

This is a section from the

**2016**

**Mid-Atlantic**

# **Commercial Vegetable Production Recommendations**

The manual, which is published annually, is NOT for home gardener use.

The full manual, containing recommendations specific to New Jersey, can be found on the Rutgers NJAES website in the Publications section  
[njaes.rutgers.edu](http://njaes.rutgers.edu)

The label is a legally-binding contract between the user and the manufacturer.

The user must follow all rates and restrictions as per label directions.

The use of any pesticide inconsistent with the label directions is a violation of Federal law.

**New Plantings**

Foliar sprays of phosphite products should begin 14 to 21 days after planting and continue on a 30 to 60 day interval as long as favorable disease conditions occur. These products include:

- Aliette--2.5 to 5.0 lb 80WDG/A
- Phosphite salts--1.0 to 3.0 qt/A or OLF
- Rampart--1.0 to 3.0 qt/A

Fungicides containing mefenoxam or metalaxyl can be applied as sprays or through drip irrigation. These fungicides include:

- Ridomil Gold--1.0 pt 4SL/*treated A*
- Ultra Flourish--2.0 pt 2F/*treated A*
- Metastar 2E--2.0 qt 2F/*treated A*

Calculate the correct rate for drip applications as for a banded spray:

$$\frac{\text{Width of Bed (in inches)}}{\text{Bed Spacing (in inches)}} \times \text{Broadcast rate of fungicide} = \text{Fungicide rate for Drip Application}$$

Bed Spacing (in inches)

For example, for strawberries planted in beds on 5 ft (60 inch) centers:

$$\frac{30 \text{ inch-wide bed}/60 \text{ inches between beds}}{60 \text{ inches}} \times 1 \text{ pt/A} = 0.5 \text{ pt 4SL/A of strawberry.}$$

**Established Plantings**

Spring applications should begin when plants start active growth and before 1<sup>st</sup> bloom. Foliar sprays of phosphite products should be repeated every 30 to 60 days as long as weather conditions favor disease development. These products include:

- Aliette--2.5 to 5.0 lb 80WDG/A
- Phosphite salts--1.0 to 3.0qt/A
- Rampart--1.0 to 3.0 qt/A

Fungicides containing mefenoxam or metalaxyl can be applied as sprays or through drip irrigation. The first spring application should be made when plants start active growth before 1<sup>st</sup> bloom. A second spring application may be made at fruit set when Ridomil Gold is used, but not Meta Star or Ultra Flourish. All 3 products may be applied to perennial plantings in the fall after harvest has been completed. These fungicides include (apply one of the following):

- Ridomil Gold--1.0 pt 4SL/*treated A*
- Ultra Flourish--2.0 pt 2E/*treated A*

Calculate the correct rate for drip applications as for a banded spray:

$$\frac{\text{Width of Bed (in inches)}}{\text{Fungicide rate for Drip Application Bed Spacing (in inches)}} \times \text{Broadcast rate of fungicide} =$$

For example, for strawberries planted in beds on 5 ft (60 inch) centers:

$$\frac{30 \text{ inch-wide bed}/60 \text{ inches between beds}}{60 \text{ inches}} \times 1 \text{ pt/A} = 0.5 \text{ pt 4SL/A of strawberry}$$

**Black Root Rot**

This is a disease complex caused by cultural stresses coupled with many different fungi and by nematode feeding injury, and is the main reason for preplant fumigation of strawberry. The most prevalent fungi associated with the disease are *Rhizoctonia* and *Pythium*. Crop rotation of 4 to 5 years will reduce the incidence of black root rot. In fields with a high water table, the use of raised beds will provide some control. If rotation is not an option, preplant fumigation may be helpful. Fumigants listed in the "Section E-Soil Fumigation" can be used.

## SUMMER SQUASH

### Varieties<sup>1</sup> Summer Squash Variety Selection Guide

Variety	Reported Disease Resistance <sup>2</sup>					Comments
	CMV	WMV2	ZYMV	PRSV	PM <sup>4</sup>	
<b>Scallop Types</b>						
Flying Saucer						Yellow and Green Fruit
Garden Sun						Yellow Fruit
Peter Pan						Light Green Fruit
Starship						Dark Green Fruit
Sunburst						Golden Yellow Fruit
Sunny Delight						Yellow Fruit
<b>Specialty Types</b>						
Comela						Middle Eastern Type, Light Green Fruit
Eight Ball						Round Green fruit
Magda						Middle Eastern Type, Light Green Fruit
One Ball						Golden Yellow Round Zucchini Type Fruit

*(Table continued next page)*

**Summer Squash Variety Selection Guide**(continued)

Variety	Reported Disease Resistance <sup>2</sup>					Comments
	CMV	WMV2	ZYMV	PRSV	PM <sup>4</sup>	
<b>Yellow Straightneck Types</b>						
Conqueror III	R	R	R	I	I	Green Stem
Fortune						Precocious Yellow <sup>3</sup>
Goldprize		I	I			Green Stem
Lemondrop L						Green Stem
Liberator	I	I	I			Precocious Yellow
Lioness		I	I			Green Stem
Multipik						Precocious Yellow
Patriot II		I	I			Precocious Yellow
Seneca Prolific						Green Stem
Superpik						Precocious Yellow
XPT 1832 III	I	I	I			Transgenic Resistance
<b>Yellow Crookneck Types</b>						
Gentry						Tolerant to High Temperatures
Gold Star	I				I	
Prelude II	I	I	I		I	Green Stem
Superset	I	I				Precocious Yellow
<b>Zucchini Green</b>						
Cashflow			I			
Dividend	I	I	I			
Elite						
Equinox		I	I		I	
Judgement III	R	R	R			Transgenic Resistance
Justice III		R				Transgenic Resistance
Independence II		R	I			Transgenic Resistance
Paycheck	I	I	I		I	
Payload	I	I	I		I	
Payroll		I	I		I	
Revenue	I	I	I			
Reward	I	I	I		I	Medium-Dark Green Fruit
Senator						
Spineless Beauty						
Spineless Perfection		I	I		I	
Tigress		I	I	I		
<b>Golden Zucchini</b>						
Golden Dawn III						
Golden Delight		I	I			
Golden Glory		I	I		I	
Golden Rod	I	I				
Gold Rush						

Listed alphabetically; consult seed vendor for maturity/days to harvest information. Information based on seed manufacturer and/or seed distributor claims.

<sup>1</sup>ALL SUMMER SQUASH VARIETIES ARE HYBRIDS. Varieties listed by alphabetically within each type and are recommended for DE, MD, NJ, PA, VA and WV.

<sup>2</sup>Reported disease resistance from source seed companies. Resistance genes: CMV=Cucumber Mosaic Virus, WMV2=Watermelon Mosaic Virus 2, ZYMV=Zucchini Yellow Mosaic Virus, PRSV=Papaya Ring Spot Virus, PM=Powdery Mildew. I=Intermediate Resistance, R=High Resistance. Transgenic resistance of specific varieties can be found by consulting the seed manufacturer or distributor.

<sup>3</sup>In yellow-fruited summer squash the precocious yellow gene, confers tolerance to CMV and WMV2 as compared to the green stem counterpart. Varieties expressing the precocious yellowing gene will mask the greening of fruit caused by WMV and CMV, but will become bumpy and/or distorted when infected with either PRSV or ZYMV. **All 4 viruses may be detected at some level in squash fields in our region in any given year, therefore it is best to plant varieties with resistance to more than one virus, especially in later plantings when virus transmission by aphids increases. Virus resistance and PM resistance is recommended for Fall/late planted varieties.**

### Recommended Nutrients Based on Soil Tests

Before using the table below, refer to important notes in the Soil and Nutrient Management chapter in Section B and your soil test report. These notes and soil test reports provide additional suggestions to adjust rate, timing, and placement of nutrients. Your state's soil test report recommendations and/or your farm's nutrient management plan supercede recommendations found below.

Pounds N per Acre	Soil Phosphorus Level				Soil Potassium Level				Nutrient Timing and Method
	Low	Med	High (Opt.)	Very High	Low	Med	High (Opt.)	Very High	
75-100	150	100	50	0 <sup>1</sup>	200	150	100	0 <sup>1</sup>	Total nutrient recommended.
25-50	150	100	50	0 <sup>1</sup>	200	150	100	0 <sup>1</sup>	Broadcast and disk-in.
50	0	0	0	0	0	0	0	0	Sidedress and fertigate when vines start to run.
25-30	0	0	0	0	0	0	0	0	Apply through irrigation system.

Apply 1.0 to 2.0 pounds of boron (B) per acre with broadcast fertilizer. See Table B-9 for more specific boron recommendations.

