Wilt it ever stop?

Managing wilts caused by insects

ZSOFIA SZENDREI

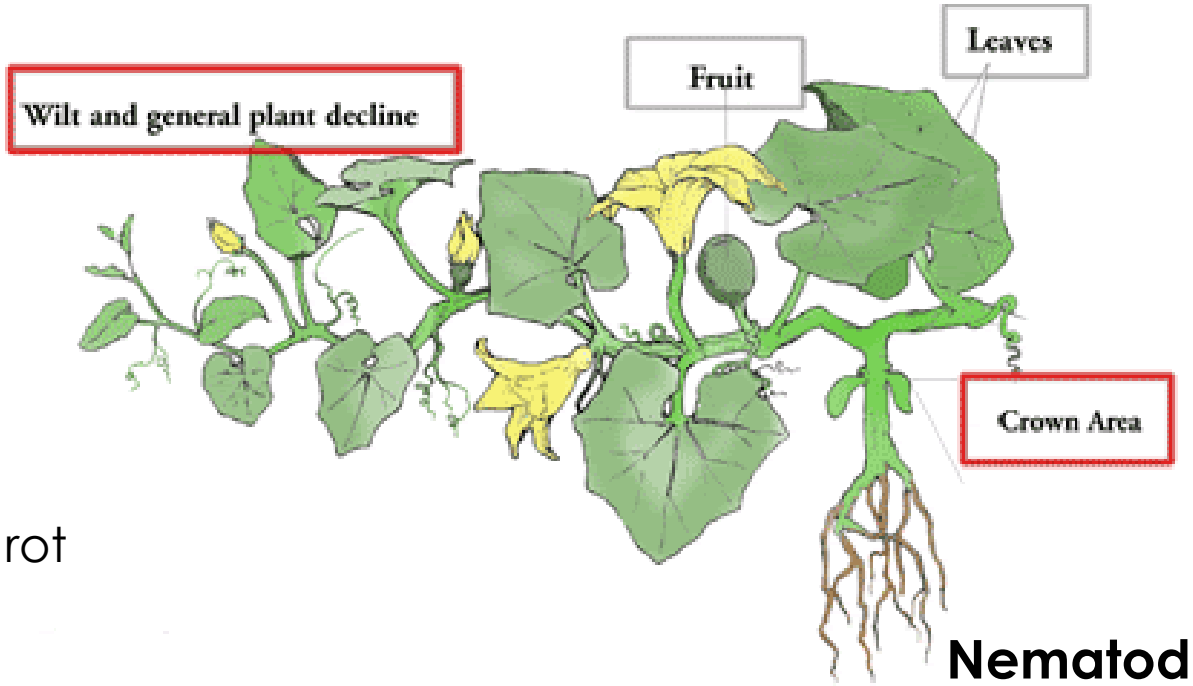
MSU, VEGETABLE ENTOMOLOGY

What's causing the wilting?

- Water
- Heat
- Nutrient
- Disease
- Insect

Bacteria:
- Bacterial wilt
- Cucurbit yellow vine decline

Viruses:
- Squash Mosaic Virus (SqMV)
- Zucchini Yellow Mosaic Virus (ZYMV) Watermelon Mosaic Virus 2 (WMV-2)
- Watermelon Mosaic Virus 1 (WMV-1), also known as Papaya Ringspot Virus (PRSV)



Fungi/oomycete:
- Anthracnose
- Fusarium crown rot
- Fusarium wilt
- Gummy stem blight
- Phytophthora crown rot
- Plectosporium
- Powdery mildew
- Scab
- Ulocladium

Nematodes:
Root knot nematode

Cornell, Dpt. Plant Pathology

Insects that cause wilt

- Seedcorn maggot
- Cucumber beetles
- Squash bugs
- Aphids
- Squash vine borer

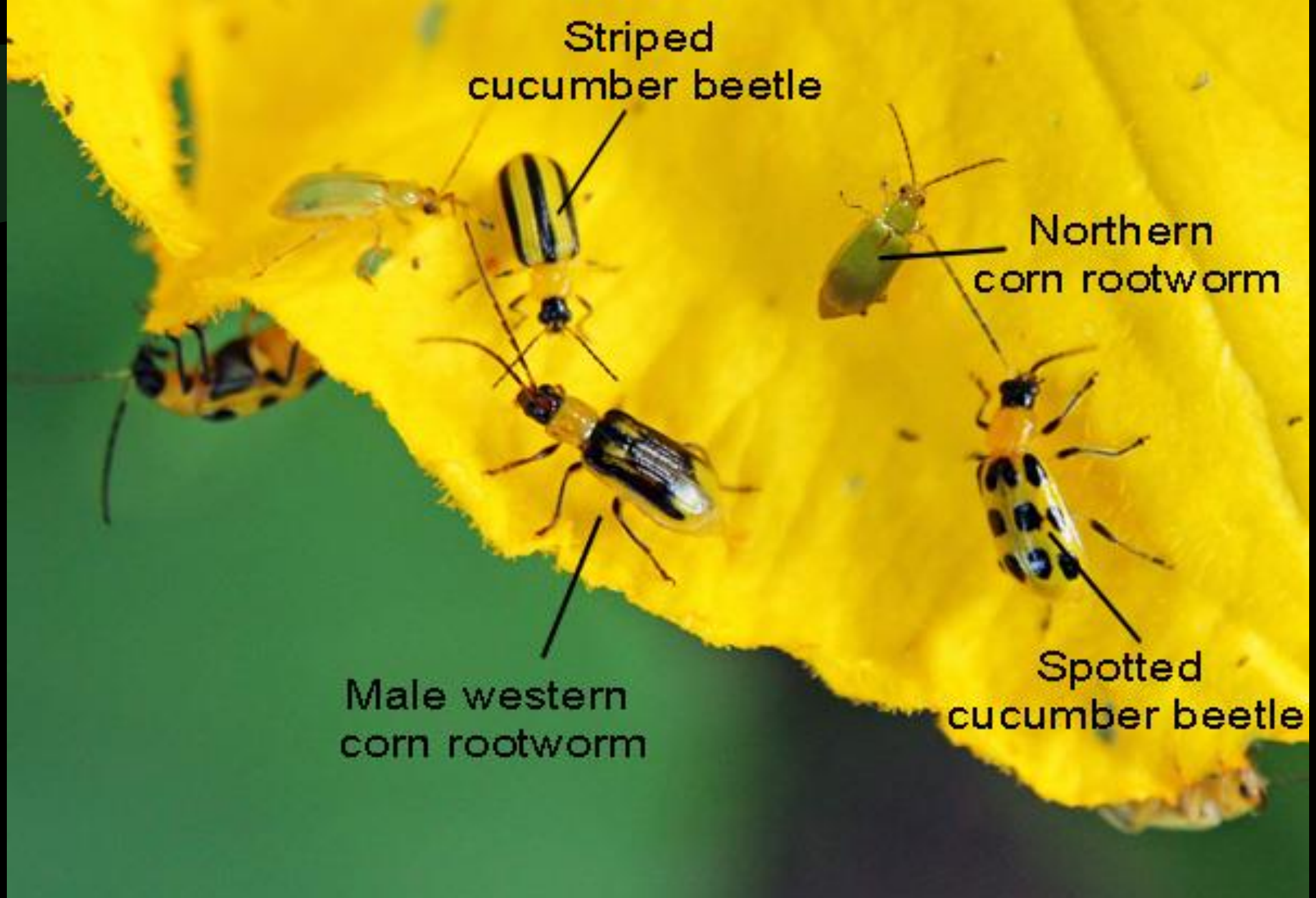
Transmit plant diseases

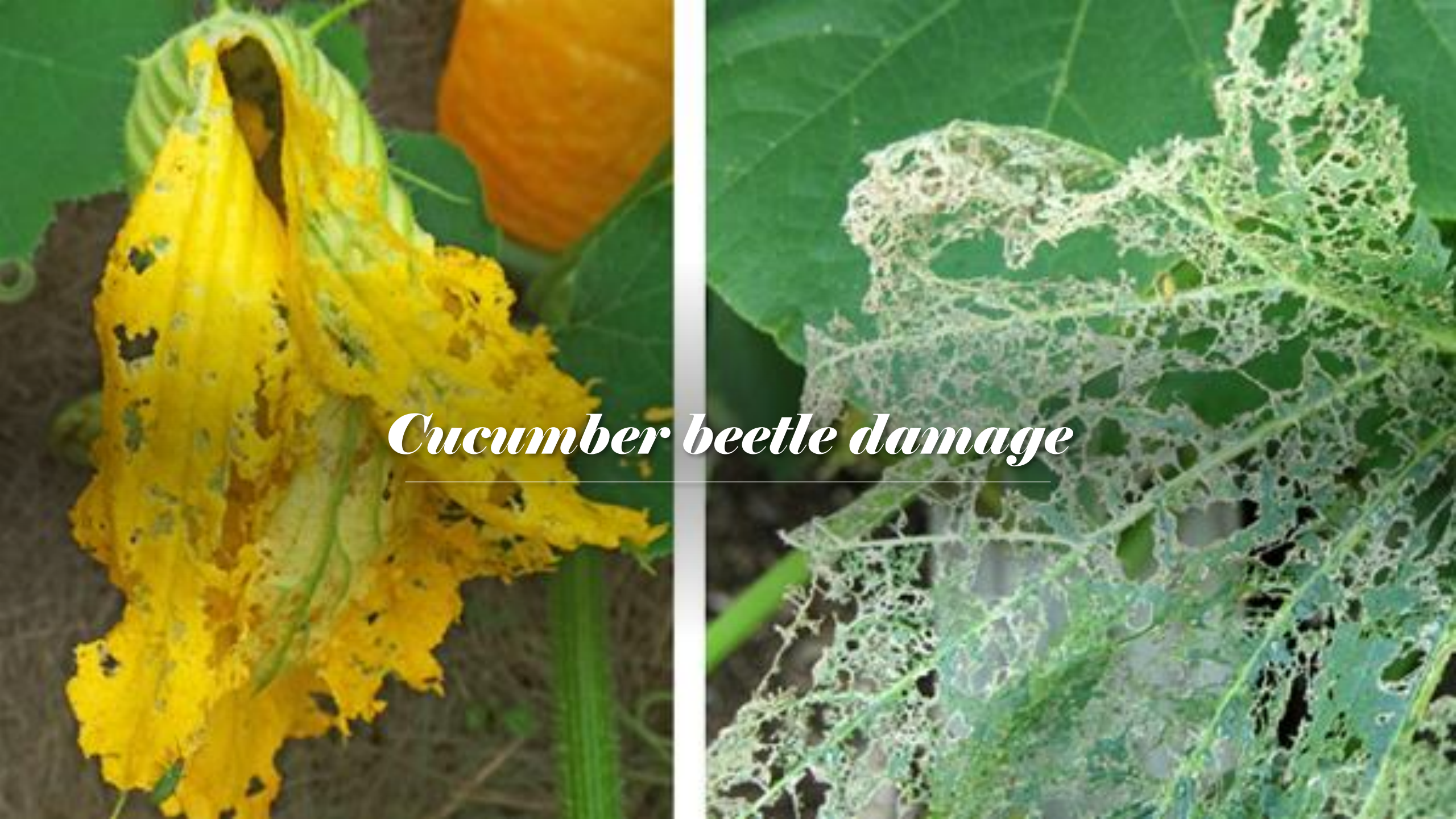
Seedcorn maggots

Early-planted melons and cucumbers

Scouting: crop emergence - June

Management: plow cover crop early, plant into warm soil, replace transplants

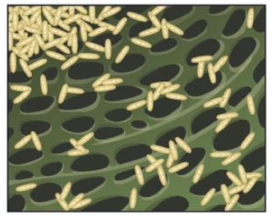

Striped
cucumber beetle
Northern
corn rootworm
Male western
corn rootworm
Spotted
cucumber beetle


Cucumber beetle damage

Transmission occurs when bacteria-infested frass comes into contact with fresh feeding wounds.

Transmission of bacteria can also occur via floral nectaries.

Overwintering beetles continue to infect plants through early summer.



Once inside the plant, bacteria multiply within xylem vessels and obstruct flow of water.

Plants wilt 7 to 21 days after transmission.

Wilted leaves attract beetles, which acquire the bacteria when feeding.

Plants collapse and die.

Adult beetles overwinter underneath soil and plant debris near cucurbit fields.

In the spring, overwintering adults become active at temperatures >12° C.

