptability.

Viruses of Multiple Crops - Multiple Pathogens

Aphids transmit virus diseases, including cucumber mosaic virus, papaya ring spot virus, watermelon mosaic virus, and zucchini yellow mosaic virus. Since these diseases usually appear later in the season, they most often affect pumpkin and squash. All varieties are susceptible to these viruses.

It may help to kill perennial weeds (virus source plants) within 150 feet of planting. Controlling aphids (virus carriers) by insecticides can reduce secondary spread

of viruses but does not reduce initial infection and rarely results in any decrease in the incidence of virus symptomatic fruit. Early planting and development of pumpkins and squash fruit before virus diseases become prevalent may reduce symptoms on fruit.

Planting: Earlier planted or earlier maturing pumpkin cultivars will help to avoid severe disease problems.

Vine Touch: Control weeds in and around production area.

Variety selection *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Varieties with host resistance include cucumbers (cucumber mosaic virus) and squash (watermelon mosaic virus; zucchini yellow mosaic virus; cucumber mosaic virus; papaya ringspot virus). Select crop varieties for competitiveness, disease resistance, and regional adaptability.

Common Cucurbit Viruses and Transmission Sources

Virus	Host Range	Transmission Source
Cucumber Mosaic Virus	wide	aphids ¹
Papaya Ring Spot Virus	Cucurbitaceae	aphids ¹
Squash Mosaic Virus	Cucurbitaceae, Chenopodiaceae	seeds, cucumber beetles
Watermelon Mosaic Virus	Cucurbitaceae, weeds	aphids ¹
Zucchini Yellow Mosaic Virus	Cucurbitaceae	aphids ¹

¹Aphidborne viruses are non-persistent, thus aphids can begin transmitting the virus after seconds of feeding, and may transmit the virus for only a few hours.

Weed Control

Weed control methods in cucurbits vary by production system. The challenges for those who rely on herbicides include the chance of injuring crops under adverse weather, the relatively short residual of preemergence herbicides, and the lack of a broad-spectrum postemergence broadleaf herbicide that can be applied over the top of the crop.

For cucurbits that are no-till direct-seeded into a killed crop (such as pumpkins after soybeans, rye cover crop, or wheat) growers often use a burndown herbicide with a preemergence herbicide. If residue and cucurbit vines are not sufficient to suppress later-emerging weeds, growers may use postemergence herbicides, or shielded applications of nonselective herbicides.

For cucurbits direct-seeded into tilled soil, growers often combine one or more preemergence herbicides

at planting with one or more cultivations. Sometimes, growers also apply a preemergence herbicide at the last cultivation to improve control of late-emerging weeds. If needed, growers may use postemergence herbicides or shielded applications of nonselective herbicides.

When cucurbits are transplanted into plastic mulch, some growers apply a preemergence herbicide under the mulch as well as between the rows. Other growers only apply between the rows. Growers may also use one or more cultivations, and if needed, postemergence herbicides or a shielded application of a nonselective herbicide.

In organic production, organic mulches, plastic mulch, cultivation, and hand-weeding are common. Planting on the square will allow cultivation in two directions.

Weed pressure may be substantially reduced when growers prepare seedbeds several weeks in advance of planting and kill the first one or two flushes of weeds before planting without stirring up new weed seeds. Cucurbits lend themselves to this stale seedbed practice because they are often planted after common weeds have emerged in tilled soil.

The more quickly cucurbit vines cover the soil surface, the better they will suppress late-emerging weeds. Closer row spacing promotes rapid vine cover, and growers can increase in-row spacing to maintain a constant plant population. Uniform plant spacing in the row will also promote uniform vine cover. Seeding equipment that allows large gaps in direct-seeded crops usually leads to weed patches where the crop population is lower.

