

with good drainage. Shortly before harvest when conditions are wet and cool, apply one of the following:

chlorothalonil--2.0 to 2.75 pt 6F/A or OLF (also very good for late blight),

Endura--9.0 to 12.5 oz 70WG/A (also very good for early blight; not for use in greenhouses),

Switch--11.0 to 14.0 oz 62.5WG/A

Leaf Mold (*Passalora/Fulvia/Cladosporium fulva*)

Leaf mold may occur during periods of high moisture particularly within the canopy. The disease is primarily damaging in greenhouse and high tunnel tomato settings. In both settings, if the disease is present, precautions should be taken to minimize canopy moisture. For field outbreaks, the following fungicide can be used:

Revus Top--5.5 to 7.0 fl oz 4.16SC/A

Catamaran--4.5 to 7.0 pt 5.3F/A

Tomato Spotted Wilt Virus (TSWV)

TSWV can be serious and result in severely stunted plants. The virus is spread by thrips from ornamental plants (flowers), field crops, and weeds to tomatoes. TSWV can be particularly devastating in southern and eastern parts of Virginia. Use resistant varieties when available. Do not grow any ornamental bedding plants in the same greenhouse as tomato transplants. Control weeds in and around greenhouses. Monitor greenhouses and tomato fields for thrips and begin an insecticide control program once thrips are observed. Use of reflective mulch can help repel thrips and can reduce the incidence of spotted wilt. If tomato crops are near wheat/barley fields be aware of increased thrips pressure (potentially increasing the likelihood of TSWV transmission) once the crop starts to turn brown in the spring.

WATERMELONS

Recommended Watermelon Varieties

Seeded	Reported Disease Resistance ¹						Size (lbs)	Shape	Flesh Color	Rind Description
	Fon Gen	Fon 0	Fon 1	Fon 2	Co	Px				
Crimson Sweet	R				R		16-20	globe	red	medium green with dark green stripes
Jamboree			I		I		24-28	oblong	red	dark green with broken light green stripes
Mardi Gras	I				I		20-24	oblong	red	dark green with broken light green stripes
Sangria	I				I		20-24	oblong	red	dark green with broken light green stripes
Starbrite					R		22-31	oblong	red	medium green with dark green stripes
Top Gun			I		I		21-24	globe	red	medium green with dark green stripes
Seedless, Early										
Melody							14-16	globe	red	medium green with dark green stripes
Sweet Gem							13-16	globe	red	dark green
Sweet Eat'n	I				I		15-20	oval	red	light green with broad, medium green stripes
Secretariat							16-20	oval	red	light green with broad, medium green stripes
Amarillo							13-15	globe	yellow	light green with narrow dark green stripes
Vagabond							14-17	oval	red	medium green with dark green stripes
Seedless, Mid Season										
Charismatic							13-16	globe	red	medium green with dark green stripes
SS 7167							16-20	oval	red	medium green with dark green stripes

(Table continued next page)

Recommended Watermelon Varieties *(continued)*

Seedless, Mid Season	Reported Disease Resistance ¹						Size (lbs)	Shape	Flesh Color	Rind Description
	Fon Gen	Fon 0	Fon 1	Fon 2	Co	Px				
Gypsy					I		13-17	globe	red	medium green with dark green stripes
Fascination			I		I		16-20	oval	red	medium green with dark green stripes
Crisp N Sweet							16-20	oval	red	light green with broad, medium green stripes
Sugar Heart							16-20	oval	red	light green with broad, medium green stripes
Tri-X 212							13-16	oval	red	light green with broad, medium green stripes
Tri-X 313					I		15-18	oval	red	light green with broad, medium green stripes
Liberty							18-20	oval	red	light green with broad, medium green stripes
SS 7187					I		16-20	oval	red	light green with broad, medium green stripes
ACX 6177 Plus			I		I		16-20	oval	red	medium green with dark green stripes
Revolution		I	I				18-24	oblong	red	medium green with dark green stripes
Declaration							16-18	oval	red	medium green with dark green stripes
Sweet Delight							16-19	oval	red	light green with broad, medium green stripes
Unbridled							13-16	globe	red	medium green with dark green stripes
Kingman							16-20	oval	red	light green with broad, medium green stripes
Embassy			I		I		14-18	oval	red	light green with broad, medium green stripes
SV0258WA							15-20	oval	red	light green with broad, medium green stripes
SV0241WA			I		R		12-15	oval	red	light green with medium green stripes
Harvest Moon							16-20	oval	red	dark green with random yellow dots
Butterball			I				12-18	globe	yellow	light green with narrow dark green stripes
Seedless, Late										
Sugar Fresh							15-18	oval	red	light green with broad, medium green stripes
Traveler					R		12-17	globe	red	medium green with dark green stripes
Troubadour					R		14-17	oval	red	medium green with dark green stripes
SS 7197					I		16-20	oval	red	medium green with dark green stripes
Sweet Polly							15-18	oval	red	medium green with dark green stripes