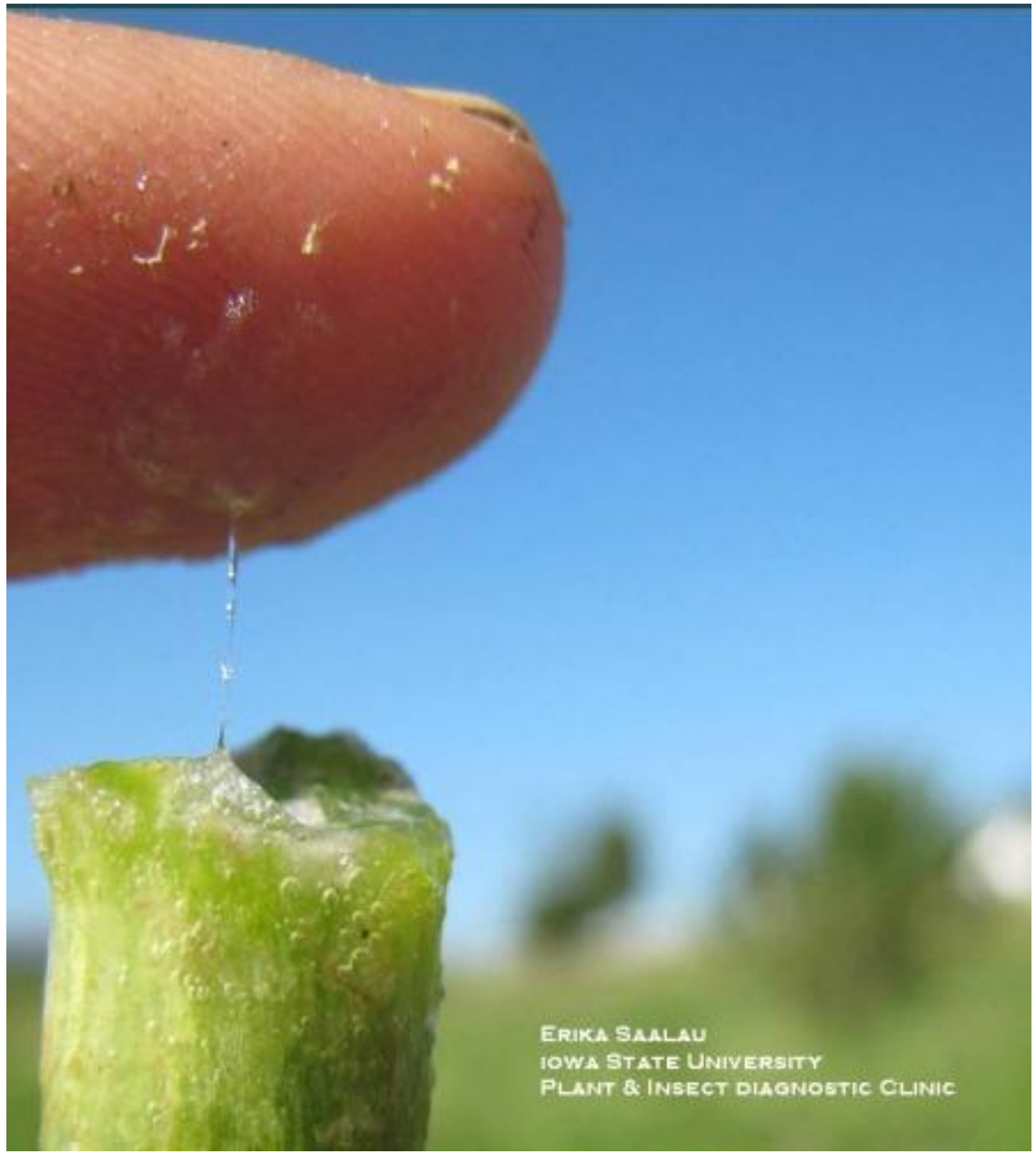
Emerging adult beetles locate and feed on cucurbit plants.

Multiple generations of beetles occur in a single growing season. Adult females lay their eggs at the base of cucurbit plants. Newly emerged adults feed on infected plants, acquire the bacteria, and continue disease transmission and dispersal.

https://apsjournals.apsnet.org/doi/10.1094/PDIS-10-14-1068-FE

Bacterial Wilt

Photo: Chris Gunter



Resources

Video confirming presence of bacterial wilt in cantalopes.

Cucumber Bacterial Wilt Time-Lapse

12,143 views • Oct 15, 2019 • The striped cucumbe...

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Management

- Muskmelons and cucumbers are susceptible
- Watermelons, pumpkin, squash do not get bacterial wilt
- Once the bacterium enters the plant, it cannot be cured
- Plants do not recover after watering
- Bacteria overwinters in adult cucumber beetle gut, plant sap

Scouting:

- crop emergence to August
- focus on borders, check 2-3 times/week

Economic threshold:

- 1 beetle/pant for muskmelon, cucumber,
- 5 beetles/plant for watermelon, squash, pumpkin

Management: treated seed provide early protection,
soil insecticide at planting, pyrethroid foliar insecticides

Perimeter trap crops

Photo: J. Batzer

DOI: 10.1094/PDIS-10-14-1068-FE

Resources

Cucumber Beetle Trap & Lure (2 Pack)

1 Each

★★★★★2 Reviews

40435-00-00-900

$11.95

This product is ready to ship

Quantity 1

ADD TO MY CART

♡ ADD TO WISHLIST

Squash bug

Cucurbit yellow vine decline

- Pathogen survives in overwintering adult squash bugs
- The only way to manage the disease is to kill the squash bugs
- Squash bugs introduce bacterium into plant when feeding
- Squash bugs attack especially squash + pumpkin
- **Economic threshold:** 1 egg mass per plant during early flowering stage
- **Management:** pyrethroid foliar insecticides, sanitation, crop rotation

Photo: Oklahoma State University

Aphids

Deformed and mottled leaves

- Many species of aphids
- Attack many cucurbits
- Overwinter as eggs outside field
- Reproduce asexually
- Feed on underside of leaves
- Problem if virus infects before fruit set

- **Scout:** Crop emergence – Sep.
- **Management:**
  - Seed treatment
  - At-plating insecticide
  - Foliar insecticides
  - Natural enemies

Squash vine borer

Photos: J. Obermeyer

Squash vine borer lure and trap

Squash vine borer

- Pest of squash and pumpkin, rarely attacks cucumbers and melons
- Larvae overwinter in soil
- **Scouting:** mid-June to late July
- **Management:**
  - foliar pyrethroid insecticide applications to kill larvae before they enter the stem
  - Crop rotation >1 mile
  - Row covers
  - Sanitation

Resources

Product code: ID-56

Midwest Vegetable Production Guide for Commercial Growers 2021

PRICE

$0.00/ Each

Free Download

DESCRIPTION

Eight Midwestern states cooperate in the production of this annually updated guide. It includes production information such as vegetable varieties, soils and fertility as well as recommendations for weed, insect and disease control for commercial growers. **Click here to open the guide online.**

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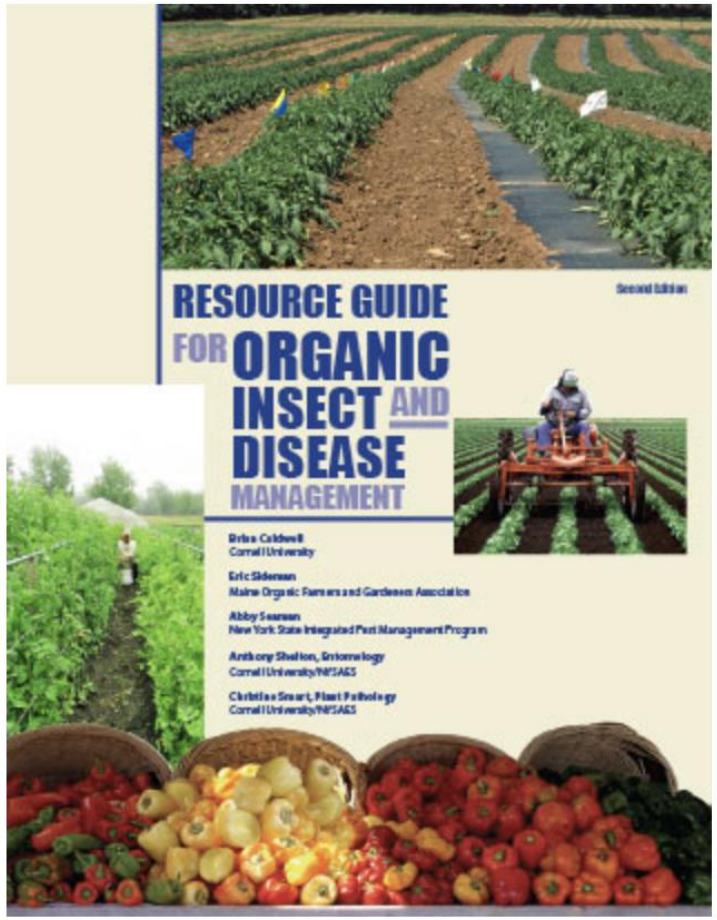
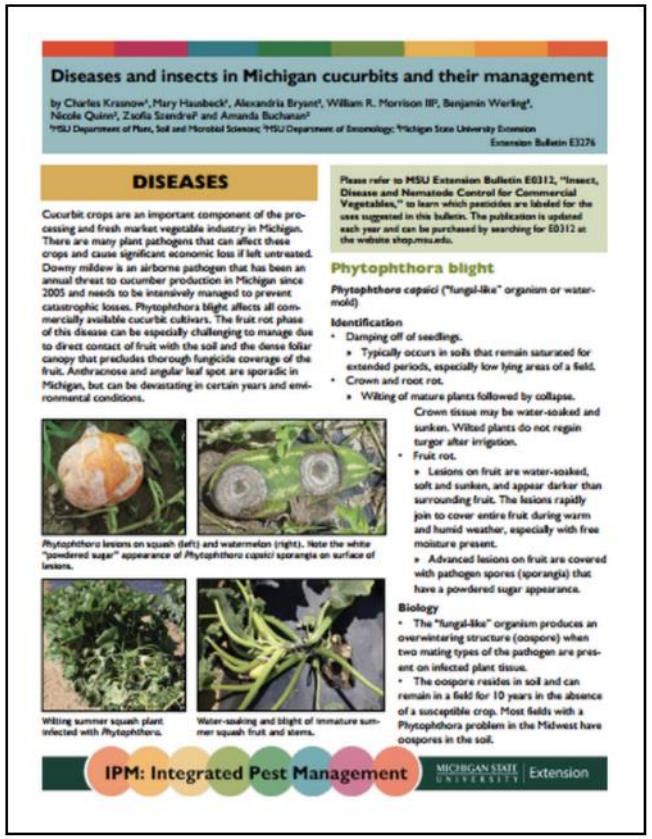


Resources

Diseases and Insects in Michigan Cucurbits and their Management (E3276)


Diseases and insects in Michigan cucurbits and their management

by Charles Krasnow[1], Mary Hausbeck[2], Alexandria Bryant[2], William R. Morrison III[3], Benjamin Werling[4], Nicole Quinn[2], Zsofia Szendrei[4] and Amanda Buchanan[2]

[1]MSU Department of Plant, Soil and Microbial Sciences; [2]MSU Department of Entomology; [3]Michigan State University Extension

Extension Bulletin E3276

DISEASES

Please refer to MSU Extension Bulletin E0312, "Insect, Disease and Nematode Control for Commercial Vegetables," to learn which pesticides are labeled for the uses suggested in this bulletin. The publication is updated each year and can be purchased by searching for E0312 at the website shop.msu.edu.

Cucurbit crops are an important component of the processing and fresh market vegetable industry in Michigan. There are many plant pathogens that can affect these crops and cause significant economic loss if left untreated. Downy mildew is an airborne pathogen that has been an annual threat to cucumber production in Michigan since 2005 and needs to be intensively managed to prevent catastrophic losses. Phytophthora blight affects all commercially available cucurbit cultivars. The fruit rot phase of this disease can be especially challenging to manage due to direct contact of fruit with the soil and the dense foliar canopy that precludes thorough fungicide coverage of the fruit. Anthracnose and angular leaf spot are sporadic in Michigan, but can be devastating in certain years and environmental conditions.

Phytophthora blight

Phytophthora capsici ("fungal-like" organism or water-mold)

Identification

- Damping off of seedlings.
  - Typically occurs in soils that remain saturated for extended periods, especially low lying areas of a field.
- Crown and root rot.
  - Wilting of mature plants followed by collapse. Crown tissue may be water-soaked and sunken. Wilted plants do not regain turgor after irrigation.
- Fruit rot.
  - Lesions on fruit are water-soaked, soft and sunken, and appear darker than surrounding fruit. The lesions rapidly join to cover entire fruit during warm and humid weather, especially with free moisture present.
  - Advanced lesions on fruit are covered with pathogen spores (sporangia) that have a powdered sugar appearance.