<sup>1</sup>In Virginia, crop replacement values of 25 lbs. P<sub>2</sub>O<sub>5</sub> and 50 lbs. K<sub>2</sub>O per acre are recommended on soils testing Very High.

### Seed Treatment

Check with your seed company to determine if seed has been treated with an insecticide and fungicide. See the Disease section for more information to treat seed to prevent disease.

### Seeding, Transplanting, and Spacing

Seed April 15 through August 15 in warmer, southern regions and May 10 to August 1 in Pennsylvania and other cool areas. Use 4 to 6 pounds of seed per acre.

Container-grown plants are planted through the plastic when daily mean temperatures have reached 60°F (15.6°C). Planting dates vary from April 15 in southern regions to June 1 in northern areas. Early plantings should be protected from winds with hot caps, tents, or row covers.

Space rows 5 to 6 feet apart with plants 2 to 3 feet apart in the row.

### Mulching

Fumigated soil aids in the control of weeds and soil-borne diseases. Plastic mulch laid before field plantings conserves moisture, increases soil temperature, and increases early and total yields. Several fumigants can be used on summer squash depending what the predominant pests are. Plastic and fumigant should be applied to well-prepared planting soil 30 days before field planting. Various widths of plastic mulch are available depending on individual production systems and available equipment. The soil must be moist when laying the plastic. Fumigation alone may not provide satisfactory weed control under plastic. Black plastic or paper can be used without a herbicide. Fertilizer must be applied during bed preparation. At least 50% of the nitrogen (N) should be in the nitrate (NO<sub>3</sub><sup>-1</sup>) form.

Foil mulches can be used to repel aphids that transmit mosaic in fall-planted (after July 1) squash. Direct seeding through the mulch is recommended for maximum virus protection. Transplants should not be used with foil or other repellent mulches. Fumigation will be necessary when there is a history of soil-borne diseases in the field.

Consider drip irrigation. See the section on "Irrigation" in this publication.

### Pollination

Honeybees, squash bees, bumblebees and other wild bees are important for proper pollination and fruit set. Populations of pollinating insects may be adversely affected by insecticides applied to flowers or weeds in bloom. Apply

insecticides only in the evening hours or wait until bloom is completed before application. See section on "Pollination" in the General Production Recommendations and/or Table D-6 for relative toxicity of various pesticides for hazards to bees.

### Harvest and Post Harvest Considerations

Zucchini and summer squash are harvested after fruits reach the desired size but before they forms hard seeds or rinds. Crook-neck, straight-neck and zucchini should be 1.25 to 2 inches in diameter and zucchini and straight-neck squash 7 to 8 inches long. Scallop squash should be 3 to 4 inches in diameter. Summer squash and zucchini are delicate and are easily prone to bruising and scratching. Handle with care when harvesting, grading and packing. Squash should be stored at 41° to 50°F and 95% relative humidity. The typical shelf life is 7 to 14 days. Summer squash is highly sensitive to freezing injury. Do not store or transport together with ethylene producing crops.

### Weed Control

Identify the weeds in each field and select recommended herbicides that control those weeds. See Tables E-3 and E-4.

Match preplant incorporated and preemergence herbicide rates to soil type and percent organic matter in each field. See the "Mulching" section above for further information on weed control under plastic mulch.

Apply postemergence herbicides when crop and weeds are within the recommended size and/or leaf stage.

Determine the preharvest interval (PHI) for the crop. See Table E-4 and consult the herbicide label.

Find the herbicides you plan to use in the Herbicide Resistance Action Committee's (HRAC) **Herbicide Site of Action Table E-8** and follow the recommended good management practices to minimize the risk of herbicide resistance development by weeds in your fields.

### For Weed Control Under Plastic Mulch

Black plastic mulch effectively controls most annual weeds by preventing light from reaching the germinated seedling. Herbicides are used under plastic mulch to control weeds around the planting hole, and under the mulch when plastic mulch is used. Trickle irrigation tubing left on the soil surface may cause weed problems by leaching herbicide away at the emitters. The problem is most serious when clear plastic mulch is used. Bury the trickle tubing several inches deep in the bed to reduce this problem.

1. Complete soil tillage, and form raised beds, if desired, prior to applying herbicide(s). Do not apply residual herbicides before forming beds, or herbicide rate and depth of incorporation may be increased, raising the risk of crop injury. When beds are formed and plastic mulch laid in a single pass, the herbicide should be applied after the bed is formed, as a part of the same operation.
2. Apply herbicide(s) recommended for use under plastic mulch in a band as wide as the mulch. Condensation that forms on the underside of the mulch will activate the herbicide. Use the trickle irrigation to provide moisture if the soil is too dry for condensation to form on the underside of the mulch.

Complete by laying the plastic mulch and trickle irrigation tubing, if used, immediately after the herbicide application. Delay punching the planting holes until seeding or transplanting.

Bensulide--5.0 to 6.0 lb/A. Apply 5.0 to 6.0 quarts per acre Prefar 4E preemergence in a band under the plastic, immediately before laying the mulch. Condensation that forms on the underside of the mulch will activate the herbicide. Annual grasses and certain annual broadleaf weeds will be suppressed or controlled under the mulch and around the plant hole. Use the maximum recommended rate to improve control of annual broadleaf weeds including common lambsquarters, smooth pigweed, and common purslane.

Fomesafen--0.125 lb/A. **A Special Local-Needs Label 24(c) has been approved for the use of Reflex 2E to control weeds in summer squash in Delaware and Maryland. The use of this product is legal ONLY if a waiver of liability has been completed. The waiver of liability can be completed on the Syngenta website, "farmassist.com". Go to the website "farmassist.com" and register (or sign in if previously registered), then under "products" on the toolbar, click on indemnified labels and follow the instructions. Labeled for straight neck yellow, crooked neck yellow, and zucchini types only.** Apply 8 fl oz/A immediately prior to laying plastic, and lay plastic without disturbing the treated soil. Foliar application of Reflex will severely damage or kill squash. The potential of crop injury is greater on lighter textured soils combined with intensive irrigation programs or high amounts of rainfall, therefore, adjust use rates accordingly. Summer squash varieties may vary in their response to Reflex; therefore, treat small acreages first to determine crop tolerance, especially when applying to a new variety. A maximum of 1.5 pint of Reflex Herbicide (or a maximum of 0.375 lb ai/A of fomesafen from any product containing fomesafen) may be applied per acre in ALTERNATE years in Delaware, Maryland, and Virginia, be sure to consider rotational crops when deciding to apply fomesafen. Rotational restrictions are dependent on whether fomesafen was applied under the plastic, bare ground, or over plastic mulch, refer to 24(c) label for specifics. Do not apply within 32 days of harvest.

#### **For Soil Strips Between Rows of Plastic Mulch (Directed and Shielded Band Applications)**

Use the following land preparation, treatment, planting sequences, and herbicides labeled for the crop to treat **Soil Strips Between Rows of Plastic Mulch**, or crop injury

and/or poor weed control may result.

1. Complete soil preparation, apply herbicide(s) under the mulch (see above), and lay plastic and trickle irrigation (optional) before herbicide application between the rows.
2. Spray preemergence herbicide(s), registered and recommended for use on the crop in bands onto the soil and the shoulders of the plastic mulch before planting and weeds germinate, **OR** apply after planting as a shielded spray combined with a postemergence herbicide to control emerged weeds. **DO NOT broadcast spray over the plastic mulch at any time!**
3. Incorporate preemergence herbicide into the soil with ½ to 1 inch of rainfall or overhead irrigation within 48 hours of application.
4. Apply Gramoxone in bands to the soil strips between the plastic mulch before the crop emerges or is transplanted, **AND/OR** as a shielded spray postemergence to control emerged weeds. Use in combination with residual herbicides that are registered for use.

**Note.** All herbicide rate recommendations are made for spraying a broadcast acre (43,560 ft<sup>2</sup>).

#### **Preemergence**

Bensulide--5.0 to 6.0 lb/A. Apply 5.0 to 6.0 quarts per acre Prefar 4E as a banded directed shielded spray preemergence to the weeds and activate with one-half inch of sprinkler irrigation within 36 hours to control most annual grasses. Use the maximum recommended rate preemergence followed by irrigation to suppress certain annual broadleaf weeds including common lambsquarters, smooth pigweed, and common purslane.

