

CUCUMBERS

For earlier cucumber production and higher, more concentrated yields, use gynoecious varieties. A gynoecious plant produces a high percentage of female flowers (the ones that produce fruits). To produce pollen, 1 to 15 percent of pollinator must be planted; seed companies add this seed to the gynoecious variety. Both pickling and slicing gynoecious varieties are available. Parthenocarpic cucumbers that produce fruits without pollination are also available for protected culture and field production.

Recommended Cucumber Varieties

Variety	Days	F1 ¹	Type ²	Use ³	Reported Disease Resistance ⁴								
					Scab (Ccu)	PM (Px)	AN (Co)	DM ⁵ (Pcu)	ALS (Psl)	Cmv	Wmv	Zmv	Prsv
Standard Slicing Varieties													
Bristol (trial)	54	Yes	Gyn	F	X	X	X		X	X	X	X	X
Dasher II	58	Yes	Gyn	F	X	X	X		X	X			
Dominator	55	Yes	Gyn	F	X	X	X		X	X			
General Lee	66	Yes	Gyn	F	X	X			X				
Indy	59	Yes	Gyn	F	X	X	X		X	X	X	X	X
Intimidator	53	Yes	Gyn	F	X	X	X		X	X			
Mongoose	55	Yes	Gyn	F	X	X	X		X	X	X	X	X
Python	55	Yes	Gyn	F	X	X	X		X	X			
Speedway	56	Yes	Gyn	F	X	X	X		X	X			
Stonewall	53	Yes	Gyn	F	X	X	X		X	X			
SV3462CS	56	Yes	Gyn	F	X	X	X	X	X			X	
SV4719CS	56	Yes	Gyn	F	X	X	X	X	X			X	
Talladega	61	Yes	Gyn	F	X	X	X		X	X	X		
Thunder	58	Yes	Gyn	F	X	X	X		X	X		X	
Slicers – Long types													
Suyo Long	61	No	Mon	F		X							
Tasty Green	52	Yes	Mon	F		X							
Pickles													
Calypso	51	Yes	Gyn	HF	X	X	X		X	X			
Eureka	57	Yes	Mon	HF	X	X	X		X	X	X		X
Expedition	50	Yes	Gyn	MP	X	X	X		X	X			
Fanci Pak	53	Yes	Gyn	HF	X	X	X		X	X			
Feisty	57	Yes	Gyn	MP	X	X	X		X	X			
Gershwin	49	Yes	Parth	MP	X	X							
Jackson Supr.	52	Yes	Gyn	HMFP	X	X	X		X	X			
Lafayette	52	Yes	Gyn	MP	X	X	X		X	X			
Max Pack	57	Yes	Mon	FH	X	X	X		X	X	X	X	X
Logan	51	Yes	Gyn	MP	X	X	X		X	X			
NQ5007	50	Yes	Parth	MP	X	X	X		X	X			
NQ5543	49	Yes	Parth	MP	X	X	X		X	X			
Puccini	50	Yes	Parth	HMFP	X	X	X		X	X			
SV7140CN	50	Yes	Gyn	MP	X	X	X		X	X			
Vlaspik	51	Yes	Gyn	MP	X	X	X		X	X			
Bowie	51	Yes	Parth	MP	X	X							
Protected Culture/High Tunnels													
Corinto	48	Yes	Parth	F	X					X			
Cucapa	48	Yes	Parth	F		X				X			
Lisboa	60	Yes	Parth	F	X								
Picolino	45	Yes	Parth	F		X				X			
Rocky	46	Yes	Parth	F	X	X							
Socrates	52	Yes	Parth	F	X	X							

¹F1 hybrid (yes).

²Type: Gyn = Gynoecious or mostly female flowers – a small amount of a monoecious pollinizer (5-15%) variety will be added as a pollen source; Mon = monoecious type with both female and male flowers; Parth = Parthenocarpic type that sets fruit without pollination.

³Use: F= Fresh Market, P=Processing (pickling), H= Hand harvest multiple times, M=Machine harvest once over.

⁴Disease resistance. X denotes high or intermediate level of resistance to Scab, Powdery Mildew (PM), Anthracnose (AN), Downy Mildew (DM), Angular Leaf Spot (ALS), Cucumber mosaic virus (Cmv) Watermelon Mosaic Virus (Wmv), Zucchini yellows mosaic virus (Zmv), or Papaya ring spot virus (Prsv).

⁵Only those varieties with some resistance to the current strain of downy mildew are noted with an X.

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.

Cucumbers	Pounds N per Acre	Soil Phosphorus Level				Soil Potassium Level				Nutrient Timing and Method
		Low	Med	(Opt.)	High	Low	Med	(Opt.)	High	
	80-150	150	100	50	0 ¹	200	150	100	0 ¹	Total nutrient recommended.
	25-50	125	75	25	0 ¹	175	125	75	0 ¹	Broadcast and disk-in.
	25	25	25	25	0	25	25	25	0	Band place with planter.
	25-75	0	0	0	0	0	0	0	0	Sidedress when vines begin to run.