(Table continued next page)

Recommended Watermelon Varieties *(continued)*

Seedless, Late	Reported Disease Resistance ¹						Size (lbs)	Shape	Flesh Color	Rind Description
	Fon Gen	Fon 0	Fon 1	Fon 2	Co	Px				
Captivation			I				14.17	oval	red	medium green with dark green stripes
Maxima							19-22	globe	red	medium green with dark green stripes
SugaRed							16-18	oval	red	light green with broad, medium green stripes
Exclamation			I				17-21	oval	red	medium green with dark green stripes
Crunchy Red						R	16-20	oval	red	light green with broad, medium green stripes
Seedless Personal Melon										
Extazy							4-7	globe	red	medium green with dark green stripes
Ladybelle							4-8	globe	red	dark green with thin darker stripes
Solitaire							3-5	globe	red	medium green with dark green stripes
Vanessa							5-7	globe	red	dark green
Edible Pollenizers										
Estrella			I			I	20-24	oblong	red	dark green with broken, light green stripes
Jade Star							13-16	globe	red	dark green
Mickeylee	R					R	8-12	globe	red	light green
Pata Negra							12-15	globe	red	dark green
Sangria			I			I	20-24	oblong	red	dark green with broken light green stripes
SF 800			I			I	24-28	oblong	red	dark green with broken light green stripes
Stargazer						I	24-26	oblong	red	dark green with broken light green stripes
Inedible Special Pollenizers										
Accomplice		I	I			R				
Pollen Pro	I					I				
Polimax										
Sidekick						R				
SP 6			I	I	I	I				
Wild Card										

¹ Reported disease resistance from source seed companies and University trials. R=Resistance; I=intermediate/partial resistance

² Fon Gen = general resistance to Fon; Co = Anthracnose caused by *Colletotrichum orbiculare*; Px = Powery mildew cause by *Podosphaeria xanthii*
Fon = Fusarium wilt caused by *Fusarium oxysporum* f. sp. *niveum* Race 1,2, or 3.

R = Resistance or I = intermediate/partial resistance to race Fon1, Fon2, or Fon3.

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.

Watermelons	Pounds N per Acre	Soil Phosphorus Level				Soil Potassium Level				Nutrient Timing and Method
		Low	Med	High	Very	Low	Med	High	Very	
				(Opt.)	High			(Opt.)	High	
		Pounds P ₂ O ₅ per Acre				Pounds K ₂ O per Acre				
Nonirrigated	80-100	150	100	50	0 ¹	200	150	100	0 ¹	Total nutrient recommended.
	50	150	100	50	0 ¹	200	150	100	0 ¹	Broadcast and disk-in.
	25-50	0	0	0	0	0	0	0	0	Sidedress when vines start to run.
Irrigated	125-150	150	100	50	0 ¹	200	150	100	0 ¹	Total nutrient recommended.
	25-50	150	100	50	0 ¹	200	150	100	0 ¹	Broadcast and disk-in or follow fertigation schedule for potassium in table.
	25-50	0	0	0	0	0	0	0	0	Sidedress when vines start to run or follow fertigation schedule in table.
	25-50	0	0	0	0	0	0	0	0	Sidedress after first harvest or follow fertigation schedule in table.

For seedless watermelons, high rates of nitrogen may increase the risk of hollow heart.