Recommended Controls

Burndown or Directed/Shielded Application Broadleaf and Grass Weeds

glyphosate formulations (glyphosate) *Cantaloupe/ Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations containing 3 lbs. ae per gal. (4 lbs. isopropylamine salt per gal.) at 1-5 qts. per acre, or formulations containing 4.5 lbs. ae per gal. (5 lbs. potassium salt per gal.) at 0.66-3.3 qts. per acre. Broadcast 3 days before transplanting or apply between crop rows with hooded or shielded sprayers. Use low rate for annuals and higher rates for perennials. See label for suggested application volume and adjuvants. Remove herbicide residue from plastic mulch prior to transplanting. REI: 4-hour. PHI: 14-day.

paraquat formulations (paraquat) *Cantaloupe/ Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2-4 pts. per acre of 2 lb. per gal.

formulations or 1.3-2.7 pt. per acre of 3 lb. per gal. formulations. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS (0.25% v/v) per 25 gal. of solution and apply to emerged weeds less than 6" tall prior to transplanting or after direct-seeding but before crop emergence. Certified applicators must successfully complete an EPA-approved training program before mixing, loading, and/or applying paraquat. REI: 24-hour. RUP.

Burndown or Directed/Shielded Application Broadleaf Weeds

Aim EC® (carfentrazone) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 0.5-2 fl. oz. per acre. Apply a minimum of 1 day prior to transplanting or 7 days prior to direct-seeding or apply between crop rows with hooded sprayer. Do not allow spray to contact crop. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gal. of spray solution (0.25% v/v). Weeds must be actively growing and less than 4 inches tall. Do not exceed 6.1 fl. oz. per acre per season REI: 12-hour. PHI: 0-day.

Preemergence Broadleaf and Grass Weeds

Command 3ME® (clomazone) at the following rates:

Cantaloupe/Muskmelon, Watermelon 0.4-0.67 pt. per acre.

Cucumber 0.4-1.0 pt. per acre. PHI: 45-day.

Pumpkin, processing pumpkins only: not for jack-o-lantern pumpkin 0.67-2.0 pt. per acre. PHI: 45-day.

Squash 0.67-1.33 pts. per acre for summer squash, 0.67-2.0 pts. per acre for winter squash. PHI: 45-day.

Not for jack-o-lantern pumpkins; see label for sensitive varieties. Apply prior to seeding or transplanting, or after seeding before crop emergence. Does not control pigweed and related species. Rates below 1 pt. will only suppress weeds. May cause temporary bleaching of crop leaves. REI: 12-hour.

Curbit EC® (ethalfluralin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 3-4 pt. per acre. Use lower rates on coarse soils. *Direct-seeded:* apply to soil surface within 2 days after seeding. Do not incorporate. *Transplants:* apply as a banded spray between rows. Does not control large-seeded broadleaves. Needs 0.5 inch of water within 5 days of application to be effective. If no rain occurs, cultivate shallowly. Do not apply over or under hot caps, row covers, or plastic mulch. Do not broadcast over top

of plants. Under cool temperatures may cause crop injury or failure. REI: 24-hour.

Dual Magnum® (s-metolachlor) at the following rates:

Note: Applicators must have 24c label, when applicable. Illinois label expires March 25, 2024. Michigan and Ohio labels expire December 31, 2021. REI: 24-hour.

Cantaloupe/Muskmelon, Watermelon in Illinois, Indiana, Michigan, and Ohio only: 0.67-1.27 pt. per acre. For crops on plastic mulch, apply between rows after laying mulch, but before crop emergence or transplanting. For crops on bare ground, apply before transplanting, or after seeding before crop emergence. On bare ground, the herbicide may be broadcast or applied just between rows. There is less risk of crop injury if applied between rows, and if melons are transplanted rather than seeded. Will not control emerged weeds. Do not exceed 1.27 pt. per acre or 1 application per crop per season. PHI: 60-day.

Cucumber in Illinois, Indiana, Michigan, and Ohio only: 0.67-1.0 pt. per acre. Apply after seeding before weeds or crop emerge, or apply broadcast after cucumbers have 1-2 true leaves. Will not control emerged weeds. Do not exceed 1 pt. per acre or 1 application per crop per season. PHI: 30-day.

Pumpkin 1.0-1.33 pt. per acre. Apply between rows or hills. Leave an untreated area at least 1 foot wide over the planted row, or at least 6 inches from planted seed or pumpkin leaves. *Additional application methods are permitted in Illinois, Indiana, and Michigan only:* Apply as a broadcast over top or between crop rows after seeding and before crop emergence. Will not control emerged weeds. Do not exceed 1.3 pt. per acre per crop. PHI: 30-day.