For plasticulture production, fertilization rates are based on a standard row spacing of 6-feet.

¹In Virginia, crop replacement values of 25 lbs. P₂O₅ and 50 lbs. K₂O per acre are recommended on soils testing Very High.

Suggested Repeat Harvest Cucumber Fertilization Schedule

This table provides examples of fertigation schedules based on two common scenarios - sandy coastal plain soils and heavier upland soils. It should be modified according to specific soil tests and base fertility.

Fertigation recommendations for 125 lbs N and 125 lbs K ₂ O ^{1,2}								
For soils with organic matter content less than 2% or coarse texture and low to medium or deficient K								
Preplant (lbs/a) ³			Nitrogen			Potash		
			25			50		
			N	N	N	K ₂ O	K ₂ O	K ₂ O
Stage and Description	Weeks	Days	lbs/day	lbs/week	lbs/stage	lbs/day	lbs/week	lbs/stage
1 Early vegetative	1	1-7	1	7	7	1	7	7
2 Late vegetative	2, 3	8-14	1.5	10.5	21	1.6	11.2	22.4
3 Fruiting and harvest	4, 5, 6, 7	15-42	2.2	15.4	61.6	2.2	15.4	61.6
4 Later harvest ⁴	8, 9, 10	43-70	1.7	11.9	35.7	1.6	11.2	33.6

Fertigation recommendations for 75 lbs N and 50 lbs K ₂ O ^{1,2}								
For soils with organic matter content greater than 2% or fine texture and high or optimum K								
Preplant (lbs/a) ³			Nitrogen			Potash		
			50			50		
			N	N	N	K ₂ O	K ₂ O	K ₂ O
Stage and Description	Weeks	Days	lbs/day	lbs/week	lbs/stage	lbs/day	lbs/week	lbs/stage
1 Early vegetative	1	1-7	0.5	3.5	3.5	0.4	2.8	2.8
2 Late vegetative	2, 3	8-14	0.9	6.3	12.6	0.7	4.9	9.8
3 Fruiting and harvest	4, 5, 6, 7	15-42	1.4	9.8	39.2	0.9	6.3	25.2
4 Later harvest ⁴	8, 9, 10	43-70	0.9	6.3	18.9	0.6	4.2	12.6

¹Rates above are based on 7,260 linear bed feet per acre (6-ft bed spacing). If beds are closer or wider, fertilizer rates should be adjusted proportionally. Drive rows should not be used in acreage calculations. See Fertigation in C-Irrigation Management for more information.

²Base overall application rate on soil test recommendations.

³Applied under plastic mulch to effective bed area using modified broadcast method.

⁴For extended harvest after 10 weeks continue fertigation at this rate.

Plant Tissue Testing

Plant tissue testing can be a valuable tool to assess crop nutrient status during the growing season, to aid with in-season fertility programs or to evaluate potential deficiencies or toxicities. The following are critical tissue test values for cucumbers.

Critical cucumber tissue test values for most recently matured leaves.

Timing	Value	N	P	K	Ca	Mg	S	Fe	Mn	Zn	B	Cu	Mo
		%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm
Before Flowering	Deficient	<3.5	0.3	1.6	2	0.58	0.3	<40	30	20	20	5	0.2
	Adequate range	3.5	0.3	1.6	2	0.58	0.3	40	30	20	20	5	0.3
		6	0.6	3	4	0.7	0.8	100	100	50	60	20	1
	High	>6.0	0.6	3	4	0.7	0.8	>100	100	50	60	20	2
	Toxic (>)	-	-	-	-	-	-	-	-	-	-	-	-
Early Bloom	Deficient	<2.5	0.3	1.6	1.3	0.3	0.3	<40	30	20	20	5	0.2
	Adequate range	2.5	0.3	1.6	1.3	0.3	0.3	40	30	20	20	5	0.3
		5	0.6	3	3.5	0.6	0.8	100	100	50	60	20	1
	High	>5.0	0.6	3	3.5	0.6	0.8	>100	100	50	60	20	2
	Toxic (>)	-	-	-	-	-	-	900	950	150	-	-	

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 on treatment to prevent disease.

Planting Dates

Start seeding for transplanting in mid-April in warmer, southern areas and May 10 in Pennsylvania and other cool areas. Successive plantings can be made through early August.

Container-grown plug plants are planted through the plastic when daily mean temperatures have reached 60°F (15.6°C). Planting dates vary from April 20 in southern regions to June 20 in northern areas. Early plantings should be protected from winds with hot caps, tents, row covers or rye windbreaks.