Phytophthora lesions on squash (left) and watermelon (right). Note the white "powdered sugar" appearance of *Phytophthora capsici* sporangia on surface of lesions.

Wilting summer squash plant infected with *Phytophthora*.

Water-soaking and blight of immature summer squash fruit and stems.

Biology

- The "fungal-like" organism produces an overwintering structure (oospore) when two mating types of the pathogen are present on infected plant tissue.
- The oospore resides in soil and can remain in a field for 10 years in the absence of a susceptible crop. Most fields with a Phytophthora problem in the Midwest have oospores in the soil.

IPM: Integrated Pest Management

MICHIGAN STATE UNIVERSITY Extension

DOWNLOAD FILE

October 20, 2016 - Author: Charles Krasnow

Diseases

Cucurbit crops are an important component of the processing and fresh market vegetable industry in Michigan. There are many plant pathogens that can affect these crops and cause significant economic loss if left untreated. Downy mildew is an airborne pathogen that has been an


Questions?

Cucurbit Crops – Horticulture

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

Crop Description

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

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

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

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

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

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

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

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

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).

Table of Watermelon Varieties Resistance to Fusarium Wilt

Inclusion of the varieties in the table below does not imply endorsement of criticism of any variety or company. Refer to company literature for information on host resistance claims. The resistance ratings provided here are averages based on several years of greenhouse research. In that research, each watermelon variety was observed after receiving an artificial inoculation with a race 1 strain of the disease. ++++ = good resistance; +++ = moderate resistance; ++ = some resistance; + = little or no resistance.

Variety	Type	Resistance
Ace	Pollenizer	+
Afternoon Delight	Seedless	+1/2
Companion	Pollenizer	+++1/2
Crunchy Red	Seedless	++
Distinction	Seedless	++++
Fascination	Seedless	++++
Fiesta	Regular	++1/2
Indiana	Seedless	++
Jenny	Pollenizer/ Regular	++1/2
Liberty	Seedless	++
Palomar	Seedless	+
Matrix	Seedless	+++1/2
Melody	Seedless	+++
Mickey Lee	Pollenizer/ Regular	++1/2
Pinnacle	Pollenizer	+1/2
Polimax 6017	Pollenizer	++
Regency	Pollenizer/ Regular	++++
Revolution	Seedless	+
Royal Sweet	Regular	++
Sidekick	Pollenizer	+++1/2
SP-5	Pollenizer	++++
Summer Sweet 5244	Seedless	++
Summer Sweet 7167	Seedless	+
SW 4502	Seedless	+1/2
Trillion	Seedless	+1/2
Triple Threat	Seedless	+++
Tri-X 313	Seedless	+1/2
Troubadour	Seedless	+
Vagabond	Seedless	+++1/2

Planting and Spacing

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

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

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

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

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

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

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

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

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

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

Pumpkins, winter squash, and watermelons are deep-rooted plants, so natural rainfall 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.

Fertilizing

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

Cucumbers, Melons, Pumpkins, Squash, and Watermelon for Fresh Market: Before planting, apply 40 to 60 pounds N per acre, 0 to 150 pounds P_2O_5 per acre, and 0 to 200 pounds K_2O per acre based on soil test results and recommendations from your state. In plasticulture systems, preplant fertilizer may be applied just over the row prior to bedding and/or laying plastic. For transplants, a starter solution at a rate of 1 cup (8 ounces) per plant is recommended. If the transplant flat receives a heavy fertilizer feeding just prior to setting, the starter solution can be eliminated.

Sidedress with 30-45 pounds N per acre when the vines begin to run. If heavy rains occur in June, apply an additional 30 pounds N per acre at fruit set. Sidedressing may be replaced by supplying N through a drip irrigation system at1/2 to 1 pound N per acre daily, or 3 to 6 pounds N weekly through the trickle system if additional N is needed until fruit are about 2 inches in diameter.

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

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

Cucumbers for processing: Before planting, apply 40 pounds N per acre, 0 to 150 pounds P_2O_5 per acre, and 0 to 200 pounds K_2O per acre based on soil test results and recommendations from your state. Sidedress with another 40 pounds N per acre.

Harvesting

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

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

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

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

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

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

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

Summer Squash: Harvesting and packing summer squash is a delicate process to avoid scratching the soft, immature fruit.

Pick off and discard large or damaged fruit to keep the plant producing new flowers and fruit.

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

Fungicide Efficacy Table for Cucurbits

Reviewed by Dan Egel, Mohammad Babadoost – September 2021

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

VG=Very Good, G=good, F=fair, P=poor, S=suppression

Trade Names (REI/PHI)	**Active Ingredients** 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**	**Anthracnose**	**Bacterial leaf & fruit blotch**	**Bacterial leaf and fruit spot**	**Downy mildew**	**Gummy stem/ black rot**	**Plectosporium blight**	**Phytophthora blight**	**Powdery mildew**	**Scab**
Actigard (12h/0d)	acibenzolar-S-methyl (P1)			F	P	P				P	P
Agri-Fos, Phostrol(4h to 12 h/0d)	acid/phosphite (33)					F	F		F		
Aprovia Top (12h/0d)	difenconazole (3), benzovindiflupyr (7)		F				F	F		F	
Bravo, Echo, Equus, Initiate (12h/0d)	chlorothalonil (M5)	G	G			F	G	F	P	P	G
Cabrio (12h/0d)	pyraclostrobin (11)	G	G			P	P	P		F	
copper (4h to 48h/0d)	copper (M1)	P	P	F	F	P	P				
Curzate (12h/3d)	cymoxanil (27)					F					
Dithane, Manzate, Penncozeb (24h/5d)	mancozeb (M3)	G	G			F	G	F			G
Elumin (12h/2d)	ethaboxam (22)					G			G		
Flint (12h/7d)	trifloxystrobin (11)					P		P		F	
Fontelis (12h/1d)	penthiopyrad (7)	G					P			F	
Forum 4.18SC (12h/0d)	dimethomorph (40)					P			F		
Gatten (12h/0d)	flutianil (U13)									G	
Gavel (48h/5d)	mancozeb (M3), zoxamide (22)	G				G			F		
Inspire Super (12h/7d)	difenoconazole (3), cyprodinil (9)	G	G				G	F		G	
Luna Experience (12h/7d)	fluopyram (7), tebuconazole (3)	G	F				G			G	
Luna Sensation (12h/0d)	trifloxystrobin (11), fluopyram (7)	G	G				F			F	
Merivon (12h/0d)	fluxapyroxad (7), pyraclostrobin (11)	G	G				P			F	
Miravis Prime (12h/1d)	pydiflumetofen (7), fludioxonil (12)						G				
Monsoon, Onset, Toledo (12h/7d)	tebuconazole (3)						G			F	
Omega 500F (12h/7d to 30d)	fluazinam (29)					G					
Orondis Gold 200 (4h/0d)	oxathiapipropilin (49)					F			F		
Orondis Opti (12h/0d)	oxathiapipropilin (49), chlorothalonil (M5)					VG			F		
Orondis Ultra (12h/0d)	oxathiapipropilin (49), mandipropamid (40)					VG			VG		
Presidio 4SC (12h/2d)	fluopicolide (43)					P			G		
Previcur Flex (12h/2d)	propamocarb (28)					G					
Pristine (12h/0d)	boscalid (7), pyraclostrobin (11)	G	G			P	P			F	
Procure (12h/0d)	triflumizole (3)									VG	
Proline (12h/7d)	prothioconazole (3)									G	
Quadris, Satori (4h/1d)	azoxystrobin (11)	G	G			P	P	P		F	
Quadris Opti (12h/1d)	azoxystrobin (11), chlorothalonil (M5)	G	G			P	P			P	
Quadris Top (12h/1d)	azoxystrobin (11), difenconazolel (3)	G	G				G			P	
Quintec (12h/3d)	quinoxyfen (13)									VG	
Rally (24h/0d)	mycolobutanil (3)									G	
Ranman (12h/0d)	cyazofamid (21)					G			G		
Revus (4h/0d)	mandipropamid (40)					G			VG		
Switch 62.5WB (12h/1d)	cyprodinil (9), fludioxanil (12)	G					G			F	
Tanos (12h/3d)	cymoxanil (27), famoxadone (11)	G	G	S		F			S		
Topsin M (24h/0d)	thiophanate-methyl (1)		G				F	F		F	
Torino (4h/0d)	cyflufenamid (U6)									F	
Velum Prime (12h/0d)	fluopyram (7)										
Vivando (12h/0d)	metrafenone (U8)									G	
Zampro (12h/0d)	ametoctradin (45), dimethomorph (40)					G			G		
Zing (12h/0d)	zoxamide (22), chlorothalonil (M5)	G	G			G			F		

Cucurbit Crops – Diseases

Reviewed by Dan Egel, Mohammad Babadoost – Sept 2021

Recommended Controls

Angular Leaf Spot of Cucurbits - Pseudomonas Bacteria

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

Non-Pesticide

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

Pesticide

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) mixed with mancozeb products (Dithane, Manzate, Penncozeb) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Several formulations of copper (Badge, Champ, Kocide) are labelled for use. See label for directions. Apply fixed copper 2 weeks prior to the opening of the first female bloom until fruit maturity. , 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. See labels for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M01. *OMRI-listed.*

Anthracnose of Cucurbits - Colletotrichum Fungus

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

Non-Pesticide

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

Pesticide

Aprovia Top (difenoconazole, benzovindiflupyr) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 10.5-13.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 03, FRAC 07.

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

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

chlorothalonil products (chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC M05.

Inspire Super (EW) (difenoconazole, cyprodinil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 03, FRAC 09.

Luna Sensation (fluopyram, trifloxystrobin) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 7.6 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 07, FRAC 11.

mancozeb products (mancozeb) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of mancozeb products (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M03.

Merivon (fluxapyroxad, pyraclostrobin) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 5.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 07, FRAC 11.

Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil) *Cantaloupe/Muskmelon, Cucumber,*

Pumpkin, Squash, Watermelon | 1.75-2.5 pts. per acre. Make no more than 2 sequential applications before rotating to a different mode of action. When 3 fungicide applications are used, Orondis can be in no more than 33% of the applications. Do not follow soil applications of Orondis Gold. REI: 12-hour. PHI: 0-day. FRAC 49, FRAC M05.

Pristine 38WG (boscalid, pyraclostrobin) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 12.5-18.5 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 07, FRAC 11.

Quadris Opti (SC) (azoxystrobin, chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 3.2 pts. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC M05.

Quadris Top (SC) (azoxystrobin, difenoconazole) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 12-14 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC 03.

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

Topsin 4.5FL (thiophanate-methyl) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | Use 4FL formulation or Cercobin at 10 fl. oz. per acre, or 70WSB formulation at 0.5 lb. per acre. REI: 24-hour to 3-day. PHI: 1-day. FRAC 01.

Zing! (zoxamide, chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 36 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 22, FRAC M05.

Bacterial Fruit Blotch of Cucurbits - Acidovorax Bacteria

Pesticide

Actigard (0.5WDG) (acibenzolar-s-methyl) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 0.5-1 oz. per acre. Apply with two of the fixed copper product applications described for bacterial fruit blotch. REI: 12-hour. PHI: 0-day. FRAC P01.

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) mixed with mancozeb products (Dithane, Manzate, Penncozeb) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Several formulations of copper (Badge, Champ, Kocide) are labelled for use. See label for directions. Apply fixed copper 2 weeks prior to the opening of the first female bloom until fruit maturity. , 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. See labels for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M01. *OMRI-listed.*

Bacterial Wilt of Cucurbits - Erwinia Bacteria

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

Pesticide

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

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

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

Non-Pesticide

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

Pesticide

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

off caused by Phytophthora and Pythium. Ridomil products cannot be used until 6 weeks after transplant. REI: 48-hour. FRAC 04.

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

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

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

Ridomil Gold SL (4SC) (mefenoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1-2 pts. per acre. For use on damping-off caused by Pythium species. Other formulations include MetaStar, Subdue Maxx, Ultra Flourish, and Xyler. Rates vary by formulation. REI: 48-hour. PHI: 5-day. FRAC 04.

Downy Mildew of Cucurbits - Pseudoperonospora Oomycete

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

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

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

Non-Pesticide

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

Pesticide

Catamaran (potassium phosphite, chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6 pts. per acre. REI: 12-hour. PHI: 1-day. FRAC 33, FRAC M05.

chlorothalonil products (chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC M05.

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

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

Gavel 75DF (zoxamide, mancozeb) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.5-2.0 lbs. per acre. REI: 48-hour. PHI: 5-day. FRAC 22, FRAC M03.

mancozeb products (mancozeb) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of mancozeb products (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M03.