Winter squash in Illinois, Indiana, Michigan, and Ohio only: 1.0-1.3 pt. per acre. Apply as a broadcast over top or between crop rows after seeding and before crop emergence. Will not control emerged weeds. Do not exceed 1.3 pt. per acre per crop. PHI: 30-day.

Summer squash in Illinois, Indiana, and Michigan only: 0.67-1.33 pt. per acre. Apply as broadcast over the top or between crop rows after seeding and before crop emergence. If crops are grown on plastic mulch, the preemergence application should be made before laying the plastic. May also be applied as a row middle application after

the laying of the plastic mulch and after crop emergence. Will not control emerged weeds. Do not exceed 1.33 pt. per acre per crop. PHI: 30-day.

Prowl H2O® (pendimethalin) *Cantaloupe/Muskmelon, Watermelon* 2.1 pt. per acre. Apply to row middles only. Use a shielded sprayer with 6 inches on either side of the row middles. Apply before transplanting or before emergence of direct-seeded crop. A second application may be made before vines run. Wait at least 21 days between applications. Do not exceed 2.1 pt. per acre per application or 4.2 pt. per acre per season. REI: 24-hour. PHI: 35-day.

Sinbar WDG® (terbacil) *Watermelon* 2-4 oz. per acre. Apply pre-transplanting to bare ground or under plastic mulch, or to row middles. For direct-seeded crops on bare ground, apply after planting but before crop emergence. Do not allow spray to contact crop. Do not plant other crops within 2 years of application. Do not use on sand or gravel soils. Not recommended on soils with less than 1% organic matter due to crop injury potential. REI: 12-hour. PHI: 70-day.

Strategy® (ethalfluralin, clomazone) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2-6 pts. per acre. *Direct-seeded:* apply to soil surface within 2 days after seeding. Do not incorporate. *Transplanted:* apply as a banded spray between rows. Does not control large-seeded broadleaves. Needs 0.5 inch of water within 5 days of application to be effective. If no rain occurs, cultivate shallowly. Do not apply over or under hot caps, row covers, or plastic mulch. Do not broadcast over top of plants. Under cool temperatures may cause crop injury or failure. REI: 24-hour. PHI: 45-day.

trifluralin formulations (trifluralin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Use 4EC formulations at 1-2 pt. per acre. Use 10G formulations at 5-10 lb. per acre. Apply as a directed spray between rows after plants have 3-4 leaves and incorporate 1-2 inches. Use low rate on coarse soils with less than 2% organic matter. Not effective on muck or high organic matter soils. REI: 12-hour. PHI: 30-day for cantaloupe, cucumber, pumpkin, and squash, 60-day for watermelon.

Preemergence Broadleaf Weeds

Chateau SW® (flumioxazin) *Cantaloupe/Muskmelon, Watermelon in Indiana only:* 4 oz. per acre. *Applicators must be in possession of 24c and section 3 labels.* Indemnified label may be required. Use a shielded or hooded sprayer to apply before transplanting to row middles between plastic mulch-covered raised beds. Bed must be at least 4 inches

higher than treated area and at least 24 inches wide. Spray must remain between raised beds and contact no more than the bottom 1 inch of plastic. Do not apply after crops are transplanted. Rainfall or irrigation over beds is required after application but before transplanting. REI: 12-hour.

League® (imazosulfuron) *Cantaloupe/Muskmelon, Watermelon* 4.0-6.4 oz. per acre. Use the higher rate in fields with a known history of yellow nutsedge. Apply between rows after plants are well-established and at least 5 inches wide. Avoid contact with crop and plastic mulch, if present. If emerged weeds are present include a manufacturer-recommended surfactant to control yellow nutsedge and labeled broadleaf weeds that are 1-3 inches tall. Do not exceed 1 application and 6.4 oz. per acre per year. REI: 12-hour. PHI: 48-day.

Reflex® (fomesafen) at the following rates:

Note: Applicators must have 24c label, when applicable. Illinois label expires Dec 31, 2020. Michigan label expires December 31, 2023. Missouri label expires December 31, 2021. REI: 24-hour.