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

Suggested Watermelon Fertigation 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								
			Nitrogen			Potash		
Preplant (lbs/a) ³			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, 2	1-14	1	7	14	1	7	14
2 Late vegetative	3, 4	15-28	1.5	10.5	21	1.5	10.5	21
3 Flowering & fruiting	5, 6, 7, 8	29-56	2	14	56	2	14	56
4 Harvest	9, 10	57-70	1.5	10.5	21	1.5	10.5	21
5 Repeat harvest ⁴	11, 12	71-84	1	7	14	1	7	14
Fertigation recommendations for 100 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								
			Nitrogen			Potash		
Preplant (lbs/a) ³			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, 2	1-14	0.4	2.8	5.6	0.3	2.1	4.2
2 Late vegetative	3, 4	15-28	0.9	6.3	12.6	0.6	4.2	8.4
3 Flowering & fruiting	5, 6, 7, 8	29-56	1.4	9.8	39.2	0.9	6.3	25.2
4 Harvest	9, 10	57-70	0.9	6.3	12.6	0.6	4.2	8.4
5 Repeat harvest ⁴	11, 12	71-84	0.4	2.8	5.6	0.3	2.1	4.2

¹Rates above are based on 6,222 linear bed feet per acre (7-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 12 weeks continue fertigation at this rate.

Plant Tissue Testing and Petiole Sap Analysis

Plant tissue testing and petiole sap analysis are useful tools to monitor watermelon plant nutrient status, especially for nitrogen and potassium. For tissue testing, take the most recent fully expanded leaves at early bloom and send to a laboratory for testing according to their instructions. Sufficiency ranges for nitrogen are between 2.5 to 3.5% and for potassium are between 2.7 to 3.5%.

Petiole sap testing can be performed with portable meters. See section B-6 for sampling details for petiole sap testing.

When vines are 6 inches in length, sap nitrate-N should be between 1200-1500 ppm and potassium between 4000-5000 ppm. When fruits are 2 inches in length, nitrate-N should be 1000-1200 ppm and potassium 4000-5000 ppm. When fruits are one-half mature, nitrate-N should be 800-1000 ppm and K should be 3500-4000 ppm and at first harvest, nitrate-N should be 600-800 ppm and potassium 3000-3500 ppm.

Critical watermelon tissue test values.

Timing	Value	N	P	K	Ca	Mg	S	Fe	Mn	Zn	B	Cu
		%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm
Most recently matured leaf when vines touch	Deficient	<3.0	0.3	3	1	0.25	0.2	<30	20	20	20	5
	Adequate range	3	0.3	3	1	0.25	0.2	30	20	20	20	5
		4	0.5	4	2	0.5	0.4	100	100	40	40	10
	High	>4.0	0.5	4	2	0.5	0.4	>100	100	40	40	10
	Toxic (>)	-	-	-	-	-	-	-	800	-	-	-
Most recently matured leaves at first flower	Deficient	<2.5	0.3	2.7	1	0.25	0.2	<30	20	20	20	5
	Adequate range	2.5	0.3	2.7	1	0.25	0.2	30	20	20	20	5
		3.5	0.5	3.5	2	0.5	0.4	100	100	40	40	10
	High	>3.5	0.5	3.5	2	0.5	0.4	>100	100	40	40	10
	Toxic (>)	-	-	-	-	-	-	-	-	-	-	-
Most recently matured leaf at first fruit	Deficient	<2.0	0.3	2.3	1	0.25	0.2	<30	20	20	20	5
	Adequate range	2	0.3	2.3	1	0.25	0.2	30	20	20	20	5
		3	0.5	3.5	2	0.5	0.4	100	100	40	40	10
	High	>3.0	0.5	3.5	2	0.5	0.4	>100	100	40	40	10
	Toxic (>)	-	-	-	-	-	-	-	-	-	-	-

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 prevent disease.

Plant Production

Transplants should be grown in plug trays with cell size at least 1.5 inches in diameter and 2 inches deep for each plant. Smaller pots or cells will restrict root growth and provide less protection to the newly set transplant. Plant one seed per cell. Triploid (seedless) watermelon seeds require a special regime to germinate well. The seed coat of seedless watermelons tends to adhere to the seedling as it emerges, at times slowing growth or reducing stand. Seeds are of lower vigor than standard diploid types.

Seedless watermelon plant production can be broken into 6 phases: sowing, initial germination, emergence, seed leaf stage to first true leaf, first true leaf to second true leaf, and hardening-off.

Seeding

Trays should be evenly filled with a general commercial greenhouse growing medium like Pro-Mix BX®, Fafard® #2, or Sunshine® #1 (these all have a starter fertilizer). Do not use fine seed starter or plug mix types. Do not compress the growing media. Trays should be watered to capacity and then allowed to drain off excess for 24 hours. During this 24 hour period, trays should be placed in a heated area so that the media reaches a temperature of 85°F. Make planting holes 1 inch deep and plant seeds with the “pointed” side up. Cover with a small amount of warm moist media just enough to fill over seeds in the holes. Do not water after seeding.