Spacing

Slicers: Space rows 3 to 4 feet apart with plants 9 to 12 inches apart. Seeding rate: 1.5 pounds per acre. *Machine Harvest Pickles:* Research and field experience has shown that 55,000 to 65,000 plants per acre is the optimum population for yield and quality. To accommodate a harvester width of 84 inches, three rows 26 to 28 inches apart should be planted on each bed. Plants should be 4 to 5 inches apart in the row. If the harvester has a 90-inch head, space rows 30 inches apart and space plants 3 to 4 inches apart in the row. For machine harvest of pickles, high plant populations concentrate pickle maturity. Parthenocarpic pickles are being trialed in the region. These are planted to achieve 22,000 to 28,000 plants per acre.

Hand Harvest Pickles: Space rows 3 to 4 feet apart with plants 6 to 8 inches apart. Seeding rate: 1.5 to 2 pounds per acre.

Mulching

Plastic mulch laid before field planting conserves moisture, increases soil temperature, and increases early and total yield. Fumigated soil aids in the control of weeds and soil-borne diseases. Several fumigants can be used on cucumber depending on what the predominant pests are. See the Chapter E “Soil Fumigation” and “Nematodes” sections under “Soil Pests--Their Detection and Control”. Fumigant and mulch should be applied to well-prepared planting beds

30 days before field planting. Various widths of plastic mulch are available depending on individual production systems and available equipment. Plastic should be laid immediately over the fumigated soil. The soil must be moist when laying the plastic. Fumigation alone may not provide satisfactory weed control under plastic. Black plastic can be used without a herbicide to provide control of most weeds. Fertilizer must be applied during bed preparation. At least 50% of the nitrogen (N) should be in the nitrate (NO₃⁻) form. Drip (trickle) irrigation is recommended for plastic mulch systems and tape is laid at the same time as mulch. Foil and highly reflective mulches can be used to repel aphids that transmit viruses in fall-planted (after July 1) cucurbits. Direct seeding through the mulch is recommended for maximum virus protection. Transplants should not be used with foil mulches. Also, an herbicide is not necessary. Fumigation will be necessary when there is a history of soil-borne diseases in the field.

Cucumbers also have been successfully grown in no-till systems on cover crop mulch.

Season Extension

Low Tunnel Cucumber Production

Cucumbers for early production may be successfully grown in high tunnels, in low tunnels with perforated clear plastic row covers, or using floating row covers. Use plastic mulch and trickle irrigation as discussed above in “mulching”. This field system similar to that used for early sweet corn is also successful: A modified bedshaper is used to form a ridge on each side of the plant row, leaving a suitable area for planting. A 36-inch-wide piece of embossed clear plastic is then used to cover the plant row, leaving a 5 to 6 inch-high space between the planted row and the plastic cover. It is estimated that temperatures may be increased 10-20° F depending on time of planting and sunlight availability and intensity.

High Tunnel Cucumber Production:

Cucumbers are a potentially profitable crop for spring and fall production within a high tunnel. Cucumbers mature in approximately half the length of time required for tomato ripening. Cucumbers are also amenable to vertical trellising which increases production and quality. High tunnel cucumber varieties are often parthenocarpic (requiring no

pollenizers) although gynoecious varieties can also be used (with pollenizers). Cucumbers can be established by direct seeding or transplanting. The plants should be spaced 12-18 inches between plants in-row on 42-48 inch bed centers. Pruning can reduce pest infestation and improve marketable yield, although high tunnel cucumber varieties can remain unpruned during their production cycle. If pruning is performed, the lower laterals (suckers) should be pruned on the bottom 2 feet leaving one or two stems per plant to trellis. See Table A-2 for relative planting and harvest dates.

Pollination

Honeybees, squash bees, bumblebees and other wild bees are important for proper cucumber pollination and fruit set. In high tunnels bumblebees are particularly effective. 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 the section on "Pollination" in Section A, the General Production Recommendations, and/or Table D-6 for relative toxicity of various pesticides for hazards to bees.

Parthenocarpic Cucumbers

Parthenocarpic cucumbers do not require pollination to set fruit. They will be nearly seedless or have unformed seeds. They should be isolated from seeded cucumber types to increase productivity and maintain the seedless nature. Parthenocarpic types should be considered when bee activity is limited such as in high tunnels, under row covers, or very early plantings.

Trellising

Fresh market slicer cucumbers and pickles may be produced on trellises. This is the preferred system in high tunnels. Yields are 2 to 3 times greater than the average from non-trellised fields. In high tunnels and greenhouses, parthenocarpic types can be used (requiring no pollinizers). Benefits of Trellising:

1. Improved fruit quality, particularly with respect to color and shape. Trellised cucumbers have no yellow "ground spot."
2. More effective control of many diseases and insects.
3. Less damage to vines resulting in a longer harvest season.
4. More consistent and thorough harvesting resulting in fewer jumbos and culls.
5. Harvesting trellised cucumbers is easier than harvesting ground grown cucumbers since fruit hang where visible and easily reached.