Omega 500F (4.17) (fluazinam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 0.75-1.5 pts. per acre. REI: 12-hour. PHI: 7-day for cucumber and squash, 30-day PHI for watermelon, and cantaloupe/muskmelon. FRAC 29.

Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.75-2.5 pts. per acre. Make no more than 2 sequential applications before rotating to a different mode of action. When 3 fungicide applications are used, Orondis can be in no more than 33% of the

applications. Do not follow soil applications of Orondis Gold. REI: 12-hour. PHI: 0-day. FRAC 49, FRAC M05.

Orondis Ultra Premix (SC) (oxathiapiprolin, mandipropamid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5.5-8.0 fl. oz. per acre. Make no more than 2 sequential applications before rotating to a different mode of action. When 3 fungicide applications are used, Orondis can be in no more than 33% of the applications. Do not follow soil applications of Orondis Gold. REI: 4-hour. PHI: 0-day. FRAC 49, FRAC 40.

phosphite and phosphorous acid products (phosphorous acid, potassium phosphite, mono-dipotassium salts of phosphorous acid, mono- and dibasic sodium, potassium, and ammonium phosphites, fosetyl-aluminum) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several phosphite or phosphorus acid products (Aliette, Phostrol, ProPhyt, Rampart) are labeled at various rates. Label includes different crops, PHIs, resistance instructions, and other important information. Some manufacturers recommend tank-mixing. These products may be used in a preventative program until the disease is observed. REI: 4 to 12-hour. FRAC 33.

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

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

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

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

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

Zing! (zoxamide, chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 36 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 22, FRAC M05.

Fruit Rot of Cucurbits - Fusarium Fungus

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

Non-Pesticide

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

Fusarium Wilt of Vine Crops - Fusarium Fungus

Non-Pesticide

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

Pesticide

Proline 480SC (4) (prothioconazole) *Watermelon* | 5.7 fl. oz. per acre. May be applied by ground or chemigation application equipment. Do not use in water used for hand transplanting REI: 12-hour. PHI: 7-day. FRAC 03.

VAPAM HL (4.25L) (metam sodium) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 37.5-75 gals. per acre. Use high rates on muck, and lower rates on sands. In the fall, when soil at 6 inches is above 50 F and moist, place VAPAM HL or Sectagon K42 about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, it can be applied through drip irrigation under unperforated plastic beds. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC 08F, FRAC M03, HRAC NC. *RUP.*

Gummy Stem Blight/Black Rot of Cucurbits - Didymella Fungus

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

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

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

Non-Pesticide

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

Pesticide

Aprovia Top (difenoconazole, benzovindiflupyr) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 10.5-13.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 03, FRAC 07.

chlorothalonil products (chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC M05.

Inspire Super (EW) (difenoconazole, cyprodinil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 03, FRAC 09.

Luna Experience (fluopyram, tebuconazole) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 10-17 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 07, FRAC 03.

mancozeb products (mancozeb) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of mancozeb products (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M03.

Merivon (fluxapyroxad, pyraclostrobin) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 5.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 07, FRAC 11.

Miravis Prime (SC) (pydiflumetofen, fludioxonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 9.2-11.4 fl. oz. per acre. An adjuvant may be added at recommended rates. REI: 12-hour. PHI: 1-day. FRAC 07, FRAC 12.

Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.75-2.5 pts. per acre. Make no more than 2 sequential applications before rotating to a different mode of action. When 3 fungicide applications are used, Orondis can be in no more than 33% of the applications. Do not follow soil applications of Orondis Gold. REI: 12-hour. PHI: 0-day. FRAC 49, FRAC M05.

Quadris Top (SC) (azoxystrobin, difenoconazole) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 12-14 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC 03.

Switch 62.5WG (cyprodinil, fludioxonil) *Cantaloupe/Muskmelon* | 11-14 oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 09, FRAC 12.

tebuconazole products (tebuconazole) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 8 fl. oz. per acre. There are many brand names (Monsoon, Onset, Vibe) with 3.6 lbs. a.i. per gallon that use the same rate. REI: 12-hour to 18-day. PHI: 7-day. FRAC 03.

Zing! (zoxamide, chlorothalonil) *Cantaloupe/Muskmelon* | 36 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 22, FRAC M05.

Leaf Blight of Cucurbits - Alternaria Fungus

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

Non-Pesticide

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

Pesticide

Aprovia Top (difenoconazole, benzovindiflupyr) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash,*

Watermelon | 10.5-13.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 03, FRAC 07.

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

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

chlorothalonil products (chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 0-day. FRAC M05.

Fontelis (1.67SC) (penthiopyrad) *Cantaloupe/Muskmelon* | 12-16 fl. oz. per acre. In the greenhouse use a rate of 0.5 fl. oz. per gallon per 1,360 sq. ft. REI: 12-hour. PHI: 1-day. FRAC 07.

Gavel 75DF (zoxamide, mancozeb) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.5-2.0 lbs. per acre. REI: 48-hour. PHI: 5-day. FRAC 22, FRAC M03.

Inspire Super (EW) (difenoconazole, cyprodinil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 03, FRAC 09.

Luna Experience (fluopyram, tebuconazole) *Cantaloupe/Muskmelon* | 6-17 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 07, FRAC 03.

Luna Sensation (fluopyram, trifloxystrobin) *Cantaloupe/Muskmelon* | 7.6 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 07, FRAC 11.

mancozeb products (mancozeb) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of mancozeb products (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M03.

Merivon (fluxapyroxad, pyraclostrobin) *Cantaloupe/Muskmelon* | 4-5.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 07, FRAC 11.

Miravis Prime (SC) (pydiflumetofen, fludioxonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 9.2-11.4 fl. oz. per acre. An adjuvant may be added at recommended rates. REI: 12-hour. PHI: 1-day. FRAC 07, FRAC 12.

Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.75-2.5 pts. per acre. Make no more than 2 sequential applications before rotating to a different mode of action. When 3 fungicide applications are used, Orondis can be in no more than 33% of the applications. Do not follow soil applications of Orondis Gold. REI: 12-hour. PHI: 0-day. FRAC 49, FRAC M05.

Pristine 38WG (boscalid, pyraclostrobin) *Cantaloupe/Muskmelon* | 12.5-18.5 oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 07, FRAC 11.

Quadris Opti (SC) (azoxystrobin, chlorothalonil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 3.2 pts. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC M05.

Quadris Top (SC) (azoxystrobin, difenoconazole) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 12-14 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC 03.

Switch 62.5WG (cyprodinil, fludioxonil) *Cantaloupe/Muskmelon* | 11-14 oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 09, FRAC 12.

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

Zing! (zoxamide, chlorothalonil) *Cantaloupe/Muskmelon* | 36 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 22, FRAC M05.

Leaf Blight of Cucurbits - Plectosporium Fungus

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

Non-Pesticide

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

Pesticide

Aprovia Top (difenoconazole, benzovindiflupyr) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 10.5-13.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 03, FRAC 07.

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

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

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

Inspire Super (EW) (difenoconazole, cyprodinil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 03, FRAC 09.

mancozeb products (mancozeb) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several formulations of mancozeb products (Dithane, Manzate, Penncozeb) are labeled at various rates. See label for directions. REI: 24-hour. PHI: 5-day. FRAC M03.

Merivon (fluxapyroxad, pyraclostrobin) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 5.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 07, FRAC 11.

Quadris Top (SC) (azoxystrobin, difenoconazole) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 12-14 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC 03.

Leaf Spot and Fruit Spot of Cucurbits - Xanthomonas Bacteria

Bacterial leaf and fruit spot, caused by *Xanthomonas cucurbitae*, 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 ripen (colored). 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 has been detected on and in seed for longer than 20 months from harvest. The pathogen may move from infected seed to seedling. The bacterium can survive on leaves without showing any symptoms. 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. However, bacterial spots developed on leaves of inoculated bur cucumber (*Sicyos angulatus*) and velvetleaf (*Abutilon theophrasti*) weeds in greenhouse inoculations.

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

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Use pathogen-free seed and disease-free transplants. Hot water treatment at 131 F for 15 minutes eradicates the bacteria on and in the seed. Rotate to non-Cucurbit crops for 3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important practice to minimize pathogen survival with plant debris.

Pesticide

copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide) mixed with mancozeb products (Dithane, Manzate, Penncozeb) Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Several formulations of copper (Badge, Champ, Kocide) are labelled for use. See label for directions. Apply fixed copper 2 weeks prior to the opening of the first female bloom until fruit maturity. , 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. See labels for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M01. *OMRI-listed.*

Nematodes

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

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

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

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Collect soil samples for nematodes in the fall and avoid fields with high numbers. Rotate to a non-broadleaf crop, such as grass grains or sweet corn for >3 years. Prompt destruction of the finished crop with tillage to rapidly

breakdown tissue and displace nematodes is an important method to prevent nematode build-up. Anaerobic soil disinfestation (ASD) is an effective sterilization method for greenhouse and high tunnel soils that contain nematodes.

Pesticide

K-PAM HL (5.8L) (metam potassium) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 30-62 gals. per acre. Use high rates on muck, and lower rates on sands. In the fall, when soil at 6 inches is above 50 F and moist, place K-PAM HL or Sectagon K54 about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, it can be applied through drip irrigation under unperforated plastic beds. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC 08F, FRAC M03, HRAC NC. *RUP.*

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

Telone C-17 (L) (1,3-dichloropropene, chloropicrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Muck soils*: Use C-17 formulation at 27.4-30 gals. per acre, and C-35 formulation at 33-36 gals. per acre. *Mineral soils*: Use C-17 formulation at 10.8-17.1 gals. per acre, and C-35 formulation at 13-20.5 gals per acre. In the fall, when soil at 6 inches is above 50 F and moist, place Telone C-17 or C-35 about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing, irrigation, or plastic. Or, in the spring, InLine may be applied through drip irrigation under unperforated plastic beds at 13-20.5 gals. per acre, on mineral soils only. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 3-5-day. IRAC UN, FRAC NC, IRAC 08B. *RUP.*

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

VAPAM HL (4.25L) (metam sodium) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 37.5-75 gals. per acre. Use high rates on muck, and lower rates on sands. In the fall, when soil at 6 inches is above 50 F and moist, place VAPAM HL or Sectagon K42 about 8 inches beneath the surface through shank-injectors, or broadcast sprayers directly in front of tillage tools to bury it. Seal with soil packing or irrigation. Or, in the spring, it can be applied through drip irrigation under unperforated plastic beds. Before planting, allow product to dissipate for 1 week for every 10 gals. per acre plus 1 more week. REI: 5-day. IRAC 08F, FRAC M03, HRAC NC. *RUP.*

Velum Prime (4.16SC) (fluopyram) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6.5-6.84 fl. oz. per acre. Apply through drip irrigation. Do not exceed 13.7 fl. oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. FRAC 07.

Vydate L (2WSL) (oxamyl) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Apply 1-2 gals. per acre as a banded or shank-injected pre-plant, at-plant in-furrow or directed post-plant soil treatment with at least 20 gals. water per acre incorporated 2-4 inches deep by water or mechanical means, or drip chemigate 2-4 pts. per acre after transplanting. Allow 14 days between applications. Do not exceed 8 total applications, or 3 gals. per acre per season. REI: 48-hour. PHI: 1-day. IRAC 01A. *RUP.*

Phytophthora Blight of Multiple Crops - Phytophthora Oomycete

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

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

At harvest, if you touch an infected fruit, disinfest your hands (using soap or ethanol) before touching an uninfected fruit. Do not place uninfected fruits on soil infested with *Phytophthora*.

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Avoid fields with a history of the disease and excess water. Improve drainage with raised beds. Reduce

inoculum with weed control and rotate to non-Cucurbit and non-Solanaceous crops for >4 years. Do not irrigate with surface water. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

Pesticide

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

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

Gavel 75DF (zoxamide, mancozeb) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.5-2.0 lbs. per acre. REI: 48-hour. PHI: 5-day. FRAC 22, FRAC M03.

Orondis Gold (DC) (oxathiapiprolin, mefenoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 28-55 fl. oz. per acre. Use as an at-plant soil drench, banded spray in furrow, or through drip irrigation. Do not follow soil applications of Orondis Gold with foliar applications of Orondis Opti, or Orondis Ultra. REI: 4-hour. PHI: 0-day. FRAC 49, FRAC 04.