Pumpkin in Illinois and Michigan and Squash in Michigan only: 8-16 fl. oz. per acre. May be applied as a broadcast or row-middle application after seeding but before emergence on bare ground, or before transplanting on bare ground (up to 7 days prior to transplanting), and as a row middle application that does not contact the plants. An overhead irrigation or rainfall event between Reflex application and transplanting will ensure herbicide activation and will likely reduce the potential for crop injury due to splashing. PHI: 32-day.

Watermelon in Missouri only: 10-12 fl. oz. per acre. May be applied after seeding but before emergence on bare ground, before transplanting on bare ground, and both under and over plastic mulch before transplanting at. Up to 16 fl. oz. per acre may be applied as a row middle application that does not contact the plants. PHI: 35-day.

Sandea® (halosulfuron) at the following rates:

Cantaloupe/Muskmelon, Cucumber 0.5-1.0 oz. per acre. *Direct-seed or transplanted on bare ground:* Apply to the soil surface after direct-seeding but prior to cracking or apply at least 7 days before transplanting. Or apply after the crop has been transplanted for a minimum of 14 days and reached the 3-5 true leaf stage, but before the first female flowers appear either over the top or a directed/hooded spray. *Direct-seed or*

Herbicides for All Cucurbits¹

Product (RE/PHI)	Common Name	Timing and Application Location Relative to Crop ²				Timing and Application Location Relative to Weeds			Incorporated	Timing Relative to Weeds		Weed Groups Controlled					Crops ³		
		Before seeding	After seeding before emergence	Before transplanting	Postemergence - between rows only	Postemergence	Preemergence	Annual grasses		Small-seeded broadleaves	Broadleaves	Preemergence	Annual grasses	Cucumber	Cantaloupe	Watermelon		Squash, summer	Squash, winter
Aim EC® (12h/-)	carfentrazone			X	X	X									X	X	X	X	X
Command 3ME® (12h/45d)	clomazone	X	X	X						X	X	X	X	X	X	X	X	X	*
Curbit 3EC® (24h/-)	ethalfluralin		X		X			no			X			X	X	X	X	X	X
Dacthal W-75®, Dacthal Flowable® (12h/-)	DCPA						X					X				X			
Dual Magnum® (24h/30d)	s-metolachlor	X between rows	X between rows	X between rows	X					X	X	X							X
Gramoxone® (12h to 24h/-)	paraquat	X	X	X	X					X	X	X	X	X	X	X	X	X	X
League® (12h/48d)	imazosulfuron				X					X		X			X	X			
Poast® (12h/14d)	sethoxydim																		X
Prefar 4E® (12h/-)	bensulfide	X	X	X				yes		X	X	X	X	X	X	X	X	X	X
Prowl H2O (24h/35d)	pendimethalin		X between rows	X between rows	X					X	X	X	X		X	X			X
Roundup®, others (12h/14d)	glyphosate	X	X	X	X						X	X	X	X	X	X	X	X	X
Sandea® (12h/14d)	halosulfuron		X	X	X	X				X	X	X	X	X	X	X	X	X	X
Select Max®, others (12h/14d)	clethodim									X	X	X			X	X	X	X	X
Sinbar® (12h/70d)	terbacil		X	X	X					X	X	X	X		X				
Strategy® (24h/ 45d)	clomazone and ethalfluralin		X		X			no		X	X	X	X	X	X	X	X	X	X
Treflan®, others (12h/30d to 60d)	trifluralin				X			yes		X	X	X	X	X	X	X	X	X	X

¹For effectiveness against specific weeds, see Relative Effectiveness of Herbicides for Vegetable Crops (page 68), and read label. This table does not include all label information. Be sure to read and follow all instructions and precautions on the herbicide label. Herbicides can cause serious crop injury and yield loss if not used properly.
²X=permitted for at least one crop.
³X=may be used for that crop. State-specific labels not indicated.
 *=Processing crops only.

transplanted into plastic mulch: Apply to the soil surface after final soil preparation or bed shaping and just before applying plastic mulch. Wait at least 7 days after application and mulch laying before seeding or transplanting. Or apply a minimum of 14 days after transplanting and after the crop has reached the 3-5 true leaf stage, but before the first female flowers appear as a directed/hooded spray. *Row middles on bare ground or plastic mulch*: Apply to row middles avoiding contact with the crop and plastic mulch, if present.