Production of cucumbers on trellises, however, involves a greater investment than when grown on the ground due to the cost of erecting trellises.

Erect the trellis so that it is 6 ft high with a top (No. 8) and bottom (No. 12) wire and plastic twine or netting tied between the two wires at each plant. Posts or poles should be no more than 15 ft apart and the top wire should be very taut. An additional brace between posts may be required in the season when the fruit load becomes heavy. In high tunnels wires are stretched at the height desired and plastic twine is used to train plants, cucumber plants will not climb the trellises satisfactorily by themselves. Training the main stem is required until it reaches and extends over the top wire.

Pruning lateral runners near the base of the plant will result in higher yields. The first 4 to 6 lateral runners that appear should be removed. Other runners above this point should be allowed to run. Single stem systems are often used in high tunnels.

Irrigation

Cucumbers require irrigation for best yields and quality. Cucumbers are most sensitive to moisture stress during flowering and fruiting. Water use during this period can be over 0.25 inches per day and water deficit during this period will have the greatest negative impact on yields and fruit quality. A balance must be struck, however, between maintaining adequate moisture for fruiting while minimizing wetness in the canopy and on the soil surface which promotes fruit rots and downy mildew.

Harvest and Storage

Cucumbers should be harvested when they have reached full size for the variety but while seeds are still soft. For slicers and manually-harvested pickles, multiple harvests at 2-3 day intervals, will be necessary. Machine-harvested pickles are harvested once when a small percentage (less than 5%) have become oversized. This produces the highest bushel yields. Size requirements of processors will also dictate harvest schedules for machine and hand harvest pickles.

Cucumbers can be held 10 to 14 days at 50° to 55°F with a relative humidity 90-95%. They are subject to chilling injury if held longer than about 2 days at temperatures below 50°F. At temperatures of 50°F and above, they ripen rather rapidly, the green color changing to yellow. This color change starts in about 10 days at 50°F and is accelerated if the cucumbers are stored in the same room with apples, tomatoes, or other ethylene-producing crops. Cucumbers for fresh market are usually waxed to reduce moisture loss.

Greenhouse Production

Varieties specifically developed for greenhouses are, most commonly, parthenocarpic varieties bred specifically for the lower light conditions of fall, winter, and early spring. European "English" or "Dutch" types and Asian types are available. Hydroponic nutrient solutions systems are commonly used for production in greenhouses and cucumbers are trellised with single or double stem trained onto twine. Links to greenhouse production information can be found in Section A, General Production Recommendations of this publication.

Weed Control

Section 18 Emergency Label requests may be submitted to supplement weed control recommendations in cucumbers. 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. 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.

See "Mulching" section above for further information on weed control under plastic mulch.

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 tube 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.
3. 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.

Halosulfuron--0.023 to 0.047 lb/A. Apply 0.5 to 1.0 dry ounce Sandea 75WG to suppress or control yellow nutsedge and 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. Condensation that forms on the underside of the mulch will activate the herbicide. Delay seeding or transplanting the crop for 7 days after the application of Sandea under plastic mulch. 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. Observe a 30 day PHI (Preharvest Interval) except in DE, MD, and VA where a 21 day PHI (Preharvest Interval) has been approved. **DO NOT exceed a total of 0.047 pound per acre, equal to 1 dry ounce of Sandea, applied preemergence. DO NOT exceed a total of 0.078 pounds per acre, equal to 1.66 dry ounces of Sandea, applied preemergence and postemergence, per crop-cycle. DO NOT exceed a total of 0.094 pound per**

acre, equal to 2.0 dry ounces of Sandea, applied preemergence and postemergence to multiple crops in a single year.

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 cucumbers 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 ft²). Recalibrate and reduce herbicide rates for banded applications.

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 preemergence to direct-seeded cucumbers 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 1.12 lb/A. Apply 1.0 to 3.0 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 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	Ethalfuralin (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

ethalfuralin (Curbit) and clomazone (Command).

Halosulfuron--0.023 to 0.047 lb/A. Apply 0.5 to 1.0 dry ounce Sandea 75WG 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 before the vines begin to run. 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 dry ounce of Sandea, applied preemergence. DO NOT exceed total of 0.078 pounds per acre, equal to 1.66 dry ounces of Sandea, applied preemergence and postemergence, per crop-cycle. DO NOT exceed a total of 0.094 pound per acre, equal to 2 dry ounces of Sandea, applied preemergence and postemergence to multiple crops in a single year. Observe a 30 day PHI (Preharvest Interval) except in DE, MD, and VA where a 21 day PHI (Preharvest Interval) has been approved.