Orondis Ultra Premix (SC) (oxathiapiprolin, mandipropamid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5.5-8.0 fl. oz. per acre. Make no more than 2 sequential applications before rotating to a different mode of action. When 3 fungicide applications are used, Orondis can be in no more than 33% of the applications. Do not follow soil applications of Orondis Gold. REI: 4-hour. PHI: 0-day. FRAC 49, FRAC 40.

phosphite and phosphorous acid products (phosphorous acid, potassium phosphite, mono-dipotassium salts of phosphorous acid, mono- and dibasic sodium, potassium, and ammonium phosphites, fosetyl-aluminum) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Several phosphite or phosphorus acid products (Aliette, Phostrol, ProPhyt, Rampart) are labeled at various rates. Label includes different crops, PHIs, resistance instructions, and other important information. Some manufacturers recommend tank-mixing. These products may be used in a preventative program until the disease is observed. REI: 4 to 12-hour. FRAC 33.

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

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

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

Tanos (DF) (famoxadone, cymoxanil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 8-10 oz. per acre. Suppression only. REI: 12-hour. PHI: 3-day. FRAC 11, FRAC 27.

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

Powdery Mildew of Cucurbits - Podosphaera Fungus

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

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

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

Non-Pesticide

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

Pesticide

Aprovia Top (difenoconazole, benzovindiflupyr) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 10.5-13.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 03, FRAC 07.

Fontelis (1.67SC) (penthiopyrad) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 12-16 fl. oz. per

acre. In the greenhouse use a rate of 0.5 fl. oz. per gallon per 1,360 sq. ft. REI: 12-hour. PHI: 1-day. FRAC 07.

Gatten (0.423) (flutianil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC U13.

Inspire Super (EW) (difenoconazole, cyprodinil) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 03, FRAC 09.

Luna Experience (fluopyram, tebuconazole) *Cantaloupe/Muskmelon* | 6-17 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 07, FRAC 03.

Luna Sensation (fluopyram, trifloxystrobin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 4-7.6 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 07, FRAC 11.

Merivon (fluxapyroxad, pyraclostrobin) *Cantaloupe/Muskmelon* | 4-5.5 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 07, FRAC 11.

Microthiol Disperss (80W) (sulfur) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5-10 lbs. per acre. REI: 24-hour. PHI: 0-day. FRAC M02, IRAC UN. *OMRI-listed.*

Miravis Prime (SC) (pydiflumetofen, fludioxonil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 9.2-11.4 fl. oz. per acre. An adjuvant may be added at recommended rates. REI: 12-hour. PHI: 1-day. FRAC 07, FRAC 12.

Procure 480SC (4) (triflumizole) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 4-8 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 03.

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

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

Rally 40WSP (myclobutanil) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2.5-5.0 oz. per acre. REI: 24-hour. PHI: 0-day. FRAC 03.

tebuconazole products (tebuconazole) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 4-6 fl. oz. per acre. There are many brand names (Monsoon, Onset, Vibe) with 3.6 lbs. a.i. per gallon that use the same rate. REI: 12-hour to 18-day. PHI: 7-day. FRAC 03.

Torino (10SC) (cyflufenamid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 3.4 oz. per acre. REI: 4-hour. PHI: 0-day. FRAC U06.

Velum Prime (4.16SC) (fluopyram) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6.5-6.84 fl. oz. per acre. May cause a mild yellowing of leaf margins. May be applied through drip. REI: 12-hour. PHI: 0-day. FRAC 07.

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

Scab of Cucurbits - Cladosporium Fungus

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

Non-Pesticide

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

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. Also, seedborne squash mosaic virus occurs in the Midwest. these diseases usually appear later in the season, they most often affect pumpkin and squash. All types of vine crops are susceptible to these viruses. Squash mosaic virus is seed-borne and can be transferred by cucumber beetles. See insect section.

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | It may help to kill perennial weeds (virus source plants) within 150 feet of planting. Controlling aphids (virus carriers) by insecticides can reduce secondary spread of viruses but does not reduce initial infection and rarely results in any decrease in the incidence of virus symptomatic fruit. Early planting and development of pumpkins and squash fruit before virus diseases become prevalent may reduce symptoms on fruit. Earlier planted or earlier maturing

cultivars will help to avoid severe disease problems. Varieties with host resistance include cucumbers (cucumber mosaic virus) and squash (watermelon mosaic virus; zucchini yellow mosaic virus; cucumber mosaic virus; papaya ringspot virus).

Cucurbit Crops – Insects

Reviewed by Laura Ingwell, Raymond Cloyd – Sept 2021

Recommended Controls

Aphids

Non-Pesticide

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

Pesticide

Actara (25WDG) (thiamethoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.5-3.0 oz. per acre. Apply as a foliar spray. Do not exceed 11 oz. per acre per season. See pollinator precautions. REI: 12-hour. PHI: 0-day. IRAC 04A.

Admire Pro (4.6SC) (imidacloprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 7.0-10.5 fl. oz. per acre. See label for various soil application methods. Do not exceed 10.5 fl. oz. per acre per season. Should never be used in combination with insecticide seed treatments. REI: 12-hour. PHI: 21-day. IRAC 04A.

Assail 30SG (acetamiprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 30SG formulations at 2.5-4.0 oz. per acre and do not exceed 26.5 oz. per acre per season. Use 70WP formulations at 1.1-1.7 oz. per acre and do not exceed 11.5 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 04A.

Belay (2.13SC) (clothianidin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Soil applications*: 9-12 fl. oz. per acre. *Foliar applications*: 3-4 fl. oz. per acre. Do not use as foliar after the 4th true leaf on main stem has unfolded. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 04A.

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

Dimethoate 4EC (dimethoate) *Cantaloupe/Muskmelon, Watermelon* | Use 2.67EC formulations at 0.75-1.5 pts. per acre and do not exceed 3 pts. per acre per season. Use 4EC, LV-4, and 400EC formulations at 0.5-1.0 pt. per acre and do not exceed 2 pts. per acre per season. REI: 48-hour. PHI: 3-day. IRAC 01B.

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

Fulfill (50WDG) (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. IRAC 09B.

Harvanta (0.42SL) (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. IRAC 28.

Lannate LV (2.4L) (methomyl) *Cantaloupe/Muskmelon, Cucumber, Squash, Watermelon* | 1.5-3.0 pts. per acre. Not for pumpkins or winter squash. Do not exceed 18 pts. per acre per season. REI: 48-hour. PHI: 1-day for 1.5 pts. rate, 3-day for rates over 1.5 pts. IRAC 01A. *RUP.*

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

Malathion 5EC (malathion) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 5EC formulations at 1.5-2.8 pts. per acre for cucumber and squash, 1.6 pts. per acre for melon, 1.5 pts. per acre for pumpkin, 1.6-2.8 pts. per acre for squash, or 1.5-2.5 pts. per acre for watermelon. Use 57EC formulations at 1.5 pts. per acre on cucumber, melon, pumpkin, squash, and watermelon. Do not exceed 2 applications per season on cucumbers, pumpkins, melons, and watermelons, or 3 applications per season on squash. REI: 12-hour. PHI: 1-day. IRAC 01B.

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

per season for all cucurbits. REI: 12-hour. PHI: 0-day. IRAC 03A. *RUP.*

Platinum 2SC (thiamethoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5-11 fl. oz. per acre. Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. Should never be used in combination with insecticide seed treatments. REI: 12-hour. PHI: 30-day. IRAC 04A.

Scorpion 35SL (3.24) (dinotefuran) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Soil application*: Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-7.5 oz. per acre. *Foliar application*: Use Scorpion 35SL at 2.0-7.0 fl. oz. per acre, or Venom 70SG at 1-4 oz. per acre. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 04A.

Sivanto 200 (1.67SL) (flupyradifurone) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 21-28 fl. oz. per acre soil application, or 7-12 fl. oz. per acre foliar application. Should never be used in combination with insecticide seed treatments. REI: 4-hour. PHI: 21-day for soil application, or 1-day for foliar application. IRAC 04D.

Venom 70SG (dinotefuran) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Soil application*: 5-7.5 oz. per acre and do not exceed 12 oz. per acre per season. *Foliar application*: 1-4 oz. per acre and do not exceed 6 oz. per acre per season. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 04A.

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

Warrior II (2.08CS) (lambda-cyhalothrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.28-1.92 fl. oz. per acre. Do not exceed 11.5 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 03A. *RUP.*

Cucumber Beetles

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

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

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Yellow sticky traps are attractive to cucumber beetles and can detect mass emergence during periods of heavy beetle activity.

Pesticide

Admire Pro (4.6SC) (imidacloprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 7.0-10.5 fl. oz. per acre. See label for various soil application methods. Do not exceed 10.5 fl. oz. per acre per season. Should never be used in combination with insecticide seed treatments. REI: 12-hour. PHI: 21-day. IRAC 04A.

Asana XL (0.66EC) (esfenvalerate) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5.8-9.6 fl. oz. per acre. Do not exceed 48 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 03A. *RUP.*

Assail 30SG (acetamiprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2.5-5.3 oz. per acre. Use 30SG formulations at 2.5-5.3 oz. per acre and do not exceed 26.5 oz. per acre per season. Use 70WP formulations at 1.1-2.3 oz. per acre and do not exceed 11.5 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 04A.

Azera (C) (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. IRAC UN, IRAC 03A. *OMRI-listed.*

Baythroid XL (1EC) (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. IRAC 03A. *RUP.*

Belay (2.13SC) (clothianidin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Soil applications*: 9-12 fl. oz. per acre. *Foliar applications*: 3-4 fl. oz. per acre. Do not use as foliar after the 4th true leaf on main stem has unfolded. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 04A.

Brigade 2EC (bifenthrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 2EC formulations at 2.6-6.4 fl. oz. per acre and do not exceed 19.22 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 8-16 oz. per acre and do not exceed 48 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 03A. *RUP.*

Danitol 2.4EC (30.9) (fenpropathrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 10.67-16 fl. oz. per acre. Do not exceed 42.67 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 03A. *RUP.*

Harvanta (0.42SL) (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. IRAC 28.

Mustang Maxx (0.8) (zeta-cypermethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2.8-4 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP.*

Perm-Up 25DF (permethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6.4-12.8 oz. per acre. Use 25W, 25WP, and 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2 oz. per acre per season for cantaloupe and 76.8 oz. per acre per season for all other cucurbits. Use 12.8 oz. per acre for aphids. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on cantaloupe. or 48 fl. oz. per acre per season for all cucurbits. REI: 12-hour. PHI: 0-day. IRAC 03A. *RUP.*

Seed treatments for insects (thiamethoxam, spinosad, abamectin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Seed treatments containing thiamethoxam (FarMore FI400, Cruiser) offer maximum protection against cucumber beetles and root maggots for about 2 to 3 weeks after seedling emergence. For transplanted crops and direct-seeded plants over 3 weeks old, the concentration of insecticide from seed treatments is no longer strong enough to kill beetles, but can still harm bees due to sublethal doses in the pollen and nectar. Seed treatments should never be used in combination with at-plant soil drenches with flupyradifurone (Sivanto), imidacloprid (Admire or generics), or thiamethoxam (Platinum). IRAC 04A, IRAC 05, IRAC 06.

Sevin XLR Plus (4SC) (carbaryl) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1 qt. per acre. When applied during hot, humid conditions, carbaryl may cause some phytotoxicity, especially on seedlings and newly set plants. See pollinator precautions. Do not exceed 6 qts. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 01A.

Warrior II (2.08CS) (lambda-cyhalothrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.28-1.92 fl. oz. per acre. Do not exceed 11.5 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 03A. *RUP.*

Leafhoppers

Pesticide

Admire Pro (4.6SC) (imidacloprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 7.0-10.5 fl. oz. per acre. See label for various soil application methods. Do not exceed 10.5 fl. oz. per acre per season. Should never be used in combination with insecticide seed treatments. REI: 12-hour. PHI: 21-day. IRAC 04A.

Asana XL (0.66EC) (esfenvalerate) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5.8-9.6 fl. oz. per acre. Do not exceed 48 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 03A. *RUP.*

Assail 30SG (acetamiprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 30SG formulations at 2.5-4.0 oz. per acre and do not exceed 26.5 oz. per acre per season. Use 70WP formulations at 1.1-1.7 oz. per acre and do not exceed 11.5 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 04A.

Baythroid XL (1EC) (beta-cyfluthrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 0.8-1.6 fl. oz. per acre. Do not exceed 11.2 fl. oz. per acre or 4 applications per season. Allow 7 days between applications. REI: 12-hour. PHI: 0-day. IRAC 03A. *RUP.*

Belay (2.13SC) (clothianidin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Soil applications*:

9-12 fl. oz. per acre. *Foliar applications*: 3-4 fl. oz. per acre. Do not use as foliar after the 4th true leaf on main stem has unfolded. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 04A.