If weeds are present, add 0.5 pt. NIS per 25 gal. of solution (0.25% v/v). Not recommended for use under cool temperatures due to potential for crop injury. May delay crop maturity. Do not exceed 2 applications or 2 oz. per acre per 12-month period. REI: 12-hour. PHI: 30-day for cucumber, 57-day for cantaloupe.

Pumpkin 0.5-1.0 oz. per acre. *Direct-seed or transplanted on bare ground* (0.50-0.75 oz. per acre): Apply to the soil surface after direct-seeding but prior to cracking or apply at least 7 days before transplanting. Or apply after the crop has been transplanted for a minimum of 14 days and reached the 2-5 true leaf stage, but before the first female flowers appear either over the top or a directed/hooded spray. *Processing pumpkins*: 0.50-1.0 oz. per acre may be applied. *Row middle application*: Apply 0.5-1.0 oz. per acre between rows. Avoid contact with crop and plastic mulch, if present.

If weeds are present, add 0.5 pt. NIS per 25 gal. of solution (0.25% v/v). Not recommended for use under cool temperatures due to potential for crop injury. May delay crop maturity. Do not exceed 2 applications of 1 oz. per acre or 2 oz. total per 12 month period. REI: 12-hour. PHI: 30-day.

Summer squash for processing in Missouri only: 0.5-1.0 oz. per acre. Apply after direct-seeding, but prior to soil cracking or apply between rows of direct-seeded or transplanted summer squash, avoiding contact with the crop. Do not apply more than 2 applications of 1 oz. per acre or 2 oz. per acre per 12 month period. If weeds are present, add 0.5 pt. NIS per 25 gal. of solution (0.25% v/v). REI: 12-hour. PHI: 30-day.

Watermelon: 0.5-1.0 oz. per acre. *Direct-seed or transplanted on bare ground in Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio only* (0.50-

0.75 oz. per acre): Apply to the soil surface after direct-seeding but prior to cracking or apply at least 7 days before transplanting. *Direct-seed or transplanted into plastic mulch in Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio only*: Apply to the soil surface after final soil preparation or bed shaping and just before applying plastic mulch. Wait at least 7 days after application and mulch laying before seeding or transplanting. *Row middle application (all states)*: Apply 0.5-1.0 oz. per acre between rows. Avoid contact with crop and plastic mulch, if present.

If weeds are present, add 0.5 pt. NIS per 25 gal. of solution (0.25% v/v). Not recommended for use under cool temperatures due to potential for crop injury. May delay crop maturity. Do not exceed 2 applications or 1 oz. per acre per 12-month period. REI: 12-hour. PHI: 57-day.

Preemergence Grass Weeds

Dacthal W75® (DCPA) *Cantaloupe/Muskmelon,*

Watermelon Dacthal W-75® at 6-14 lbs. per acre, or Dacthal Flowable® at 6-14 pts. per acre. Apply when plants have 4-5 true leaves and growing conditions favor good plant growth. Crop injury may occur if applied under unfavorable growing conditions or earlier than recommended. REI: 12-hour.

Prefar 4E® (bensulide) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 5-6 qt. per acre. Use low rate on soils with less than 1% organic matter. Apply before planting and incorporate 1-2 in. or apply after seeding before crop emerges and irrigate within 24 hours. REI: 12-hour.

Postemergence Broadleaf Weeds

League® (imazosulfuron) See details in the Preemergence Broadleaf Weeds section of this chapter.

Reflex® (fomesafen) See details in the Preemergence Broadleaf Weeds section of this chapter.

Sandea® (halosulfuron) See details in the Preemergence Broadleaf Weeds section of this chapter.

Postemergence Grass Weeds

clethodim formulations (clethodim) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Use 2 lb. per gal. formulations at 6-8 fl. oz. per acre with 1 qt. COC per 25 gal. of spray solution (1% v/v). Do not exceed 32 fl. oz. per acre per season. Use 0.97 lb. per gal. formulations at 9-16 fl. oz. per acre with 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gal. of spray solution (0.25% v/v). Do not exceed 64 fl. oz. per acre per season. Use lower rates for annual grasses

and higher rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. REI: 24-hour. PHI: 14-day.