Seeding should be done in a way that trays stay at 85° F (do not allow trays to get cold).

Initial Germination

Germination should be done in a room or chamber where temperatures can be maintained at 85-90°F and where there is high humidity. Uniform tray temperature is critical. This phase will last 48 hours. To insure even germination, it may be necessary to move trays around after 24 hours (trays on bottom shelves moved to top shelves and vice versa) to ensure even temperature exposure. In this phase the seed root will emerge but the epicotyl (“crook”) that will carry the seed leaves above the surface should not be visible. If you see crooks, you have left trays in the germination area too long and you may experience plant “stretch” during emergence (if plants have emerged you are too late – stretch has already occurred). Stretching results in poor transplant quality.

Emergence

After initial germination, it is critical to move plants immediately from germination areas to the greenhouse for emergence. If you are having another grower germinate your seeds, it is important to schedule pickup or delivery so that there are no delays. Greenhouses should be set for 72-75°F day temperatures and 65°F night temperatures. Do not water until after you observe crook emergence. Thereafter, water sparingly as needed to keep trays and emerging seedlings from drying out. Excess water and high greenhouse temperatures during the emergence phase will lead to stretch.

Seed Leaf Stage to First True Leaf

Maintain greenhouse temperatures in the 72°-75°F day and 65°F night range during this period. Water moderately to

keep plants from drying out but do not fertilize during this period if you are growing in a medium that has starter fertilizer. Plants should grow slowly for highest quality.

First True Leaf to Second True Leaf

Continue maintaining greenhouse temperatures in the 72-75°F day and 65°F night range during this period. You can fertilize once the first true leaf emerges. Generally 2 fertilizations of 100 ppm nitrogen concentration one at first true leaf and one at second true leaf will be sufficient. If a constant feed system is used, set for 50 ppm nitrogen for each watering once the first true leaf has emerged. These fertilization rates are for the media listed in the seeding section that contain a starter fertilizer charge. Avoid using fertilizers with high amounts of ammonium N as the nitrogen source as this can lead to stretch (use fertilizers with calcium nitrate and potassium nitrate as the main nitrogen sources). Avoid over-watering. Some growers use media with no starter fertilizer charge. If that is the case, a different fertilizer program will be needed. Use fertilizers with calcium nitrate and potassium nitrate as nitrogen sources. Use 50 ppm N from emergence to first true leaf every 3 days, 200 ppm N every other day from first true leaf to second true leaf.

Hardening Off

It will take 4 to 6 weeks from sowing to finish transplants. Prior to transplanting into the field, harden off plants for one week. This is accomplished by lowering day time temperatures in the greenhouse (if greenhouses have side curtains roll them up during days if temperatures are not too cool). Reduce watering and stop fertilization. Some growers have the ability to place plants on wagons or move benches outside during the day, bringing them in at night. This is advised where possible but make sure the area is sheltered from high winds and avoid days where the temperature is below 60°F.

Pollenizers

The above information is for growing the seedless watermelons. Seeded pollenizers and standard seeded watermelons do not need special germinating conditions and can be grown directly in the greenhouse. It is of crucial importance to time the production so that plants are produced and hardened off at the same time as the seedless types. They also should be grown slowly and attention should be paid to avoid stretch. Follow the same recommendations from seed leaf stage through hardening off.

Planting and Spacing

Transplants: Transplant container-grown plants through plastic mulch when daily mean temperatures have reached 60°F (15.6°C). Planting dates vary from May 1 in southern regions to June 20 in northern areas. Early plantings should be protected from winds with hot caps, tents, row covers, or rye windbreak strips.

Direct-seeded: Seed April 20 to May 15 in Virginia and normally warmer areas, and May 15 to June 10 in Pennsylvania and normally cooler areas. Seed 3 to 5 pounds of seed per acre.

The recommended spacing for watermelons is 6 to 8 feet between rows with 3 to 4 feet between plants in the row.

Seedless Varieties: See Pollination and Pollenizers section for planting recommendations.

Mulching

The majority of watermelons are grown on black plastic mulch with drip irrigation (see Chapter C). Weed control under the plastic is performed by using labeled herbicides (see Weed Control section) or by fumigation. Fumigation is also used to control soil borne diseases such as *Fusarium*. See section E6 for fumigation recommendations. Fumigation will be necessary when there is a history of soil-borne diseases in the field.