Brigade 2EC (bifenthrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 2EC formulations at 2.6-6.4 fl. oz. per acre and do not exceed 19.22 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 8-16 oz. per acre and do not exceed 48 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 03A. *RUP.*

Dimethoate 4EC (dimethoate) *Cantaloupe/Muskmelon, Watermelon* | Use 2.67EC formulations at 0.75-1.5 pts. per acre and do not exceed 3 pts. per acre per season. Use 4EC, LV-4, and 400EC formulations at 0.5-1.0 pt. per acre and do not exceed 2 pts. per acre per season. REI: 48-hour. PHI: 3-day. IRAC 01B.

Perm-Up 25DF (permethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6.4-12.8 oz. per acre. Use 25W, 25WP, and 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2 oz. per acre per season for cantaloupe and 76.8 oz. per acre per season for all other cucurbits. Use 12.8 oz. per acre for aphids. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on cantaloupe. or 48 fl. oz. per acre per season for all cucurbits. REI: 12-hour. PHI: 0-day. IRAC 03A. *RUP.*

Platinum 2SC (thiamethoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5-11 fl. oz. per acre. Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. Should never be used in combination with insecticide seed treatments. REI: 12-hour. PHI: 30-day. IRAC 04A.

Scorpion 35SL (3.24) (dinotefuran) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Soil application*: Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-7.5 oz. per acre. *Foliar application*: Use Scorpion 35SL at 2.0-7.0 fl. oz. per acre, or Venom 70SG at 1-4 oz. per acre. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 04A.

Sivanto 200 (1.67SL) (flupyradifurone) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 21-28 fl. oz. per acre soil application, or 7-12 fl. oz. per acre foliar application. Should never be used in combination with insecticide seed treatments. REI: 4-hour. PHI: 21-day for soil application, or 1-day for foliar application. IRAC 04D.

Venom 70SG (dinotefuran) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Soil application*: 5-7.5 oz. per acre and do not exceed 12 oz. per acre per season. *Foliar application*: 1-4 oz. per acre and do not exceed 6 oz. per acre per season. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 04A.

Warrior II (2.08CS) (lambda-cyhalothrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.28-1.92 fl. oz. per acre. Do not exceed 11.5 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 03A. *RUP.*

Mites

Pesticide

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. IRAC UN.

Agri-Mek SC (0.7) (abamectin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 0.7SC formulations at 1.75-3.5 fl. oz. per acre and do not exceed 10.25 fl. oz. per acre per season. Use 0.15EC formulations at 8-16 fl. oz. per acre and do not exceed 48 fl. oz. per acre per season. Allow at least 7 days between applications. Do not make more than 2 sequential applications. REI: 12-hour. PHI: 7-day. IRAC 06. *RUP.*

Brigade 2EC (bifenthrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5.12-6.4 fl. oz. per acre. Use 2EC formulations at 5.12-6.4 fl. oz. per acre and do not exceed 19.22 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 12.8-16.0 oz. per acre and do not exceed 48 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 03A. *RUP.*

Danitol 2.4EC (30.9) (fenpropathrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 10.67-16 fl. oz. per acre. Do not exceed 42.67 fl. oz. per acre per season. REI: 24-hour. PHI: 7-day. IRAC 03A. *RUP.*

Kanemite 15SC (1.25) (acequinocyl) *Cantaloupe/Muskmelon, Cucumber, Watermelon* | 31 fl. oz. per acre. Do not exceed 2 applications per year. Allow 21 days between applications. REI: 12-hour. PHI: 1-day. IRAC 20B.

Oberon 2SC (spiromesifen) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 7.0-8.5 fl. oz. per acre. Do not exceed 3 applications per season. REI: 12-hour. PHI: 7-day. IRAC 23.

Portal (0.4EC) (fenpyroximate) *Cantaloupe/Muskmelon, Cucumber* | 2 pts. per acre. Do not exceed 2 applications per

season. REI: 12-hour. PHI: 1-day for cucumber, 3-day for melon. IRAC 21A.

Zeal (72WP) (etoxazole) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2-3 oz. per acre. Do not exceed 1 application per season. REI: 12-hour. PHI: 7-day. IRAC 10B.

Seed and Root Maggots

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Early plowing of cover crops and weeds will generally result in less damage to seedling plants in field.

Pesticide

Seed treatments for insects (thiamethoxam, spinosad, abamectin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Seed treatments containing thiamethoxam (FarMore FI400, Cruiser) offer maximum protection against cucumber beetles and root maggots for about 2 to 3 weeks after seedling emergence. For transplanted crops and direct-seeded plants over 3 weeks old, the concentration of insecticide from seed treatments is no longer strong enough to kill beetles, but can still harm bees due to sublethal doses in the pollen and nectar. Seed treatments should never be used in combination with at-plant soil drenches with flupyradifurone (Sivanto), imidacloprid (Admire or generics), or thiamethoxam (Platinum). IRAC 04A, IRAC 05, IRAC 06.

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

Slugs

Occasionally, slugs and snails seriously damage seedlings; tender, low-growing leafy vegetables; or ripening fruit that are on the ground. Slug and snail feeding damage (hollowed-out areas) can be found anywhere on fruit, but is usually concentrated near the stem. Slugs leave behind telltale slime trails (silvery trails) on the surfaces of fruit or leaves. Slugs and snails are active at night or cloudy days.

Slugs and snails favor continuously moist soil and organic mulch. They lay eggs in groups in moist soil, and overwinter in organic mulch. Slugs can complete their entire life cycle in a field.

Prevent infestation by scattering bait products to the soil surface around the perimeter of the planting. Make a rescue treatment by scattering the bait products on the soil as a band between rows. Apply in evening after a rain or irrigation. Avoid contact with edible product.

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Slug hiding places should be eliminated - such as, boards, stones, weedy areas, or heavy mulch - so the soil can become warm and dry. Raised beds that can dry out more readily than flat beds reduce slug problems. Using black plastic mulch discourages slug build-up because it causes the soil to heat up and dry out.

Pesticide

Sluggo 1B (iron phosphate) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 20-44 lb. per acre, or 0.5-1 lb. per 1,000 sq. ft. REI: 0-hour. PHI: 0-day. IRAC UN. *OMRI-listed.*

Squash Bug

Pesticide

Asana XL (0.66EC) (esfenvalerate) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5.8-9.6 fl. oz. per acre. Do not exceed 48 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 03A. *RUP.*

Assail 30SG (acetamiprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2.5-5.3 oz. per acre. Use 30SG formulations at 2.5-5.3 oz. per acre and do not exceed 26.5 oz. per acre per season. Use 70WP formulations at 1.1-2.3 oz. per acre and do not exceed 11.5 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 04A.

Azera (C) (azadirachtin, pyrethrins) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 32-48 fl. oz. per acre. Use higher rates for squash bug adults, or when pest pressure is extreme of plant canopy is dense. Do not exceed 10 applications per season. Do not reapply within 3 days except under extreme pest pressure. REI: 12-hour. PHI: 0-day. IRAC UN, IRAC 03A. *OMRI-listed.*

Belay (2.13SC) (clothianidin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Soil applications*: 9-12 fl. oz. per acre. *Foliar applications*: 3-4 fl. oz. per acre. Do not use as foliar after the 4th true leaf on main stem has unfolded. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 04A.

Brigade 2EC (bifenthrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 2EC formulations at 2.6-6.4 fl. oz. per acre and do not exceed 19.22 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 8-16 oz. per acre and do not exceed 48 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 03A. *RUP.*

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

Mustang Maxx (0.8) (zeta-cypermethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2.8-4 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP.*

Perm-Up 25DF (permethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6.4-12.8 oz. per acre. Use 25W, 25WP, and 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2 oz. per acre per season for cantaloupe and 76.8 oz. per acre per season for all other cucurbits. Use 12.8 oz. per acre for aphids. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on cantaloupe. or 48 fl. oz. per acre per season for all cucurbits. REI: 12-hour. PHI: 0-day. IRAC 03A. *RUP.*

Scorpion 35SL (3.24) (dinotefuran) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Soil application*: Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-7.5 oz. per acre. *Foliar application*: Use Scorpion 35SL at 2.0-7.0 fl. oz. per acre, or Venom 70SG at 1-4 oz. per acre. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 04A.

Sevin XLR Plus (4SC) (carbaryl) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1 qt. per acre. When applied during hot, humid conditions, carbaryl may cause some phytotoxicity, especially on seedlings and newly set plants. See pollinator precautions. Do not exceed 6 qts. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 01A.

Venom 70SG (dinotefuran) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Soil application*: 5-7.5 oz. per acre and do not exceed 12 oz. per acre per season. *Foliar application*: 1-4 oz. per acre and do not exceed 6 oz. per acre per season. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 04A.

Warrior II (2.08CS) (lambda-cyhalothrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.28-1.92 fl. oz. per acre. Do not exceed 11.5 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 03A. *RUP.*

Squash Vine Borer

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Pheromone-bated traps are attractive to squash vine borers and can detect mass flights and heavy egg-laying activity. Fall tillage can disrupt overwintering success.

Pesticide

Asana XL (0.66EC) (esfenvalerate) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5.8-9.6 fl. oz. per acre. Do not exceed 48 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 03A. *RUP.*

Assail 30SG (acetamiprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2.5-5.3 oz. per acre. Use 30SG formulations at 2.5-5.3 oz. per acre and do not exceed 26.5 oz. per acre per season. Use 70WP formulations at 1.1-2.3 oz. per acre and do not exceed 11.5 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 04A.

Brigade 2EC (bifenthrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 2EC formulations at 2.6-6.4 fl. oz. per acre and do not exceed 19.22 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 8-16 oz. per acre and do not exceed 48 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 03A. *RUP.*

Mustang Maxx (0.8) (zeta-cypermethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2.8-4 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP.*

Perm-Up 25DF (permethrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6.4-12.8 oz. per acre. Use 25W, 25WP, and 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 51.2 oz. per acre per season for cantaloupe and 76.8 oz. per acre per season for all other cucurbits. Use 12.8 oz. per acre for aphids. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on cantaloupe. or 48 fl. oz. per acre per season for all cucurbits. REI: 12-hour. PHI: 0-day. IRAC 03A. *RUP.*

Warrior II (2.08CS) (lambda-cyhalothrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 1.28-1.92 fl. oz. per acre. Do not exceed 11.5 fl.

oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 03A. *RUP.*

Thrips

Pesticide

Admire Pro (4.6SC) (imidacloprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 7.0-10.5 fl. oz. per acre. See label for various soil application methods. Do not exceed 10.5 fl. oz. per acre per season. Should never be used in combination with insecticide seed treatments. REI: 12-hour. PHI: 21-day. IRAC 04A.

Entrust SC (2) (spinosad) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | Use 2SC formulations at 6.0-8.0 fl. oz. per acre and do not exceed 29.0 fl. oz. per acre per season. Use 80WP formulations at 2.0-2.5 oz. per acre and do not exceed 9.0 oz. per acre per season. Allow 5 days between applications. REI: 4-hour. PHI: 1-day for cucumber, 3-day for all others. IRAC 05. *OMRI-listed.*

Harvanta (0.42SL) (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. IRAC 28.

Platinum 2SC (thiamethoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5-11 fl. oz. per acre. Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. Should never be used in combination with insecticide seed treatments. REI: 12-hour. PHI: 30-day. IRAC 04A.

Radiant 1SC (spinetoram) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6-10 fl. oz. per acre. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day for cucumber; 3-day for cantaloupe/muskmelon, pumpkin, squash, and watermelon. IRAC 05.

Venom 70SG (dinotefuran) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Soil application*: 5-7.5 oz. per acre and do not exceed 12 oz. per acre per season. *Foliar application*: 1-4 oz. per acre and do not exceed 6 oz. per acre per season. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 04A.

Whiteflies

Pesticide

Actara (25WDG) (thiamethoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 3.0-5.5 oz. per acre. Apply as a foliar spray. Do not exceed 11 oz. per acre per season. See pollinator precautions. REI: 12-hour. PHI: 0-day. IRAC 04A.

Admire Pro (4.6SC) (imidacloprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 7.0-10.5 fl. oz. per acre. See label for various soil application methods. Do not exceed 10.5 fl. oz. per acre per season. Should never be used in combination with insecticide seed treatments. REI: 12-hour. PHI: 21-day. IRAC 04A.

Assail 30SG (acetamiprid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2.5-5.3 oz. per acre. Use 30SG formulations at 2.5-5.3 oz. per acre and do not exceed 26.5 oz. per acre per season. Use 70WP formulations at 1.1-2.3 oz. per acre and do not exceed 11.5 oz. per acre per season. Allow 5 days between applications. REI: 12-hour. PHI: 0-day. IRAC 04A.