Poast® (sethoxydim) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 1-1.5 pt. per acre. Add 1 qt. COC per 25 gal. of spray solution (1% v/v). Spray on actively growing grass. Do not exceed 3 pt. per acre per growing season. REI: 12-hour. PHI: 14-day for squash, pumpkin, and watermelon; 3-day for cantaloupe and cucumber.

Insect Control

Recommended Controls

Aphids

Conserve or introduce natural enemies *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Limiting insecticide use will conserve predators and parasites that help control aphid populations. Monitor the presence of predators and parasitized aphids. Several predators per aphid colony will probably bring the aphid population under control without insecticide. Biocontrols are the enemy of the enemy. Some can be purchased and deployed, and other can be conserved through non-crop habitat management and careful pesticide use.

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

Actara® (thiamethoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 1.5-4 oz. per acre. Do not exceed 11 oz. per acre per season. See pollinator precautions. REI: 12-hour. PHI: 0-day.

Admire Pro® (imidacloprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 7-10.5 fl. oz. per acre. See label for various soil application methods. Do not exceed 10.5 fl. oz. per acre per season. See pollinator precautions. REI: 12-hour. PHI: 21-day.

Assail 30SG® (acetamiprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2.5-4 oz. per acre. Do not exceed 26.5 oz. per acre per season. REI: 12-hour. PHI: 0-day.

Belay® (clothianidin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 3-4 fl. oz. per acre. Use as foliar or soil application. Do not use as foliar after the 4th true leaf on main stem has

unfolded. See pollinator precautions. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day.

Beleaf 50SG® (flonicamid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2-2.8 oz. per acre. Do not exceed 3 applications per season. REI: 12-hour. PHI: 0-day.

dimethoate formulations (dimethoate) *Cantaloupe/Muskmelon, Watermelon* 0.5-1.0 pt. per acre for 400 or 4E formulations. 0.75-1.5 pts. per acre for 2.67EC formulations. REI: see label. PHI: 3-day.

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

Fulfill® (pymetrozine) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2.75 oz. per acre. Do not exceed 5.5 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day.

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

Lannate SP® (methomyl) *Cantaloupe/Muskmelon, Cucumber, Squash, Watermelon* 0.5-1 lb. per acre. Not for pumpkins or winter squash. REI: 48-hour. PHI: 1-day for 0.5 lb. rate, 3-day for rates over 0.5 lb. *RUP.*

malathion formulations (malathion) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 5EC formulations use 1.5-2.8 pts. per acre for cucumber and squash, 1.6 pts. per acre for melon, 1.5 pts. per acre for pumpkin, 1.6-2.8 pts. per acre for squash, 1.5-2.5 pts. per acre for watermelon. 57EC formulations use 1.5 pts. per acre on cucumber, melon, pumpkin, squash, and watermelon. 8E formulations use 1.75 pts. per acre for cucumber, 1 pt. per acre for squash. REI: 12-hour for melon, pumpkin, winter squash, and watermelon; 24-hour for cucumber and summer squash. PHI: 1-day.

Platinum 2SC® (thiamethoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 5-11 fl. oz. per acre. See label for application methods. Do not exceed 11 fl. oz. per acre per season. See pollinator precautions. REI: 12-hour. PHI: 30-day.

Pounce 25WP® (permethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 6.4-12.8 oz. per acre. Apply a minimum of 4 gallons finished spray per acre by air, or 20 gallons finished spray per acre with ground equipment. Do not exceed 3.2 lbs. per acre on cantaloupe. Do not exceed 4.8 lbs. per acre for all others. REI: 12-hour. PHI: 0-day. *RUP*.

Scorpion 35SL® (dinotefuran) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2-7 fl. oz. per acre. Do not exceed 10.5 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day.

Sivanto 200SL® (flupyradifurone) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 21-28 fl. oz. per acre soil application, or 7-12 fl. oz. per acre foliar application. REI: 4-hour. PHI: 21-day for soil application, or 1-day for foliar application.