Plastic and fumigant should be applied on well-prepared planting beds 30 days before field planting. Plastic should be 3-4 feet wide and laid on 6- to 8-foot centers immediately over the fumigated soil. The soil must be moist when laying the plastic. IRT plastic has been used in cooler areas for additional soil heating. Fertilizer must be applied during bed preparation. At least 50% of the nitrogen (N) should be in the nitrate (NO₃⁻¹) form. Direct seeding through the mulch is possible for seeded types but is not generally recommended for seedless varieties

Pollination and Pollenizers

Watermelon fruit set and enlargement is dependent upon growth regulators from the pollen grains and from embryos in developing seeds within the fruit. Inadequate pollination results in triploid watermelon fruits that are triangular in shape and of inferior quality. Inadequate pollination may increase the incidence of hollowheart. Triploid watermelon flowers do not produce sufficient viable pollen to induce fruit set and development. Therefore, pollen from a normal or a special diploid pollenizer watermelon variety must be present. Fields should be inter-planted with triploid and pollenizer plants. There are three methods that can be used to incorporate pollenizer plants into the field. Pollenizer plants may be dedicated to every third row. A second alternative is to plant a pollenizer every third or fourth plant in-row with additional spacing for pollenizers. A third alternative is to plant the pollenizer between every third and fourth plant in-row without changing plant spacing. When this method is chosen, the use of a special pollenizer is recommended. The use of standard diploid varieties planted in-row may decrease yields of closely associated triploid plants. Special pollenizer varieties have been developed solely for pollen production and most do not produce marketable fruit. The use of special pollenizers planted in-row allows the field to be 100% seedless. Special pollenizer varieties found to perform well are listed above in the “variety” table. Follow suppliers’ instructions. **Under no circumstances should the pollenizer variety and the seedless variety be planted in separate but adjacent blocks!**

When using pollenizer plants arranged in dedicated rows, it is important to use a pollenizer variety that is marketable because up to one-third of all melons produced in the field will be of this variety. The rind pattern and/or shape of the seeded pollenizer fruit should be easily distinguished from that of the triploid fruit to reduce confusion at harvest. Most special pollenizers are distinguishable from triploid fruit by size however, if mini seedless watermelons are planted rind pattern must be used to distinguish pollenizer and seedless fruit. Selection of a pollenizer variety that will be harvested should also take into account the market demand, plant vigor, pollen production, disease resistance, and environmental conditions.

It is important that pollen from the diploid pollenizer variety be available when the female blossoms on the triploid

plants are open and ready for pollination. The following recommendations pertain only to pollenizers planted in dedicated rows, special pollenizer plants should be transplanted at the same times as triploid plants. As a general rule, direct field seeding of the pollenizer variety should be done on the same day the triploid seed is planted in the greenhouse. If transplants are used for pollenizers, they can be seeded a few days after triploid transplants are scheduled to be seeded.

Honeybees, squash bees, bumblebees and other wild bees are essential for proper watermelon pollination and fruit set. Honeybee or bumblebee colonies are commonly rented or purchased. 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 Chapter A, the General Production Recommendations, and/or Table D-6 for relative toxicity of various pesticides for hazards to bees.

Windbreaks

Use windbreaks as necessary especially in windy areas. Small grain windbreaks are recommended and may be established between every bed, every 2-3 beds, or in drive row areas (every 6-8 beds). Use windbreaks between every row for earliest plantings for additional protection. Rye is the most common small grain used for windbreaks due to height and rapid growth. Establish windbreaks in the fall, either as a solid planting or spacing windbreak rows at intervals the width of the rows. Plant at high density to insure a good stand. In the spring, for solid plantings, till areas where plastic is to be laid before small grain starts to elongate. Windbreaks may be eliminated with herbicides or mowed out after the crop is well established.

Vine Turning

It is important to move vines in outer rows out of driveways so they are not damaged by vehicle traffic. This reduces disease incidence. Several trips over the field may be necessary.

Irrigation

Watermelons can be grown under dryland conditions, however highest yields are obtained with irrigation. Irrigation is recommended for seedless watermelons. Schedule irrigation so that soil moisture does not drop below 50% of field capacity. At peak, during fruit set and full vine cover, watermelons will use up to 0.30 inches of water per day.