Beleaf (50SG) (flonicamid) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 2-8 oz. per acre. Do not exceed 3 applications per season. REI: 12-hour. PHI: 0-day. IRAC 29.

Brigade 2EC (bifenthrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5.12-6.4 fl. oz. per acre. Use 2EC formulations at 5.12-6.4 fl. oz. per acre and do not exceed 19.22 fl. oz. per acre per season. Use 10DF, 10WP, or 10WSB formulations at 12.8-16.0 oz. per acre and do not exceed 48 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day. IRAC 03A. *RUP.*

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

Fulfill (50WDG) (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. IRAC 09B.

Knack (0.86) (pyriproxyfen) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 8-10 fl. oz. per acre. Do not exceed 2 applications. REI: 12-hour. PHI: 7-day. IRAC 07C.

M-Pede (3.8) (potassium salts of fatty acids) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash,*

Watermelon | 1-2% by volume. Must contact insect to be effective. REI: 12-hour. PHI: 0-day. IRAC UN, FRAC NC. *OMRI-listed.*

Neemix (0.39) (azadirachtin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 6-16 fl. oz. per acre. REI: 4-hour. PHI: 0-day. IRAC UN. *OMRI-listed.*

Oberon 2SC (spiromesifen) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 7.0-8.5 fl. oz. per acre. Do not exceed 3 applications per season. REI: 12-hour. PHI: 7-day. IRAC 23.

Platinum 2SC (thiamethoxam) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 5-11 fl. oz. per acre. Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. Should never be used in combination with insecticide seed treatments. REI: 12-hour. PHI: 30-day. IRAC 04A.

Scorpion 35SL (3.24) (dinotefuran) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Soil application*: Use Scorpion 35SL at 9.0-10.5 oz. per acre, or Venom 70SG at 5.0-7.5 oz. per acre. *Foliar application*: Use Scorpion 35SL at 2.0-7.0 fl. oz. per acre, or Venom 70SG at 1-4 oz. per acre. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 04A.

Sivanto 200 (1.67SL) (flupyradifurone) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 21-28 fl. oz. per acre soil application, or 7-12 fl. oz. per acre foliar application. Should never be used in combination with insecticide seed treatments. REI: 4-hour. PHI: 21-day for soil application, or 1-day for foliar application. IRAC 04D.

Venom 70SG (dinotefuran) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | *Soil application*: 5-7.5 oz. per acre and do not exceed 12 oz. per acre per season. *Foliar application*: 1-4 oz. per acre and do not exceed 6 oz. per acre per season. See pollination precautions. REI: 12-hour. PHI: 21-day for soil application, 1-day for foliar application. IRAC 04A.

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

Wireworms

Pesticide

Capture LFR (1.5) (bifenthrin) *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 0.2-0.39 fl. oz. per 1,000 linear ft. of row. Do not exceed 8.5 fl. oz. per acre per season. REI: 12-hour. IRAC 03A. *RUP.*

Cucurbit Crops – Weeds

Reviewed by Stephen Meyers, Ben Phillips – Sept 2021

Recommended Controls

All Weeds

Weed control methods in cucurbits vary by production system.

For cucurbits that are no-till planted into a killed crop (such as a rye cover crop, or wheat) growers often use a burndown herbicide with a preemergence herbicide. For cucurbits planted 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. Small, emerged weeds in both systems can be controlled with selective postemergence herbicides and/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 row middles.

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

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

Non-Pesticide

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | A stale seedbed can be prepared prior to transplanting with flame weeding or very shallow cultivation to control emerged weeds, instead of herbicides. Cucurbits lend themselves to this stale seedbed practice because they are often planted after common weeds have emerged in tilled

soil. The more quickly vines cover the soil surface, the better they will suppress late-emerging weeds. In-row plant spacing can be decreased to close canopy more quickly. Planting on the square will allow cultivation in two directions. Cucurbits can benefit from the soil warming properties of plastic mulch in addition to the in-row weed control it provides. Materials include landscape cloth/fabric, plastic, and biodegradeable plastic. Straw mulch can delay early season growth by suppressing soil temperatures. Weeds between beds and along the edges of beds can be controlled with a combination of cultivation, mowing, or hand hoeing/pulling. Weeds along the edge of the mulches can be a particular challenge to avoid ripping the mulch. Some fresh market plantings are often small enough to accommodate some hand hoeing or pulling. For larger plantings it may make more sense to mechanically cultivate with tow-able tools between plastic rows or between bare-soil rows.

Pesticide

Aim EC (2) (carfentrazone) POST

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. HRAC 14.

Chateau SW (51WDG) (flumioxazin) PRE

Cantaloupe/Muskmelon, Watermelon | 4 oz. per acre. For **cantaloupe, honeydew, and watermelon** *in Indiana only (IN 24c accessed through Indiana Vegetable Growers Association)*: use a shielded or hooded sprayer to apply before transplanting to row middles between plastic mulch-covered raised beds. Bed must be at least 4 inches higher than treated area and at least 24 inches wide. Spray must remain between raised beds and contact no more than the bottom 1 inch of plastic. Do not apply after crops are transplanted. Rainfall or irrigation over beds is required after application but before transplanting. REI: 12-hour. HRAC 14.

clethodim products (clethodim) POST

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | Use 2EC formulations at 6-8 fl. oz. per acre with 1 qt. COC per 25 gals. of spray solution (1% v/v). Do not exceed 32 fl. oz. per acre per season. Use Select Max at 9-16 fl. oz. per acre with 1 qt. COC (1% v/v) or 0.5 pt. NIS per 25 gals. of spray solution (0.25% v/v). Do not exceed 64 fl. oz. per acre per season. Use lower rates for annual grasses, the high rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. REI: 24-hour. PHI: 14-day. HRAC 01.

Command 3ME (clomazone) PRE

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | For **cucumber:** use 0.4-1.0 pt. per acre. For **cantaloupe/muskmelon and watermelon:** use 0.4-0.67 pt. per acre. For **summer squash:** use 0.67-1.33 pts. per acre. For **winter squash and processing pumpkins:** use 0.67-2.0 pts. per acre. *Not for jack-o-lantern pumpkins*. See label for sensitive varieties. Apply prior to seeding or transplanting, or after seeding before crop emergence. Does not control pigweed species. Rates below 1 pt. will only suppress weeds. May cause temporary bleaching of crop leaves. REI: 12-hour. PHI: 30-day for cucumber; 30-day for summer squash; 45-day for winter squash and processing pumpkins. HRAC 13.

Curbit EC (3) (ethalfluralin) PRE

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 3-4 pts. per acre. Use lower rates on coarse soils. *Direct-seeded crops*: apply to soil surface within 2 days after seeding. Do not incorporate. *Transplants*: apply as a banded spray between rows. Does not control large-seeded broadleaves. Needs 0.5 inch of water within 5 days of application to be effective. If no rain occurs, cultivate shallowly. Do not apply over or under hot caps, row covers, or plastic mulch. Do not broadcast over top of plants. Under cool temperatures may cause crop injury or failure. REI: 24-hour. HRAC 03.

Dacthal Flowable (6F) (DCPA) PRE

Cantaloupe/Muskmelon, Watermelon | 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. HRAC 03.

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

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | *Illinois, Indiana, Michigan, Minnesota, and Ohio only. IL 24c exp. 03/25/24. MI 24c exp. 12/31/21. MN 24c exp. 12/31/25. OH 24c exp. 12/31/22.* For **cantaloupes/muskmelon and watermelon:** use 0.67-1.27 pts. per acre before transplanting or after seeding and before crop emergence. For **cucumbers:** use 0.67-1.0 pt. per acre after seeding before weeds or crop emerge, or broadcast after cucumbers have 1-2 true leaves. For **pumpkins and winter squash:** use 1.0-1.33 pts. per acre between rows after seeding and before emergence, or after emergence leaving an untreated area at least 6 inches from planted seed or pumpkin leaves. *Broadcast application over top of pumpkin rows after seeding and before crop emergence permitted in all states listed above except Ohio.* For **summer squash in all states**

listed above except Ohio: use 0.67-1.33 pts. per acre as a broadcast application over top or between crop rows after seeding and before crop emergence. If growing on plastic mulch, broadcast before laying plastic. In all crops, there is less risk of crop injury if applied between rows and with transplants. Will not control emerged weeds. Do not exceed 1 application per crop per season. REI: 24-hour. PHI: 30-day for cucumbers, squash, and pumpkins; 60-day for cantaloupe/muskmelon, and watermelon. HRAC 15.

glyphosate products (glyphosate) POST

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 to 12-hour. PHI: 14-day, HRAC 9.

League (75WDG) (imazosulfuron) POST | PRE

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. HRAC 02.

paraquat products (paraquat) POST

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 2-4 pts. per acre of 2 lb. per gal. formulation or 1.3-2.7 pt. per acre of 3 lb. per gal. formulation. Add 1 qt. COC (1% v/v) or 0.5 pt. NIS (0.25% v/v) per 25 gal. of solution and apply to emerged weeds less than 6" tall prior to transplanting or after direct-seeding but before crop emergence. Certified applicators must successfully complete an EPA-approved training program before mixing, loading, and/or applying paraquat. REI: 12 to 24-hour. HRAC 22. *RUP.*

pendimethalin products (pendimethalin) PRE

Cantaloupe/Muskmelon, Watermelon | 2.1 pts. per acre. Apply 3.8 formulations to row middles using a shielded sprayer with 6 inches on either side of the row middles. Apply before transplanting or before emergence of direct-seeded crop. A second application may be made before vines run. Wait at least 21 days between applications. Do not exceed 2.1 pts. per acre per application or 4.2 pts. per acre per season. REI: 24-hour. PHI: 35-day. HRAC 03.

Poast (1.5EC) (sethoxydim) POST

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 1-1.5 pts. per acre. Add 1 qt. COC per 25 gal. of spray solution (1% v/v). Spray on actively growing grass. Do not exceed 3 pts. per acre per growing season. REI: 12-hour. PHI: 14-day for squash, pumpkin, and watermelon; 3-day for cantaloupe and cucumber. HRAC 01.

Prefar 4E (bensulide) PRE

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | 5-6 qts. per acre. Use low rate on soils with less than 1% organic matter. Apply before planting and incorporate 1-2 in. or apply after seeding before crop emerges and irrigate within 24 hours. REI: 12-hour. HRAC NC.

Reflex (2L) (fomesafen) PRE *Pumpkin, Squash, Watermelon* | *For Illinois, Michigan, Minnesota, Missouri, and Ohio only. IL 24c exp. 04/28/26. MI 24c exp. 12/31/23. MN 24c exp. 12/31/25. MO 24c exp. 12/31/21. OH 24c exp. 12/31/24.* For **pumpkins:** 6-16 fl. oz. per acre in all states listed above except Missouri. For **squash:** 8-16 fl. oz. per acre in all states listed above except Illinois and Missouri. 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. For **watermelon:** 10-16 fl. oz. per acre in Missouri only. Applied as with squash and pumpkin, but can also be used both under and over plastic mulch before transplanting. 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. REI: 24-hour. PHI: 32-day for squash, and pumpkin; 35-day for watermelon. HRAC 14.

Sandea (75) (halosulfuron) POST | PRE

Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon | For **cantaloupe/muskmelon, cucumber, pumpkin:** apply 0.5-0.75 oz. per acre to the soil surface after direct-seeding but prior to cracking or apply at least 7 days before transplanting. Or apply 0.5-1.0 oz. per acre either over the top or a directed/hooded spray after the crop has been transplanted for a minimum of 14 days and reached the 2-5 true leaf stage, but before the first female flowers appear. Avoid contact with the top surface of plastic mulch if present. For **watermelon in Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio:** used as directed for cantaloupes/muskmelon but can also be applied under plastic mulch before laying. Wait at least 7 days after application and mulch laying before seeding or transplanting. For

processing summer squash in Missouri: used as directed for pumpkin, but up to 1 oz. per acre can be used after direct-seeding and before emergence. If weeds are present, add 0.5 pt. NIS per 25 gal. of solution (0.25% v/v). Not recommended for use under cool temperatures due to potential for crop injury. May delay crop maturity. Do not exceed 2 applications or 2 oz. per acre per 12-month period. REI: 12-hour. PHI: 30-day for cucumbers, pumpkins, and squash; 57-day for cantaloupes/muskmelons, and watermelons. HRAC 02.

Sinbar WDG (80) (terbacil) PRE *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. HRAC 05.