Clomazone--0.094 to 0.188 lb/A. Apply 4.0 to 8.0 fluid ounces per acre Command 3ME as a banded directed shielded spray preemergence to the weeds to control annual grasses and many broadleaf weeds including common lambsquarters, velvetleaf, spurred anoda, and jimsonweed. Mustards, morningglory species, and pigweed species will not be controlled. Use lowest recommended rate on coarse-textured, sandy soils low in organic matter. Higher rates should only be used on medium- and fine-textured soils and sites that have been heavily manured. Combine with Curbit 3EC to control pigweed species where Curbit is registered for use, or use Strategy, the jug-mix that contains clomazone (Command) and ethalfluralin (Curbit). Observe a 45 day PHI (Preharvest Interval).

**WARNING: Command spray or vapor drift may injure sensitive crops and other vegetation up to several hundred yards from the point of application. Do not apply when wind or weather conditions favor herbicide drift. Do not apply to fields adjacent to horticultural, fruit, vegetable, or other sensitive crops (see label). Drift injury from offsite Command movement is extremely apparent; therefore, do not use Command on fields near sensitive locations.**

**Herbicide residues may limit subsequent cropping options when Command is used for weed control in cucumbers. See planting restrictions on the label or consult your local Cooperative Extension office for information regarding subsequent cropping options when Command is used.**

Ethalfluralin--0.38 to 1.12 lb/A. Apply 1.0 to 3.0 pints per acre Curbit 3E as a banded directed shielded spray

preemergence to control annual grasses and certain annual broadleaf weeds, including carpetweed and pigweed sp. Control of many other broadleaf weeds, including common lambsquarters, jimsonweed, morningglory sp., ragweed sp., mustard sp., and others may not be acceptable. Dry weather following application may reduce weed control. Cultivate to control emerged weeds if rainfall or irrigation does not occur prior to weed emergence. DO NOT preplant incorporate. DO NOT apply under plastic mulch or tunnels. DO NOT use on transplanted summer squash. DO NOT use when soils are cold or wet. Crop injury may result!

Ethalfluralin plus Clomazone (jug-mix)--0.394 to 1.575 lb/A. Apply 1.5 to 6.0 pints per acre of Strategy 2.1SC preemergence to control annual grasses and many annual broadleaf weeds. Use the lowest recommended rates on coarse-textured sandy soils low in organic matter. Higher rates should only be used on medium and fine textured soils and sites that have been heavily manured. Observe a 45 day PHI (Preharvest Interval).

Strategy is a **jug-mix** of ethalfluralin (Curbit 3E) and clomazone (Command 3ME). Refer to the chart below to determine the amount of each herbicide at commonly used rates:

**Curbit and Command Active Ingredients (ai) in Commonly Used Strategy Rates**

Strategy pints/A	Ethalfluralin (Curbit) lb ai/A	Clomazone (Command) lb ai/A
1.5	0.3	0.094
2.0	0.4	0.125
3.0	0.6	0.188
4.0	0.8	0.250
5.0	1.0	0.312
6.0	1.2	0.375

Labeled for use in all the mid-Atlantic States. Read and follow all the recommendations and warnings (above) for ethalfluralin (Curbit) and clomazone (Command)

Fomesafen--0.125 to 0.188 lb/A. **A Special Local-Needs Label 24(c) has been approved for the use of Reflex 2E to control weeds in summer squash in Delaware and Maryland. The use of this product is legal ONLY if a waiver of liability has been completed. The waiver of liability can be completed on the Syngenta website, "farmassist.com". Go to the website "farmassist.com" and register (or sign in if previously registered), then under "products" on the toolbar, click on indemnified labels and follow the instructions. Labeled for straight neck yellow, crooked neck yellow, and zucchini types only.** Apply 8 to 12 fl oz/A to row middles only prior to transplanting squash. If applying overtop of plastic mulch (broadcast) rate is 8 fl oz; and it is critical that top of mulch bed is shaped to shed water and water does not accumulate in the transplant row. Foliar application or contact of Reflex will severely damage or kill squash. The potential of crop injury is greater on lighter textured soils combined with intensive irrigation programs or high amounts of rainfall, therefore, adjust use rates accordingly. Summer squash varieties may vary in their response to Reflex; therefore, treat small acreages first to determine crop tolerance, especially when applying to a new variety. Reflex rates less than 16 fl oz/A are not intended to be used

as a stand-alone weed control program and should be used with other herbicides and/or other methods of weed control. A maximum of 1.5 pint of Reflex (**or a maximum of 0.375 lb ai/A of fomesafen from any product containing fomesafen**) may be applied per acre in ALTERNATE years in Delaware, Maryland, and Virginia, be sure to consider rotational crops when deciding to apply fomesafen. If crop is replanted do not re-apply Reflex. Rotational restrictions are dependent on whether fomesafen was applied under the plastic, bare ground, or over plastic mulch, refer to 24(c) label for specifics. Do not apply within 32 days of harvest.

Halosulfuron--0.023 to 0.047 lb/A. Apply 0.5 to 1.0 dry ounce Sandea 75WG as a banded directed shielded spray between rows of plastic mulch to suppress or control broadleaf weeds including common cocklebur, redroot, pigweed, smooth pigweed, ragweed species, and galinsoga. Use the lower rate on coarse-textured soils low in organic matter and higher rates on fine-textured soils and on soils with high organic matter. Rainfall or irrigation after application is necessary before weeds emerge to obtain good control. Occasionally, slight stunting may be observed following Sandea use early in the season. When observed, recovery is rapid with no effect on yield or maturity. Sandea is an ALS inhibitor. Herbicides with this mode of action have a single site of activity in susceptible weeds. The risk of the development of resistant weed populations is high when herbicides with this mode of action are used continuously and exclusively to control a weed species for several years or in consecutive crops in a rotation. Integrate mechanical methods of control and use herbicides with a different mode of action to control the target broadleaf weeds when growing other crops in the rotation. Do NOT apply Sandea to crops treated with a soil applied organophosphate insecticide, or use a foliar applied organophosphate insecticide within 21 days before or 7 days after a Sandea application. **DO NOT exceed a total of 0.047 pound per acre, equal to 1.0 dry ounce of Sandea, applied preemergence. Do NOT exceed total of 0.094 pounds per acre, equal to 2.0 dry ounces of Sandea per crop-cycle. DO NOT exceed a total of 0.094 pound per acre, equal to 2.0 dry ounces of Sandea, in a year.**

**Postemergence**

Carfentrazone--0.008 to 0.031 lb/A. Apply 0.5 to 2.0 fluid ounces of Aim 2EC as a banded directed shielded spray between the rows of plastic mulch to suppress or control broadleaf weeds including morningglory species, pigweed species, common lambsquarters, and nightshade species when the crop has 2 to 5 true leaves but has not yet begun to bloom or run. Aim applied postemergence will not control annual or perennial grasses. Add nonionic surfactant to be 0.25 percent of the spray solution (1 quart per 100 gallons of spray solution), or oil concentrate or methylated seed oil to be 1 to 2% percent of the spray solution (1.0 to 2.0 gallons per 100 gallons of spray solution). **The shielded (hooded) sprayer must be designed to prevent spray or drift from contacting the stems, leaves, flowers or fruit of the crop, or severe injury may occur.**

Halosulfuron--0.023 to 0.031 lb/A. Apply 0.5 to 0.66 dry ounce Sandea 75WG as a banded directed shielded spray between rows of plastic mulch to suppress or control yellow nutsedge and broadleaf weeds including common cocklebur,

redroot pigweed, smooth pigweed, ragweed species, and galinsoga when the crop has 2 to 5 true leaves but has not yet begun to bloom or run. Sandea applied postemergence will not control common lambsquarters or eastern black nightshade. Add nonionic surfactant to be 0.25 percent of the spray solution (1.0 quart per 100 gallons of spray solution). Do NOT use oil concentrate. Susceptible broadleaf weeds usually exhibit injury symptoms within 1 to 2 weeks of treatment. Typical symptoms begin as yellowing in the growing point that spreads to the entire plant and is followed by death of the weed. Injury symptoms are similar when yellow nutsedge is treated but may require 2 to 3 weeks to become evident and up to a month for the weed to die. Occasionally, slight yellowing of the crop may be observed within a week of Sandea application. When observed, recovery is rapid with no effect on yield or maturity. Sandea is an ALS inhibitor. Herbicides with this mode of action have a single site of activity in susceptible weeds. The risk of the development of resistant weed populations is high when herbicides with this mode of action are used continuously and exclusively to control a weed species for several years or in consecutive crops in a rotation. Integrate mechanical methods of control and use herbicides with a different mode of action to control the target broadleaf weeds when growing other crops in the rotation. DO NOT apply Sandea to crops treated with a soil applied organophosphate (OP) insecticide, or use a foliar applied organophosphate (OP) insecticide within 21 days before or 7 days after a Sandea application. **DO NOT exceed a total of 0.031 pound per acre, equal to 0.66 dry ounces of Sandea, applied postemergence. DO NOT exceed total of 0.094 pounds per acre, equal to 2.0 dry ounces of Sandea per crop-cycle. DO NOT exceed a total of 0.094 pound per acre, equal to 2.0 dry ounces of Sandea, in a year.**

Paraquat--0.6 lb/A. **A Special Local-Needs 24(c) label has been approved for the use of Gramoxone SL 2.0 or OLF postemergence as a directed shielded spray in Delaware, Maryland, New Jersey, Pennsylvania, and Virginia.** Apply 2.4 pints per acre Gramoxone SL 2.0 or OLF as a directed spray to control emerged weeds between the rows after crop establishment. Add nonionic surfactant according to the labeled instructions. Do not allow spray or spray drift to contact the crop or injury may result. Use shields to prevent spray contact with the crop plants. Do not exceed a spray pressure of 30 psi. See the label for additional information and warnings.