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

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

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

Cucumber Beetles

Cantaloupe: 1 beetle per plant

Cucumber: 1 beetle per plant

Watermelon: 1 beetle per plant

Squash: 5 beetles per plant

Pumpkin: 5 beetles per plant

The threshold for cantaloupe and cucumber is lower because those crops are susceptible to bacterial wilt, which is vectored by striped cucumber beetles. The threshold for squash and pumpkin is higher because those crops are not as susceptible to bacterial wilt. Watermelons are resistant to bacterial wilt too, but beetles feed on the undersides of fruit.

Trapping *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Yellow sticky traps are attractive to cucumber beetles and can detect mass emergence to focus

insecticide applications during periods of heavy beetle activity. Use traps to monitor pest populations.

Actara® (thiamethoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 3-5.5 oz. per acre. Do not exceed 11 oz. per acre per season. See pollinator precautions. REI: 12-hour. PHI: 0-day.

Admire Pro® (imidacloprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 7-10.5 fl. oz. per acre. See label for various soil application methods. Do not exceed 10.5 fl. oz. per acre per season. See pollinator precautions. REI: 12-hour. PHI: 21-day.

Ambush® (permethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 6.4-12.8 fl. oz. per acre. Apply a minimum of 4 gals. finished spray per acre by air, or 20 gals. finished spray per acre with ground equipment. Do not exceed 102.4 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. *RUP*.

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

Assail 30SG® (acetamiprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2.5-5.3 oz. per acre. Do not exceed 26.5 oz. per acre per season. REI: 12-hour. PHI: 0-day.

Azera® (azadirachtin, pyrethrins) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 48 fl. oz. per acre. Do not exceed 10 applications per season. Do not reapply within 3 days except under extreme pest pressure. REI: 12-hour. PHI: 0-day. *OMRI-listed*.

Baythroid XL® (beta-cyfluthrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2.4-4.8 fl. oz. per acre. Do not exceed 11.2 fl. oz. per acre or 4 applications per season. Allow 7 days between applications. REI: 12-hour. PHI: 0-day. *RUP*.

Belay® (clothianidin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 3-4 fl. oz. per acre. Use as foliar or soil application. Do not use as foliar after the 4th true leaf on main stem has unfolded. See pollinator precautions. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day.

Brigade 2EC® (bifenthrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2.6-6.4 fl. oz. per acre. Do not exceed 19.2 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. *RUP*.

Danitol 2.4EC® (fenpropathrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 10.67-16 fl. oz. per acre. Do not exceed 42.67 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. *RUP*.

Harvanta® (cyclaniliprole) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 10.9-16.4 fl. oz. per acre. Do not exceed 65.6 fl. oz. per acre per year. REI: 4-hour. PHI: 1-day.

Mustang Maxx® (zeta-cypermethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2.8-4 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. *RUP.*

Pounce 25WP® (permethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 6.4-12.8 oz. per acre. Apply a minimum of 4 gallons finished spray per acre by air, or 20 gallons finished spray per acre with ground equipment. Do not exceed 3.2 lbs. per acre on cantaloupe. Do not exceed 4.8 lbs. per acre for all others. REI: 12-hour. PHI: 0-day. *RUP.*

Seed treatments (thiamethoxam, mefenoxam, fludioxonil, azoxystrobin, thiabendazole, spinosad, abamectin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Seed treatments containing thiamethoxam provide control.

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

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

Leafhoppers

Admire Pro® (imidacloprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 7-10.5 fl. oz. per acre. See label for various soil application methods. Do not exceed 10.5 fl. oz. per acre per season. See pollinator precautions. REI: 12-hour. PHI: 21-day.

Ambush® (permethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 6.4-12.8 fl. oz. per acre. Apply a minimum of 4 gals. finished spray per acre by air, or 20 gals. finished spray per acre with ground equipment. Do not exceed 102.4 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. *RUP.*

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

Assail 30SG® (acetamiprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2.5-4 oz. per acre. Do not exceed 26.5 oz. per acre per season. REI: 12-hour. PHI: 0-day.

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

Belay® (clothianidin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 3-4 fl. oz. per acre. Use as foliar or soil application. Do not use as foliar after the 4th true leaf on main stem has unfolded. See pollinator precautions. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day.