Postemergence

Halosulfuron--0.023 to 0.047 lb/A. Apply 0.5 to 1.0 dry ounce Sandea 75WG 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). 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. Observe a 30 day PHI (Preharvest Interval) except in DE, MD, and VA where a 21 day PHI (Preharvest Interval) has been approved. **DO NOT exceed a total of 0.031 pound per acre, equal to 0.66 dry ounces of Sandea, applied postemergence. DO NOT exceed a total of 0.078 pounds per acre, equal to 1.66 dry ounces of Sandea, applied preemergence and postemergence, per crop-cycle. DO NOT exceed a total of 0.094 pound per acre, equal to 2.0 dry ounces of Sandea applied preemergence and postemergence to multiple crops in one 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 as or OLF 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 (1.0 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 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 3.0 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 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 ft²).

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).

Halosulfuron--0.023 to 0.047 lb/A. Apply 0.5 to 1.0 dry ounce Sandea 75WG 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. Observe a 30 day PHI (Preharvest Interval) except in DE, MD, and VA where a 21 day PHI (Preharvest Interval) has been approved. **DO NOT exceed a total of 0.047 pound per acre, equal to 1 dry ounce of Sandea, applied preemergence. DO NOT exceed a total of 0.078 pounds per acre, equal to 1.66 dry ounces of Sandea, applied preemergence and postemergence, per crop-cycle. DO NOT exceed a total of 0.094 pound per**

acre, equal to 2.0 dry ounces of Sandea, applied preemergence and postemergence to multiple crops in a single year.

Postemergence

Halosulfuron--0.023 to 0.031 lb/A. Apply 0.50 to 0.66 dry ounce Sandea 75WG 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. Observe a 30 day PHI (Preharvest Interval) except in DE, MD, and VA where a 21 day PHI (Preharvest Interval) has been approved. **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 0.078 pounds per acre, equal to 1.66 dry ounces of Sandea, applied preemergence and postemergence, per crop-cycle. DO NOT exceed a total of 0.094 pound per acre, equal to 2.0 dry ounces of Sandea applied preemergence and postemergence to multiple crops in one year.**

Paraquat--0.6 lb/A. A Special Local-Needs 24(c) label has been approved for the use **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 SelectMax 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 2EC 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 ft²).

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 www.CDMS.net or www.greenbook.net. Also, specific labels can be obtained via Google or other web search engines.

Seed Corn Maggot

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

chlorpyrifos (seed treatment-Lorsban 50W or OLF)

thiamethoxam (seed treatment Farmore DI-400 or OLF)

Note: The use of imidacloprid at planting may reduce seed corn maggot populations.

Aphids

Note. Aphids transmit multiple viruses. For chemical control of aphids, apply one of the following formulations:

acetamidprid--2.5 to 4.0 oz/A Assail 30G (or OLF)

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

imidacloprid--**soil only** 7.0 to 10.5 fl oz/A Admire PRO (or OLF)

lambda-cyhalothrin+thiamethoxam--4.5 fl oz/A Endigo ZC

methomyl--Lannate LV (see label for rates and current registration status)

methomyl (melon aphid only)--Lannate LV ((see label for rates and current registration status)

pymetrozine--2.75 oz/A Fulfill 50WP

sulfloxafor--1.5 to 2.0 fl oz/A Closer SC

thiamethoxam--**soil** 1.66 to 3.67 oz/A Platinum 75SG (or

OLF); **foliar** 1.5 to 3.0 oz/A Actara 25WDG

thiamethoxam + chlorantraniliprole--**soil/drip** 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)

beta-cyfluthrin--1.6 to 2.4 fl oz/A Baythroid XL

bifenthrin--2.6 to 6.4 fl oz/A Bifenture 2EC (Sniper, or OLF)

chlorantraniliprole--soil/drip/foiar 3.5 to 5.0 fl oz/A Coragen 1.67SC (or other labeled mixtures containing chlorantraniliprole like Voliam Flexi)

cyfluthrin--1.6 to 2.4 fl oz/A Tombstone (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 SC

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)

(or other labelled mixtures containing lambda-cyhalothrin like Endigo ZC)

lambda-cyhalothrin + chlorantraniliprole--6.0 to 9.0 fl oz/A Voliam Xpress

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 EC

spinosad--4.0 to 8.0 fl oz/A Entrust SC **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 (or OLF)

zeta-cypermethrin+avermectin B1-19.0 fl oz/A Gladiator

zeta-cypermethrin+bifenthrin--4.0 to 10.3 fl 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. Pickling cucumbers grown in high-density rows for once-over harvesting can compensate for at least 10 percent stand losses. On farms with a history of bacterial wilt infections and where susceptible varieties are