Clethodim--0.094 to 0.125 lb/A. Apply 6.0 to 8.0 fluid ounces per acre Select 2EC with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) or 12.0 to 16.0 fluid ounces of Select Max 0.97EC with nonionic surfactant to be 0.25% of the spray solution (1.0 quart per 100 gallons of spray solution) postemergence to control many annual and certain perennial grasses, including annual bluegrass. Select will not consistently control goosegrass. The use of oil concentrate with Select 2EC may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, omit additives or switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control

certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled, as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 14 days.

Sethoxydim--0.2 to 0.3 lb/A. Apply 1.0 to 1.5 pints per acre Poast 1.5EC with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) postemergence to control annual grasses and certain perennial grasses. **The use of oil concentrate may increase the risk of crop injury when hot or humid conditions prevail.** To reduce the risk of crop injury, omit additives or switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled, as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 14 days and apply no more than 3 pints per acre in one season.

#### **For Seeding Into Soil Without Plastic Mulch (Broadcast Applications)**

Use the following land preparation, treatment, planting sequences, and herbicides labeled for the crop when **Seeding into Soil Without Plastic Mulch**, or crop injury and/or poor weed control may result.

1. Complete soil tillage, apply preplant incorporated herbicide(s), and incorporate. Use a finishing disk or field cultivator that sweeps at least 100% of the soil surface twice, at right angles, operated at a minimum of 7 miles per hour (mph), OR a PTO driven implement once, operated at less than 2 miles per hour (mph).
2. Seed and apply preemergence herbicide(s) immediately after completing soil tillage, and mechanical incorporation of preplant herbicides. Irrigate if rainfall does not occur, to move the herbicide into the soil and improve availability to germinating weed seeds within 2 days of when the field was last tilled, or plan to control escaped weeds by other methods.

**Note.** All herbicide rate recommendations are made for spraying a broadcast acre (43,560 ft<sup>2</sup>).

#### **Preplant Incorporated or Preemergence**

Bensulide--5.0 to 6.0 lb/A. Apply 5.0 to 6.0 quarts per acre Prefar 4E before planting and incorporate 1 to 2 inches deep with power-driven rotary cultivators, or apply preemergence and activate with one-half inch of sprinkler irrigation within 36 hours to control most annual grasses. Use the maximum recommended rate preemergence followed by irrigation to suppress certain annual broadleaf weeds including common lambsquarters, smooth pigweed, and common purslane.

#### **Preemergence**

Clomazone--0.094 to 0.188 lb/A. Apply 4.0 to 8.0 fluid ounces per acre Command 3ME preemergence to a direct-

seeded crop to control annual grasses and many broadleaf weeds including common lambsquarters, velvetleaf, spurred anoda, and jimsonweed. Mustards, morningglory species, and pigweed species will not be controlled. Use lowest recommended rate on coarse-textured, sandy soils low in organic matter. Higher rates should only be used on medium- and fine-textured soils and sites that have been heavily manured. Combine with Curbit 3EC to control pigweed species where Curbit is registered for use. Some temporary crop injury (partial whitening of leaf or stem tissue) may be apparent after crop emergence. Complete recovery will occur from minor early injury without affecting yield or earliness. Banding the herbicide reduces the risk of crop injury and offsite movement due to vapor drift. Observe a 45 day PHI (Preharvest Interval).

**WARNING: Command spray or vapor drift may injure sensitive crops and other vegetation up to several hundred yards from the point of application. Do not apply when wind or weather conditions favor herbicide drift. Do not apply to fields adjacent to horticultural, fruit, vegetable, or other sensitive crops (see label). Drift injury from offsite Command movement is extremely apparent; therefore, do not use Command on fields near sensitive locations.**

**Herbicide residues may limit subsequent cropping options when Command is used for weed control in cucumbers. See planting restrictions on the label or consult your local Cooperative Extension office for information regarding subsequent cropping options when Command is used.**

Ethalfuralin--0.38 to 0.94 lb/A. Apply 1.0 to 2.5 pints per acre Curbit 3E preemergence to control annual grasses and certain annual broadleaf weeds, including carpetweed and pigweed sp. Control of many other broadleaf weeds, including common lambsquarters, jimsonweed, morningglory sp., ragweed sp., mustard sp., and others may not be acceptable. Dry weather following application may reduce weed control. Cultivate to control emerged weeds if rainfall or irrigation does not occur prior to weed emergence. **DO NOT preplant incorporate. DO NOT apply under plastic mulch or tunnels. DO NOT use when soils are cold or wet. Crop injury may result!**

Ethalfuralin *plus* Clomazone (jug-mix)--0.394 to 1.575 lb/A. Apply 1.5 to 6.0 pints per acre of Strategy 2.1SC preemergence to control annual grasses and many annual broadleaf weeds. Use the lowest recommended rates on coarse-textured sandy soils low in organic matter. Higher rates should only be used on medium- and fine-textured soils and sites that have been heavily manured. Observe a 45 day PHI (Preharvest Interval).

Strategy is a **jug-mix** of ethalfuralin (Curbit 3E) and clomazone (Command 3ME). Refer to the chart under Ethalfuralin *plus* clomazone (jug-mix) in the section **For Soil Strips Between Rows of Plastic Mulch** to determine the amount of each herbicide at commonly used rates.

Read and follow all the recommendations and warnings (above) for ethalfuralin (Curbit) and clomazone (Command).

Fomesafen--0.125 lb/A. **A Special Local-Needs Label 24(c) has been approved for the use of Reflex 2E to control weeds in summer squash in Delaware and Maryland. The use of this product is legal ONLY if a waiver of liability has been completed. The waiver of**

**liability can be completed on the Syngenta website, "farmassist.com". Go to the website "farmassist.com" and register (or sign in if previously registered), then under "products" on the toolbar, click on indemnified labels and follow the instructions.** Direct seeding: apply 8 fl oz/A within 24 hours of planting followed by 0.2 to 0.5 inch of overhead irrigation or rainfall at least 36 hours prior to squash cracking the ground. Transplants: apply 8 fl oz/A and irrigate with 0.5 to 0.5 inch to activate the herbicide then prepare plant holes and transplant, do not punch holes until after Reflex application and irrigation has occurred. Avoid overhead irrigation during soil cracking and emergence. Foliar application of Reflex will severely damage or kill squash. The potential of crop injury is greater on lighter textured soils combined with intensive irrigation programs or high amounts of rainfall, therefore, adjust use rates accordingly. Summer squash varieties may vary in their response to Reflex; therefore, treat small acreages first to determine crop tolerance, especially when applying to a new variety. A maximum of 1.5 pint of Reflex (or a maximum of 0.375 lb ai/A of fomesafen from any product containing fomesafen) may be applied per acre in ALTERNATE years in Delaware, Maryland, and Virginia, be sure to consider rotational crops when deciding to apply fomesafen. If crop is replanted do not re-apply Reflex. Rotational restrictions are dependent on whether fomesafen was applied under the plastic, bare ground, or over plastic mulch, refer to 24(c) label for specifics.

#### Postemergence

Clethodim--0.094 to 0.125 lb/A. Apply 6.0 to 8.0 fluid ounces per acre Select 2EC with oil concentrate to be 1 percent of the spray solution (1.0 gallon per 100 gallons of spray solution) or 12.0 to 16.0 fluid ounces of Select Max 0.97EC with nonionic surfactant to be 0.25% of the spray solution (1.0 quart per 100 gallons of spray solution) postemergence to control many annual and certain perennial grasses, including annual bluegrass. Select will not consistently control goosegrass. The use of oil concentrate with Select 2EC may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, omit additives or switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled, as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 14 days.