Brigade 2EC® (bifenthrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2.6-6.4 fl. oz. per acre. Do not exceed 19.2 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. *RUP.*

dimethoate formulations (dimethoate) *Cantaloupe/Muskmelon, Watermelon* 0.5-1.0 pt. per acre for 400 or 4E formulations. 0.75-1.5 pts. per acre for 2.67EC formulations. REI: see label. PHI: 3-day.

Platinum 2SC® (thiamethoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 5-11 fl. oz. per acre. See label for application methods. Do not exceed 11 fl. oz. per acre per season. See pollinator precautions. REI: 12-hour. PHI: 30-day.

Pounce 25WP® (permethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 6.4-12.8 oz. per acre. Apply a minimum of 4 gallons finished spray per acre by air, or 20 gallons finished spray per acre with ground equipment. Do not exceed 3.2 lbs. per acre on cantaloupe. Do not exceed 4.8 lbs. per acre for all others. REI: 12-hour. PHI: 0-day. *RUP.*

Sivanto 200SL® (flupyradifurone) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 21-28 fl. oz. per acre soil application, or 7-12 fl. oz. per acre foliar application. REI: 4-hour. PHI: 21-day for soil application, or 1-day for foliar application.

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

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

Mites

abamectin formulations (abamectin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 8-16 fl. oz. per acre for 0.15EC formulations. 1.75-3.5 fl. oz. per acre for SC formulations. Allow at least 7 days between applications. Do not make more than 2 sequential applications. Do not exceed 48 fl. oz. per acre per season for 0.15EC formulations. Do not exceed 10.25 fl. oz. per acre per season for SC formulations. REI: 12-hour. PHI: 7-day. *RUP*.

Acramite 50WS® (bifenazate) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 0.75-1 lb. per acre. One application per season. REI: 12-hour. PHI: 3-day.

Brigade 2EC® (bifenthrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 5.12-6.4 fl. oz. per acre. Do not exceed 19.2 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. *RUP*.

Danitol 2.4EC® (fenpropathrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 10.67-16 fl. oz. per acre. Do not exceed 42.67 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. *RUP*.

Kanemite 15SC® (acequinocyl) *Cantaloupe/Muskmelon, Cucumber, Watermelon* 31 fl. oz. per acre. Do not exceed 2 applications per year. Allow 21 days between applications. REI: 12-hour. PHI: 1-day.

Oberon 2SC® (spiromesifen) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 7.0-8.5 fl. oz. per acre. Do not exceed 3 applications per season. REI: 12-hour. PHI: 7-day.

Portal® (fenpyroximate) *Cantaloupe/Muskmelon, Cucumber* 2 pts. per acre. Do not exceed 2 applications per season. REI: 12-hour. PHI: 1-day for cucumber, 3-day for melon.

Zeal® (etoxazole) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2-3 oz. per acre. Do not exceed 1 application per season. REI: 12-hour. PHI: 7-day.

Seed and Root Maggots

Moldboard plow *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Early plowing of cover crops and weeds will generally result in less damage to seedling plants in field. Plowing can eliminate emerged annual weeds by turning soil.

Seed treatments (thiamethoxam, mefenoxam, fludioxonil, azoxystrobin, thiabendazole, spinosad, abamectin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* Seed treatments containing thiamethoxam provide control.

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

Squash Bug

Ambush® (permethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 6.4-12.8 fl. oz. per acre. Apply a minimum of 4 gals. finished spray per acre by air, or 20 gals. finished spray per acre with ground equipment. Do not exceed 102.4 fl. oz. per acre per season. REI: 12-hour. PHI: 0-day. *RUP*.

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

Assail 30SG® (acetamiprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 2.5-5.3 oz. per acre. Do not exceed 26.5 oz. per acre per season. REI: 12-hour. PHI: 0-day.

Azera® (azadirachtin, pyrethrins) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 32-48 fl. oz. per acre. Use higher rates for squash bug adults, or when pest pressure is extreme of plant canopy is dense. Do not exceed 10 applications per season. Do not reapply within 3 days except under extreme pest pressure. REI: 12-hour. PHI: 0-day. *OMRI-listed*.

Belay® (clothianidin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* 3-4 fl. oz. per acre. Use as foliar or soil application. Do not use as foliar after the 4th true leaf on main stem has unfolded. See pollinator precautions. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day.