used, insecticides should be used to control adult beetles before they 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. Treatments may be required until vines begin to run (usually about 3 weeks after plant emergence). Seeds pretreated with a neonicotinoid seed treatment such as Farmore DI-400 should provide up to 21 days of control of cucumber beetle, otherwise, apply one of the following formulations:

acetamiprid--2.5 to 5.3 oz/A Assail 30SG (or OLF)
 beta-cyfluthrin--2.4 to 2.8 fl oz/A Baythroid XL
 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 (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 to 4 oz 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 (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 (LambdaT, 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
 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 labelled mixtures containing thiamethoxam like Durivo and Voliam Flexi)
 zeta-cypermethrin--2.8 to 4.0 fl oz/A Mustang Maxx (or OLF)
 zeta-cypermethrin+avermectin B1-19.0 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
 bifenthrin--2.6 to 6.4 fl oz/A Bifenture 2EC (Sniper, or OLF)
 cyfluthrin--0.8 to 1.6 fl oz/A Tombstone (or OLF)
 esfenvalerate--5.8 to 9.6 fl oz/A Asana XL
 flubendiamide--1.5 fl oz/A Belt SC
 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 (LambdaT, or OLF)
 lambda-cyhalothrin + chlorantraniliprole--6.0 to 9.0 fl oz/A Voliam Xpress (or other labeled mixtures containing lambda-cyhalothrin, like Endigo ZC)
 methomyl--(variegated cutworm only) 1.5 pts/A Lannate LV, (granulate cutworm) 1.5 to 3.0 pts/A Lannate LV
 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
 zeta-cypermethrin+avermectin B1-19.0 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 2Lspinetroram--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 75SG; **foliar** 3.0 to 5.5 oz/A Actara
 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 since this forces mites 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, or when 50 percent of the terminal leaves are infested later in the season. Apply one of the following formulations:

Note. Continuous use of carbaryl, or a pyrethroid 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 50WS
 etoxazole--2.0 to 3.0 oz/A Zeal Miticide¹
 fenpyroximate--2.0 pts/A Portal
 spiromesifen--7.0 to 8.5 fl oz/A Oberon 2SC
 zeta-cypermethrin+avermectin B1-19.0 fl oz/A Gladiator

Pickleworm, Melonworm

When using foliar materials, make one treatment prior to fruit set, and then treat weekly. If using soil or drip applications, follow instructions on the label. Apply one of the following formulations:

acetamiprid--2.5 to 5.3 oz/A Assail 30SG (or OLF)
 beta-cyfluthrin--1.6 to 2.4 fl oz/A Baythroid XL
 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 (or OLF)
 chlorantraniliprole--(melonworm) **drip** 2.0 to 3.5 fl oz/A Coragen 1.67SC, **foliar** 2.0 to 5.0 fl oz/A; (pickleworm) **drip/foliar** 3.5 to 5.0 fl oz/A Coragen 1.67SC (or other labeled mixtures containing chlorantraniliprole like Voliam Flexi)
 cyfluthrin--1.6 to 2.4 fl oz/A Tombstone (or OLF)
 esfenvalerate (pickleworm only)--5.8 to 9.6 fl oz/A Asana XL
 flubendiamide--1.5 fl oz/A Belt SC

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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)
(or other labeled mixtures containing lambda-cyhalothrin
like Endigo ZC) 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 SC
spinosad--4.0 to 8.0 fl oz/A Entrust SC **OMRI listed**
zeta-cypermethrin--2.8 to 4.0 fl oz/A Mustang Maxx
zeta-cypermethrin+avermectin B1-19.0 fl oz/A Gladiator
zeta-cypermethrin+bifenthrin--4.0 to 10.3 fl oz/A Hero EC

Thrips

Apply one of the following formulations:

dinotefuran--**soil** 9.0 to 10.5 fl oz/A Scorpion 35SL or 5.0
to 6.0 oz/A Venom 70SG (or OLF); **foliar** 2.0 to 7.0 fl
oz/A Scorpion 35SL or 1.0 to 4.0 oz/A Venom 70SG (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 (LambdaT, or OLF)
lambda-cyhalothrin+thiamethoxam--4.0 to 4.5 fl oz/A
Endigo ZC
oxamyl--2.0 to 4.0 pts/A Vydate L
spinetoram--6.0 to 10.0 fl oz/A Radiant SC
spinosad--6.0 to 8.0 fl oz/A Entrust SC
thiamethoxam--**soil** 1.66 to 3.67 oz/A Platinum 75SG (or
OLF)
thiamethoxam + chlorantraniliprole--**soil/drip** 10.0 to 13.0
fl oz/A Durivo

Nematode Control

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

Vydate L--1.0 to 2.0 gal 2L/A. Incorporate into 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--3.5 to 5.0 pt 4EC /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 480 DP/100
lb seed) and an approved commercially available insecticide.