Sethoxydim--0.2 to 0.3 lb/A. Apply 1.0 to 1.5 pints per acre Poast 1.5EC with oil concentrate to be 1 percent of the spray solution (1.0 gallon per 100 gallons of spray solution) postemergence to control annual grasses and certain perennial grasses. **The use of oil concentrate may increase the risk of crop injury when hot or humid conditions prevail.** To reduce the risk of crop injury, omit additives or switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best

results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled, as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 14 days and apply no more than 3 pints per acre in one season.

### Postharvest

#### With or Without Plastic Mulch

Paraquat--0.6 lb/A. **A Special Local-Needs 24(c) label has been approved for the use of Gramoxone SL 2.0 or OLF for postharvest desiccation of the crop in Delaware, New Jersey and Virginia.** Apply 2.4 pints per acre Gramoxone SL 2.0 or OLF as a broadcast spray after the last harvest. Add nonionic surfactant according to the labeled instructions. Use to prepare plastic mulch for replanting, or to aid in the removal of the mulch. See the label for additional information and warnings.

**Note.** All herbicide rate recommendations are made for spraying a broadcast acre (43,560 ft<sup>2</sup>).

### Insect Control

#### THE LABEL IS THE LAW. PLEASE REFER TO THE LABEL FOR UP TO DATE RATES AND RESTRICTIONS

**NOTE:** Copies of specific insecticide product labels can be downloaded by visiting the websites [www.CDMS.net](http://www.CDMS.net) or [www.greenbook.net](http://www.greenbook.net). Also, specific labels can be obtained via web search engines.

### Seed Corn Maggot

(See Chapter E "Maggots" section in "Soil Pests--Their Detection and Control".)

### Aphids

**Note.** Aphids transmit multiple viruses. Cultivars that are resistant to multiple aphid-transmitted viruses are available. For chemical control of aphids, apply one of the following formulations:

acetamiprid--2.5 to 4.0 oz/A Assail 30G  
 clothianidin--**soil** 9.0 to 12.0 fl oz/A Belay 2.13SC; **foliar** 3.0 to 4.0 fl oz/A Belay 2.13SC  
 flonicamid--2.0 to 2.8 oz/A Beleaf 50SG  
 flupyradifurone--7.0 to 12.0 fl oz/A Sivanto 200SL  
 imidacloprid--**soil only** 7.0 to 10.5 fl oz/A Admire PRO 4.6SC (or OLF)  
 lambda cyhalothrin+thiamethoxam--4.5 fl oz/A Endigo ZC  
 methomyl--(**melon aphid only**) 1.5 to 3.0 pts/A Lannate LV  
 oxamyl--2.0 to 4.0 pts/A Vydate 2L  
 pymetrozine--2.75 oz/A Fulfill 50WDG  
 thiamethoxam--**soil** 1.66 to 3.67 oz/A Platinum 75SG; **foliar** 1.5 to 3.0 oz/A Actara 25WDG  
 thiamethoxam+chlorantraniliprole--**soil** 10.0 to 13.0 fl oz/A Durivo, **foliar** 4.0 to 7.0 oz/A Voliam Flexi  
 zeta-cypermethrin+ avermectin B1--19.0 fl oz/A Gladiator

### Cabbage Looper

Apply one of the following formulations:

*Bacillus thuringiensis*--0.5 to 2.0 lb/A DiPel (or OLF) (**OMRI listed**)

beta-cyfluthrin--1.6 to 2.4 fl oz/A Baythroid XL 1EC  
 bifenthrin--2.6 to 6.4 fl oz/A Bifenture 2EC (Sniper, or OLF)  
 chlorantraniliprole--**soil/drip/foliar** 3.5 to 5.0 fl oz/A Coragen 1.67SC  
 cyfluthrin--1.6 to 2.4 fl oz/A Tombstone 2EC (or OLF)  
 esfenvalerate--5.8 to 9.6 fl oz/A Asana XL  
 fenpropathrin--10.67 to 16.0 fl oz/A Danitol 2.4EC  
 flubendiamide--1.5 fl oz/A Belt 4SC  
 flubendiamide+buprofezin--12.0 to 17.0 fl oz/A Vetica  
 indoxacarb--2.5 to 6.0 oz/A Avaunt 30WDG  
 lambda-cyhalothrin--1.28 to 1.92 fl oz/A Warrior II or 2.56 to 3.84 fl oz/A Lambda-Cy EC (LambdaT CS, or OLF)  
 lambda-cyhalothrin+chlorantraniliprole--6.0 to 9.0 fl oz/A Voliam Xpress  
 lambda cyhalothrin+thiamethoxam--4.0 to 4.5 fl oz/A Endigo ZC  
 methomyl--1.5 to 3.0 pts/A Lannate LV  
 methoxyfenozide--4.0 to 10.0 fl oz/A Intrepid 2F  
 permethrin--4.0 to 8.0 fl oz/A Perm-Up 3.2 EC (or OLF)  
 spinetoram--5.0 to 10.0 fl oz/A Radiant 1SC  
 spinosad--4.0 to 8.0 fl oz/A Entrust 2SC (**OMRI listed**)  
 thiamethoxam+chlorantraniliprole--**foliar** 4.0 to 7.0 oz/A Voliam Flexi  
 zeta-cypermethrin--2.8 to 4.0 oz/A Mustang Maxx 0.8EC  
 zeta-cypermethrin+ avermectin B1--14.0 to 19.0 fl oz/A Gladiator  
 zeta-cypermethrin+bifenthrin--4.0 to 10.3 oz/A Hero EC

### Cucumber Beetle

Cucumber beetles can transmit bacterial wilt; however, losses from this disease vary greatly from field to field and among different varieties. Therefore, when plants are young, they need to be protected from cucumber beetle feeding to manage bacterial wilt. Also, adult beetles can cause direct feeding injury to young plants. If adult beetles are abundant and there is a history of disease problems, insecticides should be applied before beetles feed extensively on the cotyledons and first true leaves. If foliar insecticides are used, begin spraying shortly after plant emergence and repeat applications at weekly intervals if new beetles continue to invade fields.

Apply one of the following formulations:

acetamiprid--2.5 to 5.3 oz/A Assail 30SG  
 beta-cyfluthrin--2.4 to 2.8 fl oz/A Baythroid XL 1EC  
 bifenthrin--2.6 to 6.4 fl oz/A Bifenture 2EC (Sniper, or OLF)  
 carbaryl--1.0 qt/A Sevin XLR Plus  
 clothianidin--**soil** 9.0 to 12.0 fl oz/A Belay 2.13SC; **foliar** 3.0 to 4.0 fl oz/A Belay 2.13SC  
 cyfluthrin--2.4 to 2.8 fl oz/A Tombstone 2EC (or OLF)  
 dinotefuran--**soil** 9.0 to 10.5 fl oz/A Scorpion 35SL; **foliar** 2.0 to 7.0 fl oz/A Scorpion 35SL or 1.0 to 4.0 oz/A Venom 70SG  
 esfenvalerate--5.8 to 9.6 fl oz/A Asana XL  
 fenpropathrin--10.67 to 16.0 fl oz/A Danitol 2.4EC  
 imidacloprid--**soil only** 7.0 to 10.5 fl oz/A Admire PRO 4.6SC (or OLF)  
 lambda-cyhalothrin--1.28 to 1.92 fl oz/A Warrior II or 2.56 to 3.84 fl oz/A Lambda-Cy EC (LambdaT CS, or OLF) (or other labeled mixtures containing lambda-cyhalothrin like Voliam Xpress)  
 lambda cyhalothrin+thiamethoxam--4.0 to 4.5 fl oz/A Endigo ZC  
 methomyl--1.5 to 3.0 pts/A Lannate LV

## SUMMER SQUASH

permethrin--4.0 to 8.0 fl oz/A Perm-Up 3.2 EC (or OLF)  
thiamethoxam--**soil** 1.66 to 3.67 oz/A Platinum 75SG ;  
**foliar** 3.0 to 5.5 oz/A Actara 25WDG (or other labeled mixtures containing thiamethoxam like Durivo and Voliam Flexi)  
zeta-cypermethrin--2.8 to 4.0 fl oz/A Mustang Maxx 0.8EC  
zeta-cypermethrin+ avermectin B1--14.0 to 19.0 fl oz/A Gladiator  
zeta-cypermethrin+bifenthrin--4.0 to 10.3 fl oz/A Hero EC

### Cutworms

(Also see Chapter E "Cutworms" section in "Soil Pests--Their Detection and Control".)