Harvest and Post Harvest Considerations

Watermelons are hand harvested into bins, trucks, or buses for shed packing. Use every sixth or eighth row as a drive row for field access. Ripeness is indicated by a creamish to slight yellowing of the white background color of the part of the melon that rests on the ground. Drying of the stem tendril nearest the attachment point of the watermelon and green color tone of the rind are also indicators of ripeness but these vary with cultivar. Melons should be cut from the vine rather than pulled, twisted, or broken off.

Harvested watermelons should be stored at 50° to 60°F and a relative humidity of 90% during storage and shipping. Watermelons are not adapted to long storage. At low temperatures, they are subject to various symptoms of

chilling injury and loss of quality, and at high temperatures they are subject to decay.

Watermelons should be consumed within 2 to 3 weeks after harvest, primarily because of the gradual loss of crispness. Quality in watermelons is determined largely by high sugar content, a deep red fresh color, and a pleasant crisp texture of the edible flesh. These factors are dependent on maturity, cultivar, and handling methods.

Commercial melons for distant market are usually harvested when mature, but before full ripeness, to minimize handling damage and flesh breakdown.

Watermelons are sensitive to high levels of ethylene gas during storage, watermelons should not be stored or shipped with fruits that emit substantial amounts of ethylene.

Rough handling will result in serious losses. Bulk bins with pallets, if used, can speed handling and minimize melon damage

Watermelons are marketed by weight and bin counts: large, or 32-35 (more than 18 lbs per melon) per bin, medium, or 45 per bin (14-18 lbs) and smaller, or 50-60 per bin (14 lbs or less). The wholesale grower is generally paid by the pound. "Personal" (very small) watermelons are marketed by box counts and weight. The trend in consumer preference has been increased demand for smaller sizes.

Watermelon Disorders

Misshapen Fruits

Poor pollination due to low bee activity, may result in "bottlenecks", or constricted growth at the stem end of the fruit, especially in seeded/elongated watermelons. Research has shown that a minimum of 1,000 grains of pollen are required to be distributed over the three lobes of the stigma of the female flower to produce a uniformly shaped fruit.

In seedless watermelon, poor pollination may lead to undesirable "triangular" fruits.

Sunscald

Sunscald occurs when fruits are exposed to direct sunlight, especially on extremely hot days. Under these conditions, rind surfaces can reach temperatures exceeding 140° F killing cells and resulting in sunburn spots. Fruits with little or no foliar cover are at most risk. Sunscald or sunburn first appears as a gray or white area on the exposed upper surface of the fruit. Fruit with dark rinds are more susceptible to sunscald than those with light colored rinds.

Sunscald severity is related directly to fertility regime and foliage cover. Proper fertility and soil management promotes adequate vine growth and coverage of fruit.

Sunscald severity is also associated with diseases that reduce foliage cover, such as anthracnose, alternaria, gummy stem blight and downy mildew. Recommendations for managing these diseases may be found in the Disease Control section below.

Hollow Heart

Hollow heart is an internal crack in the flesh of the melon. Hollow heart is generally more severe in seedless varieties and in crown-set fruit. Inadequate pollen has been shown to be one causal factor. Cold weather during fruit set, poor fruit set and low fruit load, excess nutrients (especially nitrogen), and factors producing rapid growth have been reported to impact the severity of hollow heart.

Water Soaking

This disorder occurs where excess water accumulates at the bottom of the fruit resulting in a water soaked appearance of internal flesh. Water accumulates during cloudy weather when transpiration from vines is low. Water soaking sometimes appears in fruits where foliage has deteriorated since excess water cannot be transpired.

Splitting

Splitting during handling occurs in fruits under excessive water pressure. Excess irrigation or rainfall are the usual causes.

Irregular Ripening

Irregular ripening can be a problem in some years and varieties. Watermelons are classified as non-climacteric since they do not continue to ripen significantly after harvest. However, recent research has shown that watermelon fruit produce a burst of ethylene at the white fruit stage and factors that reduce ethylene will slow ripening. Watermelon fruit development and ripening are also dependent on the accumulation of sugars. Loss of foliage or stem tissue due to diseases such as gummy stem blight or insect or mite feeding can reduce the amount of sugars available to the fruit. Different varieties, low potassium nutrition, or variability in vine health will lead to variability in fruit ripening.

Internal Rind Necrosis

Internal rind necrosis is indicated by the presence of a corky, red-brown layer of tissue that occurs on the inside of the rind of affected fruit but that does not extend into the fruit flesh. The disease occurs sporadically and is thought to be caused by bacteria (*Erwinia*) that are naturally present on fruit. Drought stress has been implicated in this disorder.