Damping-Off

Apply the following in a 7-inch band after seeding. Use
formula given in the "Calibration for Changing from
Broadcast to Band Application" section of 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 Ultra
Flourish--2.0 to 4.0 pt 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. Use
varieties with multiple virus resistance when possible (see
recommended variety table). Plant fields far away from
existing cucurbit plantings to help reduce aphid transmission
of viruses from existing fields into new fields.

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.

Angular Leaf Spot

At first sign of disease, apply the labeled rates of fixed
copper *plus* mancozeb. Repeat every 7 days. To minimize the
spread of disease, avoid working in field while foliage is wet.

Powdery Mildew

Excellent resistance is available in most recommended
cucumber varieties (see 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 has been reported in the
Eastern US. 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. Observe plants for the presence of
powdery mildew. If one lesion is found on the underside of
45 old leaves, begin the following fungicide program:

Alternate one of the following tank mixes:

Torino--3.4 fl oz 0.85SC/A *plus* chlorothalonil--2.0 to 3.0 pt
6F/A or OLF
Procure--4.0 to 8.0 fl oz 480SC/A *plus* chlorothalonil--2.0 to
3.0 pt 6F/A or OLF
Proline--5.7 fl oz 480SC/A *plus* chlorothalonil 2.0 or 3.0 pt
6F/A
Rally--5.0 oz 40WSP/A *plus* chlorothalonil--2.0 to 3.0 pt
6F/A or OLF
tebuconazole--4.0 to 6.0 fl oz 3.6 F/A or OLF *plus*
chlorothalonil--2.0 to 3.0 pt 6F/A
Inspire Super--16.0 to 20.0 fl oz 2.8F/A *plus* chlorothalonil
2.0 to 3.0 pt 6F/A
Aprovia Top--10.5 to 13.5 fl oz 1.62EC/A

With:

Fontelis--12.0 to 16.0 fl oz 1.67SC /A *plus* chlorothalonil--
2.0 to 3.0 pt 6F/A,
Pristine--12.5 to 18.5 oz 38WG/A *plus* chlorothalonil--2.0 to
3.0 pt 6F/A or OLF
Vivando--15.4 fl oz 2.5SC/A

Downy Mildew

Downy mildew pathogen strains present in the mid-
Atlantic have changed in recent years. Newly developed
cultivars with resistance or tolerance to downy mildew
should be planted where available. Even when using resistant

cultivars (see Table), it is important to maintain a good fungicide program. The downy mildew pathogen does not overwinter in the mid-Atlantic. However introduction to the region has occurred very early in recent years (in 2012-2014 downy mildew was found on cucumber in the region as early as mid-June).). Strains of the pathogen can vary from season to season and therefore fungicide efficacy may vary year to year. Scout fields for disease incidence beginning at plant emergence. Begin sprays when vines run or earlier 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. Once the disease has become established in an area, new plantings should receive an application of Ranman, or Previcur Flex at the 1-3 leaf stage. Spray programs that include fungicides with several modes of action [for example, Ranman (Group 21) plus Gavel (Groups 22 + M3) alt. with Previcur Flex (Group 28) plus chlorothalonil (Group M5)] are more effective than programs with few modes of action. Follow all label precautions for preventing development of resistance to these fungicides. **Preventative applications are much more effective than applications made after disease is detected.**

The following are the most effective materials (always tank-mix these products with a protectant such as chlorothalonil--1.5 to 3.0 pt 6F/A or OLF, or mancozeb--3.0 lb 75DF/A or Gavel--1.5 to 2.0 lb 75DF/A):

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

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

Previcur Flex--1.2 pt 6F/A

Zampro--14.0 fl oz 525SC/A

Tanos--8.0 oz 50DF/A

Forum--6.0 fl oz 4.17SC/A

Curzate--3.2 oz 60DF/A

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

Presidio--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 always be alternated.

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

Anthracnose

Excellent resistance is available in some varieties and should be used when possible (see Table). Begin fungicide applications when vines begin to run, or earlier if symptoms are detected. Alternate chlorothalonil or mancozeb with other effective fungicides every 7 days. Fungicides with a high risk for resistance development such as FRAC code 11 fungicides (Cabrio, Pristine and Quadris), should be tank-mixed with a protectant fungicide. When tank-mixing, use at least the minimum labeled rate of each fungicide in the tank-mix. Do not apply FRAC code 11 fungicides more than 4 times total per season. If resistance to FRAC code 11 fungicides exists in the area, do not apply them. Use fungicides from a different FRAC code.