Apply one of the following formulations:

beta-cyfluthrin--0.8 to 1.6 fl oz/A Baythroid XL 1EC  
bifenthrin--2.6 to 6.4 fl oz/A Bifenture 2EC (Sniper, or OLF)  
cyfluthrin--0.8 to 1.6 fl oz/A Tombstone 2EC (or OLF)  
esfenvalerate--5.8 to 9.6 fl oz/A Asana XL  
flubendiamide--1.5 fl oz/A Belt 4SC  
flubendiamide+buprofezin--12.0 to 17.0 fl oz/A Vetica  
lambda-cyhalothrin--1.28 to 1.92 fl oz/A Warrior II or 2.56 to 3.84 fl oz/A Lambda-Cy EC (LambdaT CS, or OLF) (or other labeled mixtures containing lambda-cyhalothrin like Voliam Xpress)  
lambda cyhalothrin+chlorantraniliprole--6.0 to 9.0 fl oz/A Voliam Xpress  
lambda cyhalothrin+thiamethoxam--4.0 to 4.5 fl oz/A Endigo ZC  
permethrin--4.0 to 8.0 fl oz/A Perm-Up 3.2 EC (or OLF)  
zeta-cypermethrin--1.28 to 4.00 fl oz/A Mustang Maxx 0.8EC  
zeta-cypermethrin+ avermectin B1--6.0 to 19.0 fl oz/A Gladiator  
zeta-cypermethrin+bifenthrin--4.0 to 10.3 fl oz/A Hero EC

### Leafminers

Apply one of the following formulations:

abamectin--1.75 to 3.5 fl oz/A Agri-Mek 0.7 SC (or OLF)  
chlorantraniliprole--**soil/drip** 5.0 to 7.5 fl oz/A Coragen 1.67SC; **foliar** 5.0 to 7.0 fl oz/A Coragen 1.67SC  
clothianidin--**soil** 9.0 to 12.0 fl oz/A Belay 2.13SC  
cyromazine--2.66 oz/A Trigard 75WSP  
dinotefuran--**soil** 9.0 to 10.5 fl oz/A Scorpion 35SL or 5.0 to 6.0 oz/A Venom 70SG; **foliar** 2.0 to 7.0 fl oz/A Scorpion 35SL or 1.0 to 4.0 oz/A Venom 70SG  
lambda-cyhalothrin+chlorantraniliprole--9.0 fl oz/A Voliam Xpress  
lambda cyhalothrin+thiamethoxam--4.5 fl oz/A Endigo ZC  
oxamyl--2.0 to 4.0 pts/A Vydate 2L  
spinetoram--6.0 to 10.0 fl oz/A Radiant 1SC  
spinosad--6.0 to 8.0 fl oz/A Entrust 2SC (**OMRI listed**)  
thiamethoxam--**soil** 1.66 to 3.67 oz/A Platinum 75SC, **foliar** 3.0 to 5.5 oz/A Actara 25WDG  
thiamethoxam+chlorantraniliprole--**soil** 10.0 to 13.0 fl oz/A Durivo, **foliar** 4.0 to 7.0 oz/A Voliam Flexi  
zeta-cypermethrin+avermectin B1--19.0 fl oz/A Gladiator

### Mites

Mite infestations generally begin around field margins and grassy areas. **CAUTION:** DO NOT mow or maintain these areas after midsummer to prevent mites from moving into the crop. Localized infestations can be spot treated. Begin treatment when 10 to 15 percent of the crown leaves are

infested early in the season. Apply one of the following formulations:

**Note.** Continuous use of carbaryl, or pyrethroids may result in mite outbreaks.

abamectin--1.75 to 3.5 fl oz/A Agri-Mek 0.7 SC (or OLF)  
bifenazate--0.75 to 1.00 lb/A Acramite 50 WS  
etoxazole--2.0 to 3.0 oz/A Zeal Miticide<sup>1</sup>  
spiromesifen--7.0 to 8.5 fl oz/A Oberon 2SC  
zeta-cypermethrin+avermectin B1--19.0 fl oz/A Gladiator

### Pickleworm, Melonworm

Make one treatment prior to fruit set, and then treat weekly with one of the following formulations:

acetamiprid--2.5 to 5.3 oz/A Assail 30SG  
beta-cyfluthrin--1.6 to 2.4 fl oz/A Baythroid XL 1EC  
bifenthrin--2.6 to 6.4 fl oz/A Bifenture 2EC (Sniper, or OLF)  
carbaryl--0.5 to 1.0 qt/A Sevin XLR Plus  
chlorantraniliprole--(melonworm) **drip** 2.0 to 3.5 fl oz/A Coragen 1.67SC, **foliar** 2.0 to 5.0 fl oz/A Coragen 1.67SC; (pickleworm) **drip/foliar** 3.5 to 5.0 fl oz/A Coragen 1.67SC (or other labeled mixtures containing chlorantraniliprole like Durivo and Voliam Flexi)  
cyfluthrin--1.6 to 2.4 fl oz/A Tombstone 2EC (or OLF)  
esfenvalerate--(**pickleworm only**) 5.8 to 9.6 fl oz/A Asana XL  
flubendiamide--1.5 fl oz/A Belt 4SC  
flubendiamide+buprofezin--12.0 to 17.0 fl oz/A Vetica  
indoxacarb--2.5 to 6.0 oz/A Avaunt 30WDG  
lambda-cyhalothrin--1.28 to 1.92 fl oz/A Warrior II or 2.56 to 3.84 fl oz/A Lambda-Cy EC (LambdaT CS, or OLF)  
lambda cyhalothrin+chlorantraniliprole--6.0 to 9.0 fl oz/A Voliam Xpress  
lambda cyhalothrin+thiamethoxam--4.0 to 4.5 fl oz/A Endigo ZC  
methomyl--1.5 to 3.0 pts/A Lannate LV  
methoxyfenozide--4.0 to 10.0 fl oz/A Intrepid 2F  
permethrin--4.0 to 8.0 fl oz/A Perm-Up 3.2 EC (or OLF)  
spinetoram--5.0 to 10.0 fl oz/A Radiant 1SC  
spinosad--4.0 to 8.0 fl oz/A Entrust 2SC (**OMRI listed**)  
zeta-cypermethrin--2.8 to 4.0 fl oz/A Mustang Maxx 0.8EC  
zeta-cypermethrin +avermectin B1--14.0 to 19.0 fl oz/A Gladiator  
zeta-cypermethrin+bifenthrin--4.0 to 10.3 fl oz/A Hero EC

### Rindworms (cucumber beetle larvae)

Damage to the rinds may result from a complex of insect pests including cucumber beetle, wireworms, and a number of "worm" species, (beet army worm, etc). Management of adult cucumber beetles early in the season may help reduce damage. See cucumber beetle section for labeled products.

For Lepidopteran rindworms (armyworms), use one of the following formulations:

beta-cyfluthrin--1.6 to 2.4 fl oz/A Baythroid XL 1EC  
bifenthrin--2.6 to 6.4 fl oz/A Bifenture 2EC (Sniper, or OLF)  
cyfluthrin--1.6 to 2.4 fl oz/A Tombstone 2EC (or OLF)  
esfenvalerate--5.8 to 9.6 fl oz/A Asana XL  
flubendiamide--1.5 fl oz/A Belt 4SC  
flubendiamide+buprofezin--12.0 to 17.0 fl oz/A Vetica  
lambda-cyhalothrin--1.28 to 1.92 fl oz/A Warrior II or 2.56 to 3.84 fl oz/A Lambda-Cy EC (LambdaT CS, or OLF)

lambda-cyhalothrin+chlorantraniliprole--6.0 to 9.0 fl oz/A  
 Voliam Xpress  
 lambda cyhalothrin+thiamethoxam--4.0 to 4.5 fl oz/A  
 Endigo ZC  
 methoxyfenozide--4.0 to 10.0 fl oz/A Intrepid 2F  
 permethrin--4.0 to 8.0 fl oz/A Perm-Up 3.2EC (or OLF)  
 spinetoram--5.0 to 10.0 fl oz/A Radiant 1SC  
 spinosad--4.0 to 8.0 fl oz/A Entrust 2SC (**OMRI listed**)  
 thiamethoxam+chlorantraniliprole--**foliar** 4.0 to 7.0 oz/A  
 Voliam Flexi  
 zeta-cypermethrin--2.8 to 4.0 fl oz/A Mustang Maxx 0.8EC  
 zeta-cypermethrin+avermectin B1--14.0 to 19.0 fl oz/A  
 Gladiator  
 zeta-cypermethrin+bifenthrin--4.0 to 10.3 oz/A Hero EC