Strategy (ethalfluralin, clomazone) PRE *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. HRAC 03, HRAC 13.

trifluralin products (trifluralin) PRE *Cantaloupe/Muskmelon, Cucumber, Pumpkin, Squash, Watermelon* | 0.5-1 lb. a.i. per acre. Use 10G formulations at 5-10 lbs. per acre and do not exceed 20 lbs. per acre per season on fine soils. Use 4EC formulations at 1-2 pts. per acre and do not exceed 4 pts. per acre per season on fine soils. Apply as a directed spray between rows after plants have 3-4 leaves and incorporate 1-2 inches. Use higher rates on heavier soils. 4-6 weeks of residual activity. Not effective on muck or high organic matter soils. REI: 12-hour. PHI: 30-day for cantaloupe, cucumber, pumpkin, and squash, 60-day for watermelon. HRAC 03.

Fruiting Vegetables – Horticulture

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

Crop Description

Eggplants (*Solanum melongena*): In the Midwest the primary eggplant varieties grown are tear-drop shaped and deep purple. There are many other types of eggplant and these should be considered when there is demand for them in your markets. Traditionally many types have been associated with specific cultures or cuisines. There are longer and thinner types that look more like summer squashes, and smaller and rounder types that are shaped more like beefsteak and cherry tomatoes. They come in a variety of colors from white, green, pink, purple, brown, and striped. There are also ornamental eggplants that make bright orange and red fruits shaped like miniature pumpkins, which can be dried.

Peppers (*Capsicum annuum*, *C. chinense*, *C. baccatum*, *C. frutescens*, and *C. pubescens*): Similar to eggplants, there are pepper types that are closely tied with specific cultures. The most common species grown for midwestern markets is *C. annuum*, which includes sweet green and colored bell peppers, as well as other sweet and hot peppers including banana, Hungarian wax, Italian, jalapeño, serrano, and poblano. These are grown for both fresh market and processing. The four other cultivated species include much hotter peppers that rate above 50,000 on the Scoville scale that is used to measure pepper pungency. These can be a strong niche market, but a little goes a long way, and these smaller-fruited types produce large numbers of fruit per plant. Clearly labeling varieties from seeding to sale is important to prevent look-alike sweet and hot peppers from being confused.

Tomatoes (*Solanum lycopersicum*): There are many types of tomatoes that differ in their fruit shape, size, color, and plant growth habits. Larger beefsteak tomatoes are juicy. Roma and plum types contain less juice and are better for canning and processing. Stuffing tomatoes are large like a beefsteak but without as much flesh or juice inside, leaving a hollow cavity like a pepper. Grape and cherry types tend to be sweeter. Determinate and semi-determinate plants grow 3 to 4 feet tall when trellised. Indeterminate plants continue to grow in height for the entire season and are almost always trellised or otherwise supported.

Planting and Spacing

Fresh market eggplant, peppers, and tomatoes are often grown on raised beds covered with plastic mulch to promote

Managing *Phytophthora* on Winter Squash and Pumpkin

Dr. Mary K. Hausbeck, Dr. Doug Higgins, and Cheryl Engfehr

December 2021

MICHIGAN STATE UNIVERSITY | Extension

USDA United States Department of Agriculture | National Institute of Food and Agriculture

CucCAP Cucurbit Coordinated Agricultural Project *Disease Resistance via Applied Genomics*

Vegetables that are susceptible to *Phytophthora capsici* include cucumber, zucchini, summer and winter squash, watermelon, cantaloupe, pumpkin, pepper, eggplant, tomato, and succulent bean. The pathogen may overwinter in the soil and persist for >10 years. *Phytophthora* is favored by rain and warm temperatures and spreads readily via runoff or infested surface water used for irrigation.

Recognizing *Phytophthora* on WINTER SQUASH and PUMPKIN

- Crown rot at the soil line, wilted vines and plant death
- Dark, water-soaked lesions on fruit and leaves
- White spores on the surface of the fruit that look similar to powdered sugar

The roots, crowns, stems, leaves, and fruits of winter squash and pumpkin are susceptible to *Phytophthora*. Root and crown rot symptoms include browning of tissue and rot. Lesions may appear on the foliage during periods of excessive rain. Acorn and 'Golden Delicious' processing squash are highly susceptible to root and crown rot. Spaghetti and butternut squash and some pumpkin cultivars are less susceptible to root and crown rot.

Fruit rot symptoms may appear as white spores that look similar to powdered sugar. Infected fruit eventually rot. It is possible to harvest healthy-appearing fruit, but rot develops days later while the crop is in transit or on grocer's shelves. Squash and pumpkin cultivar types that become more resistant to rot as the fruits mature include butternut and acorn squash and jack-o-lantern pumpkin. Some cultivars that remain susceptible through fruit maturity include 'Lumina' pumpkin, 'Hubba Hubba' hubbard squash and 'Golden Delicious' processing squash.

If you do not have *Phytophthora* in your fields, do everything you can to prevent it from occurring. If there is a history of *Phytophthora* in a field, take preventive measures. Do not plant susceptible crops in the field. Fields must be well-drained and leave low-lying areas of the field unplanted. Irrigate overhead sparsely; drip irrigation is recommended. If *Phytophthora* is recognized in the field, remove the infected plants and surrounding healthy-looking border plants. Clean all equipment used in the field to prevent spread to other areas. Discard culls in an area where crops are not grown. Plant winter squash and pumpkin into planted into raised beds, allowing excess water to drain away from the susceptible root and crown area.

White "powdered sugar" *Phytophthora* spores and lesions on fruits of acorn squash (top left), processing squash 'Golden Delicious' (top right) and butternut squash (bottom).

Apply fungicides early and often. Many cultivars produce large, dense canopies and proper application equipment is usually required to penetrate the canopy. To protect fruits, it is recommended to apply heavy foliar sprays with drop-leg nozzles at the time of initial fruit formation and again two weeks later before fruits reach full size. Rotate fungicides among FRAC groups to prevent the *Phytophthora* from developing resistance.

Remember that the pesticide label is the legal document on pesticide use. Read the label and follow all instructions. The use of a pesticide in a manner not consistent with the label can lead to the injury of crops, humans, animals, and the environment, and can also lead to civil or criminal fines and/or condemnation of the crop. Pesticides are good management tools for the control of pests on crops, but only when they are used in a safe, effective and prudent manner according to the label.

Management Strategies

- Plant into well-drained, tiled fields
- Use raised beds and drip irrigation
- Avoid using surface water for irrigation
- Irrigate sparingly from a well
- Rotate crops
- Scout fields regularly for *Phytophthora*
- Remove any diseased plants and adjacent healthy plants
- Apply fungicides preventively and at short intervals when needed
- Remove fruits from field as quickly as possible and store in a warm, dry place
- Powerwash equipment after it has been in infested fields
- Do not dump diseased culls in production fields

Wilted vines and sporulating winter squash fruits.

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture (2020-51181-32139) and the Michigan Department of Agriculture and Rural Development and Michigan Vegetable Council (SCBG GG21-488).

Preferred *Phytophthora* Fungicides for WINTER SQUASH and PUMPKIN

Product	A.I.	FRAC*	Comment
Elumin	ethaboxam	22	Rotate between applications. Apply as a soil or foliar spray or via drip.
Orondis Gold	oxathiapiprolin/ mefenoxam	49/4	Apply at-planting in-furrow, as a banded surface spray following transplanting or during seeding, or via drip. If applied via drip on direct-seeded crops delay application until after emergence.
Orondis Ultra	oxathiapiprolin/ mandipropamid	49/40	Rotate to a fungicide with a different FRAC after 2 sequential applications. For disease control, use either soil or foliar applications of oxathiapiprolin products, but not both.
Presidio 4SC	fluopicolide	43	Use in a fungicide tank mix. Apply via drip or as a foliar spray.
Revus 2.08SC	mandipropamid	40	Include surfactant.
**Apron XL	mefenoxam	4	Seed treatment. Wait 6 weeks after transplant to apply mefenoxam products.
**Ridomil Gold SL	mefenoxam	4	Apply as a preplant-incorporated, at-plant soil spray or via drip.
***Phytophthora* 'B' Team for WINTER SQUASH and PUMPKIN**			
Forum 4.18SC	dimethomorph	40	Use in a fungicide tank mix.
Gavel 75DF	mancozeb/ zoxamide	M03/22	Relatively long PHI.
Ranman 400SC	cyazofamid	21	See label about surfactant.
Zampro 4.4SC	ametoctradin/ dimethomorph	45/40	Apply via drip or as a foliar spray.

***The FRAC code is an alphanumeric code assigned by the Fungicide Resistance Action Committee and is based on the mode of action of the active ingredient.**

****Preplant incorporation of Ridomil Gold SL is not labeled for *Phytophthora*, it is labeled for control of *Pythium*. Ridomil Gold Bravo SC and Ridomil Gold Copper may be useful in protecting fruits from *Phytophthora* and are labeled as foliar applications for downy mildew control in cucurbits. Fungicide resistance has been detected in *Phytophthora* where mefenoxam has been used frequently.**

Managing *Phytophthora* on Summer Squash and Zucchini

Dr. Mary K. Hausbeck, Dr. Doug Higgins, and Cheryl Engfehr

December 2021

Vegetables that are susceptible to *Phytophthora capsici* include cucumber, zucchini, summer and winter squash, watermelon, cantaloupe, pumpkin, pepper, eggplant, tomato, and succulent bean. The pathogen may overwinter in the soil and persist for >10 years. *Phytophthora capsici* is favored by rain and warm temperatures and spreads readily via water. It has also been found in irrigation ponds and surface water sources.

Recognizing *Phytophthora* on SUMMER SQUASH and ZUCCHINI

- Wilted or dead plants
- Water-soaked lesions on fruits, stems, and leaves
- White, "powdered sugar" layer of spores on fruit

Summer squash and zucchini are very susceptible to *Phytophthora*, and symptoms are usually visible on both the plant and fruit. Most often, the first noticeable sign of *Phytophthora* is water-soaking of the crown and/or roots that are black or brown in color. The plant appears wilted. In many situations, the roots may appear healthy yet the crown and petioles are infected. Fruit symptoms include dark, water-soaked lesions and a white, "powdered sugar" layer of spores.

Top, water-soaking and white spores on summer squash. Bottom, white spores on zucchini.

It is possible to harvest infected fruits that look healthy, but these fruits may be infected and deteriorate in transit or on grocers' shelves. This can happen because symptoms can take several days to appear on fruits once infection has occurred. Take preventive measures before a problem occurs to avoid a disease outbreak. Do not plant crops susceptible to *Phytophthora* in a field with a history of the disease.

Summer squash and zucchini should be planted into raised beds at least six inches in height whenever possible. Green zucchini are less susceptible than yellow straight neck squash. It is extremely important to only plant in well-drained fields since *Phytophthora* is spread via water; drip irrigation is recommended.

Fungicides can help manage *Phytophthora*, and may need to be applied frequently when weather is

Top, water-soaking of stems and immature fruit, and bottom, wilting of infected summer squash.

Management Strategies

- Plant into well-drained, tiled fields
- Use raised beds and drip irrigation
- Avoid using surface water for irrigation
- Irrigate sparingly from a well
- Rotate crops
- Scout fields regularly for *Phytophthora*
- Remove any diseased plants and adjacent healthy plants
- Apply fungicides preventively and at short intervals when needed
- Powerwash equipment after it has been in infested fields
- Do not dump diseased culls in production fields

wet and conducive to disease. Rotating fungicide chemistries among FRAC groups is vital to avoid the development of resistance.

Scouting fields early and often can be helpful in preventing disease, especially during wet and warm periods. If *Phytophthora* is spotted in a field, remove the diseased plants and the healthy-looking plants that border the diseased area. Never dump diseased fruits back onto a production field. Clean all equipment with a power washer to remove soil.

Remember that the pesticide label is the legal document on pesticide use. Read the label and follow all instructions closely. The use of a pesticide in a manner not consistent with the label can lead to the injury of crops, humans, animals, and the environment, and can also lead to civil or criminal fines and/or condemnation of the crop. Pesticides are good management tools for the control of pests on crops, but only when they are used in a safe, effective and prudent manner according to the label.

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Preferred *Phytophthora* Fungicides for SUMMER SQUASH and ZUCCHINI

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Orondis Ultra	oxathiapiprolin/ mandipropamid	49/40	Rotate to a fungicide with a different FRAC after 2 sequential applications. For disease control, use either soil or foliar applications of oxathiapiprolin products, but not both
Presidio 4SC	fluopicolide	43	Use in a fungicide tank mix. Apply via drip or as a foliar spray.
Revus 2.08SC	mandipropamid	40	Include surfactant.
**Apron XL	mefenoxam	4	Seed treatment. Wait 6 weeks after transplant to apply mefenoxam products
**Ridomil Gold SL	mefenoxam	4	Apply as preplant-incorporated, at-plant soil spray, or via drip.
***Phytophthora* 'B' Team for SUMMER SQUASH and ZUCCHINI**			
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