Alternate:

chlorothalonil--1.5 to 3.0 pt 6F/A or OLF (use low rate early in season)

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

To improve the performance of chlorothalonil, combine it with:

thiophanate-methyl--0.5 lb 70WP/A or OLF

With one of the following formulations:

a tank-mix containing chlorothalonil or mancozeb *plus*

Pristine--18.5 oz 38WG/A

Tanos--8.0 oz 50DF/A

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

azoxystrobin--11.0 to 15.5 fl oz 2.08F/A or OLF

Cabrio--12.0 to 16.0 oz 20EG/A

Gummy Stem Blight

Gummy stem blight occurs primarily in the late summer. Fungicides with a high-risk for resistance development such as Pristine (a FRAC code 11 fungicide) should be tank-mixed with a protectant fungicide to reduce the chances for resistance development (see Table E-12). When tank-mixing, use at least the minimum labeled rate of each fungicide in the tank mix. Do not apply FRAC code 11 fungicides more than 4 times total per season. If resistance to FRAC code 11 fungicides exists in the area, do not use. Apply fungicides from a different FRAC code.

Begin sprays when vines begin to run.

Alternate one of the following formulations:

chlorothalonil--2.0 pt 6F/A

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

With:

a tank-mix containing either chlorothalonil or mancozeb plus one of the following fungicides:

tebuconazole--8.0 fl oz 3.6 F/A or OLF

Inspire Super--16.0 to 20.0 fl oz 2.8F/A

Switch--11.0 to 14.0 oz 62.5 WG/A

Fontelis--12.0 to 16.0 fl oz 1.67SC/A

or a tank-mix containing either chlorothalonil or mancozeb plus one of the following FRAC code 11 fungicides:

Pristine--12.5 to 18.5 oz 38WG/A

azoxystrobin--11.0 to 15.5 fl oz 2.08F/A or OLF (not recommended in Maryland, Delaware and Virginia due to resistance)

Cabrio--12.0 to 16.0 oz 20EG/A (not recommended in Maryland, Delaware and Virginia due to resistance)

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

Merivon--5.5 fl oz 500SC/A

Belly Rot

Apply the following at the 1- to 3-leaf stage. Make a second application 10 to 14 days later or just prior to vine tip-over or whichever occurs first.

azoxystrobin--11.0 to 15.5 fl oz 2.08F/A or OLF

Scab

Scab typically occurs during cool periods. Excellent resistance is available in some varieties and should be used when possible. Apply one of the following as true leaves form and repeat every 5 to 7 days.

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

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

Cottony Leak (*Pythium*)

At planting apply:

mefenoxam--1.0 to 2.0 pt Ridomil Gold 4SL/A or 2.0 to 4.0 pt Ultra Flourish 2E/A. Apply in a 7-inch band after seeding. Use formula in the "Calibration for Changing from Broadcast to Band Application" section of Calibrating Granular Application Equipment to determine amount of Ridomil Gold or Ultra Flourish needed per acre.

Phytophthora Crown and Fruit Rot

Multiple practices should be used to minimize the occurrence of this disease. Rotate away from susceptible crops (such as cucurbits, peppers, lima and snap beans, eggplants, and tomatoes) for as long as possible and improve drainage in the field, apply preplant fumigants to suppress disease. When conditions favor disease development fungicides should be applied under excellent resistance management practices. Apply one of the following fungicides which provide suppression only. Rotate with fungicides in different FRAC groups and tank mix with a fixed copper.

Revus--8.0 fl oz 2.08 F/A

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

Presidio--3.0 to 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

Zampro--14.0 fl oz 525SC/A

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

Pesticide	Use Category ¹	Hours to Reentry ²	Days to Harvest ³
INSECTICIDE			
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/foiar)	G	12	21/7
cyfluthrin	R	12	0
cyromazine	G	12	0
dinotefuran (soil/foiar)	G	12	21/1
esfenvalerate	R	12	3
etoxazole	G	12	7
fenpropathrin	R	24	7
fenpyroximate	G	12	1
flonicamid	G	12	0
flubendiamide	G	12	1
flubendiamide + buprofezin	G	12	1
imidacloprid (soil)	G	12	21
indoxacarb	G	12	3
lambda-cyhalothrin	R	24	1
lambda-cyhalothrin + chlorantraniliprole	R	24	1

(table continued next column)

Pesticide	Use Category ¹	Hours to Reentry ²	Days to Harvest ³
INSECTICIDE (continued)			
lambda-cyhalothrin + thiamethoxam	R	24	1
malathion	G	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	1
spinosad	G	4	1
spiromesifen	G	12	7
thiamethoxam			
soil/drip	G	12	30
foliar	G	12	0
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
FUNGICIDE (FRAC code)			
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
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
Merivon (Groups 7 + 11)	G	12	0
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
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
Switch (Groups 9 + 12)	G	12	1
Tanos (Groups 11 + 27)	G	12	3
tebuconazole (Group 3)	G	12	7
thiophanate-methyl (Group 1)	G	24	1
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 3. G = general, R = restricted

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

³ AP=at planting