**Squash Bug**

Begin treatments if greater than one egg mass per plant is present. Sprays should target nymphal stages. For best squash bug control, under leaf spray coverage is essential. Apply one of the following formulations:

acetamiprid--5.3 oz/A Assail 30SG  
 bifenthrin--2.6 to 6.4 fl oz/A Bifenture 2EC (Sniper, or OLF)  
 carbaryl--1.0 qt/A Sevin XLR Plus  
 clothianidin--**soil** 9.0 to 12.0 fl oz/A Belay 2.13SC; **foliar** 3.0 to 4.0 fl oz/A Belay 2.13SC  
 dinotefuran--**soil** 9.0 to 10.5 fl oz/A Scorpion 35SL or 5.0 to 6.0 oz/A Venom 70SG; **foliar** 2.0 to 7.0 fl oz/A Scorpion 35SL or 1.0 to 4.0 oz/A Venom 70SG  
 esfenvalerate--5.8 to 9.6 fl oz/A Asana XL  
 flupyradifurone--10.5 to 14.0 fl oz/A Sivanto 200SL  
 lambda-cyhalothrin--1.28 to 1.92 fl oz/A Warrior II or 2.56 to 3.84 fl oz/A Lambda-Cy EC (LambdaT CS, or OLF)  
 lambda-cyhalothrin+chlorantraniliprole--6.0 to 9.0 fl oz/A  
 Voliam Xpress  
 lambda cyhalothrin+thiamethoxam--4.0 to 4.5 fl oz/A  
 Endigo ZC  
 zeta-cypermethrin--2.8 to 4.0 fl oz/A Mustang Maxx 0.8EC  
 zeta-cypermethrin + avermectin B1--14.0 to 19.0 fl oz/A  
 Gladiator  
 zeta-cypermethrin+bifenthrin--4.0 to 10.3 fl oz Hero EC

**Squash Vine Borer**

When vines begin to run, apply one of the following formulations to bases of plants four times at 7-day intervals. Pheromone traps for squash vine borer are commercially available. These traps can be used to indicate when moth activity begins. Apply one of the following formulations:

**Note:** Use of spinosad or spinetoram for looper control will reduce squash vine borer populations.

acetamiprid--5.3 oz/A Assail 30SG  
 bifenthrin--2.6 to 6.4 fl oz/A Bifenture 2EC (Sniper, or OLF)  
 esfenvalerate--5.8 to 9.6 fl oz/A Asana XL  
 flubendiamide--1.5 fl oz/A Belt 4SC (or other labeled mixtures containing flubendiamide like Vetica)  
 lambda-cyhalothrin--1.28 to 1.92 fl oz/A Warrior II or 2.56 to 3.84 fl oz/A Lambda-Cy EC (LambdaT CS, or OLF)  
 lambda cyhalothrin+chlorantraniliprole--6.0 to 9.0 fl oz/A  
 Voliam Xpress  
 lambda cyhalothrin+thiamethoxam--4.0 to 4.5 fl oz /A  
 Endigo ZC  
 permethrin--4.0 to 8.0 fl oz/A Perm-Up 3.2 EC (or OLF)  
 zeta-cypermethrin--2.8 to 4.0 fl oz/A Mustang Maxx 0.8EC  
 zeta-cypermethrin+ avermectin B1--14.0 to 19.0 fl oz/A  
 Gladiator

zeta-cypermethrin+bifenthrin--4.0 to 10.3 fl oz/A Hero EC

**Thrips**

Apply one of the following formulations:

clothianidin--**soil** 9.0 to 12.0 fl oz/A Belay 2.13SC  
 dinotefuran--**soil** 9.0 to 10.5 fl oz/A Scorpion 35SL or 5.0 to 6.0 oz/A Venom 70SG ; **foliar** 2.0 to 7.0 fl oz/A Scorpion 35SL or 1.0 to 4.0 oz/A Venom 70SG  
 imidacloprid--**soil only** 7.0 to 10.5 fl oz/A Admire PRO 4.6SC (or OLF)  
 lambda-cyhalothrin--1.28 to 1.92 fl oz/A Warrior II or 2.56 to 3.84 fl oz/A Lambda-Cy EC (LambdaT CS, or OLF)  
 lambda-cyhalothrin+chlorantraniliprole--6.0 to 9.0 fl oz/A  
 Voliam Xpress  
 lambda cyhalothrin+thiamethoxam--4.0 to 4.5 fl oz/A Endigo ZC  
 oxamyl--2.0 to 4.0 pts/A Vydate 2L  
 spinetoram--6.0 to 10.0 fl oz/A Radiant 1SC  
 spinosad--6.0 to 8.0 fl oz/A Entrust 2SC  
 thiamethoxam--**soil** 1.66 to 3.67 oz/A Platinum 75SG  
 thiamethoxam+chlorantraniliprole--**soil** 10.0 to 13.0 fl oz/A  
 Durivo

Pesticide	Use Category <sup>1</sup>	Hours to Reentry <sup>2</sup>	Days to Harvest <sup>3</sup>
<b>INSECTICIDE</b>			
abamectin	R	12	7
acetamiprid	G	12	0
<i>Bacillus thuringiensis</i>	G	4	0
beta-cyfluthrin	R	12	0
bifenthrin	R	12	3
bifenazate	G	12	3
carbaryl	G	12	3
chlorantraniliprole	G	4	1
clothianidin(soil/foliar)	G	12	21/7
cyfluthrin	R	12	0
cyromazine	G	12	0
dinotefuran (soil/foliar)	G	12	21/1
esfenvalerate	R	12	3
etoxazole	G	12	7
fenpropathrin	R	24	7
flonicamid	G	12	0
flubendiamide	G	12	1
flubendiamide+buprofezin	G	12	1
flupyradifurone	G	12	1
imidacloprid (soil)	G	12	21
indoxacarb	G	12	3
lambda-cyhalothrin	R	24	1
lambda-cyhalothrin+chlorantraniliprole	R	24	1
lambda-cyhalothrin+thiamethoxam	R	24	1
methomyl	R	48	3
methoxyfenozide	G	4	3
oxamyl	R	48	1
permethrin	R	12	0
pymetrozine	G	12	0
spinetoram	G	4	3
spinosad	G	4	3
spiromesifen	G	12	7
sulfloxafor	G	12	1
thiamethoxam			
soil/drip	G	12	30
foliar	G	12	0

(table continued next page)

Pesticide	Use Category <sup>1</sup>	Hours to Reentry <sup>2</sup>	Days to Harvest <sup>3</sup>
thiamethoxam+ chlorantraniliprole			
soil/drip	G	12	30
foliar	G	12	1
zeta-cypermethrin	R	12	1
zeta-cypermethrin+ avermectin B1	R	12	7
zeta-cypermethrin+bifenthrin	R	12	3
<b>FUNGICIDE (FRAC code)</b>			
Aprovia Top (Groups 11 + 3)	G	12	0
Ariston (Groups M5 + 27)	G	12	3
azoxystrobin (Group 11)	G	4	1
Cabrio (Group 11)	G	12	0
chlorothalonil (Group M5)	G	12	0
copper, fixed (Group M1)	G	see label	0
Curzate (Group 27)	G	12	3
Flint (Group 11)	G	12	0
Fontelis (Group 7)	G	12	1
Forum (Group 40)	G	12	0
Gavel (Groups 22 + M3)	G	48	5
Inspire Super (Groups 3 + 9)	G	12	7
Mancozeb (Group M3)	G	24	5
MetaStar (Group 4)	G	48	AP
Presidio (Group 43)	G	12	2
Previcur Flex (Group 28)	G	12	2
Pristine (Groups 11 + 7)	G	12	0
Procure (Group 3)	G	12	0
Proline (Group 3)	G	12	7
Quadris Top (Groups 11 + 3)	G	12	1
Rally (Group 3)	G	24	0
Ranman (Group 21)	G	12	0
Revus (Group 40)	G	4	0
Ridomil Gold (Group 4)	G	48	5
Tanos (Groups 11 + 27)	G	12	3
tebuconazole (Group 3)	G	12	7
Torino (Group U6)	G	4	0
Ultra Flourish (Group 4)	G	48	5
Uniform (Groups 4 + 11)	G	0	AP
Vivando (Group U8)	G	12	0
Zampro (Groups 45 + 40)	G	12	0
Zing! (Groups 22 + M5)	G	12	0

See Table D-6.

<sup>1</sup> G = general, R = restricted, AP = At planting

<sup>2</sup> Chemicals with multiple designations are based on product and/or formulation differences. CONSULT LABEL.

<sup>3</sup> AP -At plant

### Nematode Control

See Chapter E - "Nematodes" part of Soil Pests--Their Detection and Control. Use fumigants listed in the "Soil Fumigation" section of the same chapter, or one of the following:

- Vydate L--1.0 to 2.0 gal 2L/A. Incorporate into the top 2 to 4 inches of soil or 2.0 to 4.0 pints 2L per acre applied 2 weeks after planting and repeat 2 to 3 weeks later
- Nimitz 4EC--3.5 to 5.0 pints/A. Incorporate or drip-apply 7 days before planting.

### Disease Control

#### Seed Treatment

Check with your seed company to determine if seed has been treated with an insecticide and fungicide. If it has not been treated, use a mixture of thiram (4.5 fl oz 480DP/100 lb) and an approved commercially available insecticide.

### Damping-Off

Apply one of the following in a 7-inch band after seeding.

Use formula in the "Calibration for Changing from Broadcast to Band Application" of Section E Calibrating Granular Application Equipment to determine amount of Ridomil Gold, Ultra Flourish or MetaStar needed per acre:

mefenoxam (Ridomil Gold--1.0 to 2.0 pt 4SL/A or 2.0 to 4.0 pt Ultra Flourish 2E/A)

metalaxyl (MetaStar--4.0 to 8.0 pt 2E/A)

Uniform--0.34 fl oz 3.66SE/1000 ft row

Previcur Flex--1.2 pt 6F/A applied in transplant water, drip irrigation, or a spray directed to the base of the plant and soil

### Viruses (WMV2, PRSV, ZYMV, and CMV)

The most prevalent virus in the mid-Atlantic region is WMV2, followed by PRSV, ZYMV, and CMV. **Varieties with multiple resistance packages are available (see variety table).** Varieties expressing the precocious yellowing gene such as "Multipik" will mask the greening of fruit caused by WMV2 and CMV but will become distorted when infected with either PRSV or ZYMV. **All 4 viruses may be detected at some level in squash fields in the region in any given year, therefore plant varieties with resistance to more than one virus.** The following control measures should also be used.

Plant fields as far apart as possible from existing cucurbit plantings to reduce the chances for aphid transmission. Using reflective mulch may help to prevent aphid transmission of viruses. (See preceding "Mulching" section.)

### Bacterial Wilt

Controlling striped and spotted cucumber beetles is essential for preventing bacterial wilt. See preceding "Cucumber Beetle" section under Insect Control for specific recommendations. Insecticide applications made at seeding may not prevent beetle damage season long, therefore, additional foliar insecticide applications may be necessary.

### Choanophora Fruit Rot

This disease occurs during warm wet weather and develops predominantly on flowers or fruit near the ground. Management is difficult because disease development is rapid, and weather dependent. Fungicide sprays are not effective because flowers, which open daily, must be protected immediately. Practices that reduce soil moisture or reduce soil contact, such as raised beds and plastic mulch, may be beneficial.

### Powdery Mildew

Some available varieties have intermediate resistance to powdery mildew and should be used if possible (see variety recommendations Table). The fungus that causes cucurbit powdery mildew has developed resistance to high-risk fungicides. Resistance to strobilurin (FRAC code 11) and DMI (FRAC code 3) fungicides have been reported in the Eastern U.S. Proper fungicide resistance management should be followed to help delay the development of resistance and minimize control failures.

Powdery mildew generally occurs from mid-July until the end of the season. Make the first fungicide application when powdery mildew is observed in the area or is detected by scouting (one lesion on the underside of 45 old leaves), begin the following fungicide program:

**Alternate one of the following tank mixes:**

Vivando--15.4 fl oz 2.5SC/A

Torino--3.4 fl oz *plus* chlorothalonil--2.0 to 3.0 pt 6F/A**with one of the following FRAC code 3 fungicides:**

Aprovia Top--10.5 to 13.5 fl oz 1.62EC /A

Procure--4.0 to 8.0 fl oz 480SC/A *plus* chlorothalonil--2.0 to 3.0 pt 6F/A or OLFProline--5.7 fl oz 480 SC/A *plus* chlorothalonil 2.0 or 3.0 pt 6F/A or OLFRally--5.0 oz 40WSP/A *plus* chlorothalonil-2.0 to 3.0 pt 6F/Atebuconazole--4.0 to 6.0 fl oz 3.6 F/A or OLF *plus* chlorothalonil--2.0 to 3.0 pt 6F/A or OLF**or one of the following:**Inspire Super 16.0 to 20.0 fl oz 2.8 F/A *plus* chlorothalonil--2.0 to 3.0 pt 6F/A or OLFFontelis--12.0 to 16.0 fl oz 1.67SC/A *plus* chlorothalonil--2.0 to 3.0 pt 6F/A or OLFPristine--12.5 to 18.5 oz 38WG/A *plus* chlorothalonil--2.0 to 3.0 pt 6F/A or OLF**Downy Mildew**

Scout fields for disease incidence early in the growing season. Begin sprays when plants meet in the row or if disease occurrence is predicted for the region. Refer to the Cucurbit Downy Mildew Forecasting website (<http://cdm.ipmpipe.org>) for current status of the disease. **Preventative applications are much more effective than applications made after downy mildew is detected.** The following are the most effective materials. Tank-mix one of these products with a protectant such as chlorothalonil--1.5 to 2.0 pt 6F/A or OLF:

Ranman--2.10 to 2.75 fl oz 400 SC/A (plus a non-ionic or organosilicon surfactant; do not apply with copper; see label for additional precautions)

Previcur Flex--1.2 pt 6F/A

Zampro--14.0 fl oz 525SC/A

Other materials for use in rotation as tank mix partners with a protectant:

Tanos--8.0 oz 50DF/A

Forum--6.0 fl oz 4.17SC/A

Gavel--1.5 to 2.0 lb 75 DF/A (Gavel contains the protectant mancozeb, and does not need a tank-mix partner)

Curzate--3.2 oz 60DF/A

Zing!--36 fl oz 4.9 SC/A (contains chlorothalonil)

Presidio--3.0 to 4.0 fl oz 4SC/A (caution, pathogen is less sensitive to Presidio than in the past)

Ariston--3.0 pt 42SC/A (contains chlorothalonil)

Materials with different modes of action (FRAC codes) should be alternated to reduce the chances for fungicide resistance development.

Sprays should be applied on a 7-day schedule. Under severe disease conditions spray interval may be reduced if label allows.

**Plectosporium Blight (Microdochium blight)**

A three year rotation with crops other than cucurbits is advised. It is important to achieve maximum foliage coverage with the fungicide application. Once symptoms appear on petioles or after fruit form, apply one of the following and repeat every 7 to 10 days:

chlorothalonil--2.0 to 3.0 pt 6F/A, or OLF

mancozeb--2.0 to 3.0 lb 75DF/A or OLF

Quadris Top--12.0 to 14.0 fl oz 2.7F/A

A spray schedule that rotates Cabrio or Flint with chlorothalonil will also provide control.

**Scab**

Use resistant varieties when possible. Scab typically develops during cool periods. Begin sprays as true leaves form and repeat every 5 to 7 days:

chlorothalonil--2.0 to 3.0 pt 6F/A or OLF

**Phytophthora Crown and Fruit Rot**

Multiple practices should be used to minimize the occurrence of this disease. Rotate away from susceptible crops (such as peppers, eggplants, tomatoes, lima and snap beans, and other cucurbits) for as long as possible. Preplant fumigants will also suppress disease. Fields should be adequately drained to ensure that water does not accumulate around the base of the plant. Mefenoxam (Ridomil Gold or Ultra Flourish) or metalaxyl (MetaStar) should be applied pre-plant for early season control. Once the canopy closes, subsoil between the rows to allow for faster drainage following rainfall. When conditions favor disease development, apply one of the the following with fixed copper at labeled rates (for suppression only):

Revus--8.0 fl oz 2.08F/A

Ranman--2.75 fl oz 400 SC/A (plus a non-ionic or organosilicon surfactant; do not apply with copper; see label for additional precautions)

Presidio--4.0 fl oz 4SC/A

Forum--6.0 fl oz 4.17SC/A

Gavel--1.5 to 2.0 lb 75DF/A

Tanos--8.0 to 10.0 oz 50DF/A

Materials with different modes of action (i.e. FRAC codes) should always be alternated to reduce the chances for fungicide resistance development.

Presidio may also be applied through the drip irrigation (see label for details). Soil drench followed by drip application has given good results in some trials on crown rot caused by *Phytophthora capsici*.