Weed Control

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

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 "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.
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.

Note: All herbicide rate recommendations are made for spraying a broadcast acre (43,560 ft²).

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--0.16 to 0.19 lb/A. **A Special Local-Needs Label 24(c) has been approved for the use of Reflex 2E to control weeds in watermelon in Delaware, Maryland, and Virginia. 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.** Apply 10 to 12 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 watermelon. 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. Watermelon 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.

Halosulfuron--0.023 to 0.031 lb/A. Apply 0.5 to 0.75 a 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. **DO NOT exceed a total of 0.031 pound per acre, equal to 0.75 dry ounces of Sandea, applied preemergence, 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. Observe a 57 day PHI (PreHarvest Interval).**

Terbacil--0.1 to 0.2 lb/A. Apply 2.0 to 4.0 dry ounces of Sinbar 80WP preemergence in a band under the plastic, immediately before laying the mulch, to control many annual broadleaf weeds under the mulch and around the planting hole. Sinbar will not control pigweed species. Condensation that forms on the underside of the mulch will activate the herbicide. Use the lower rate on fields with coarse-textured soils low in organic matter. Use the higher rates on fields with fine-textured soil and those with high organic matter. Sinbar may be used for direct seeded or transplanted watermelons. **DO NOT apply "over the top" or allow spray to contact crop foliage, or injury may result. Observe a 70 day PHI (PreHarvest Interval).**

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. Complete soil preparation, apply herbicide(s) under the mulch (see above), and lay plastic and trickle irrigation (optional) before herbicide application between the rows.

1. 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!**

2. Incorporate preemergence herbicide into the soil with ½ to 1 inch of rainfall or overhead irrigation within 48 hours of application.
3. 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).

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).

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 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 as a banded directed shielded spray 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.

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).

Flumioxazin 0.125 lbs. **A Special Local-Needs Label 24(c) has been approved for the use of Chateau SW in watermelons in Delaware only. This label is administered through the Delaware Fruit/Vegetable Association and requires a signed authorization and waiver of liability. Without a signed authorization and waiver this is a misuse of the product.** Apply Chateau SW up to 4 oz product to row middles of raised plastic-mulched beds that are at least 4 inches higher than the treated row middle and the mulched bed must be a minimum of a 24-inch bed width. Spray must remain between raised beds and contact no more than the bottom 1 inch of the side of the raised bed Do not apply after crops are transplanted/seeded. **All applications must be made with shielded or hooded equipment.** For control of emerged weeds, a burn down herbicide may be tank-mixed. Do not apply more than 4 oz during any single application. Tank-mixtures with labeled residual grass herbicides are allowed.

Fomesafen--0.16 to 0.25 lb/A. **A Special Local-Needs Label 24(c) has been approved for the use of Reflex 2E to control weeds in watermelon in Delaware, Maryland, and Virginia. 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.** Apply 10 to 12 fl oz/A in Virginia and 10 to 16 fl oz/A in Delaware or Maryland to row middles only prior to watermelon transplanting. If applying overtop of plastic mulch (broadcast) rate is 10 to 12 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 watermelon. 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. Watermelon 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.

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 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 1 year (12 month) period.**

Pendimethalin--1.0 lb/A. Apply 2.1 pints per acre Prowl H₂O as a banded directed shielded spray before transplanting, or before seeded crop has emerged. Activate with one-half inch of rainfall or sprinkler irrigation within 48 hours of application to control most annual grasses and certain broadleaf weeds. A second treatment at the same rate may be applied as a banded directed shielded spray postemergence a minimum of 21 days after the first application, but before the vines begin to run. **DO NOT apply "over the top" of the crop, or severe injury may occur. Observe a 35 day PHI (PreHarvest Interval).**

S-metolachlor--0.64 to 1.21 lb/A. **A Special Local-Needs Label 24(c) has been approved for the use of Dual Magnum 7.62E to control weeds between the rows of plastic mulch in watermelons in Delaware. The use of this product is legal ONLY if a waiver of liability is 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. Apply 0.67 to 1.27 pints per acre Dual Magnum 7.62E to control annual grasses, galinsoga, and certain other broadleaf weeds, and to suppress or control yellow nutsedge. Use as a surface-applied shielded and directed spray preemergence to the weeds before crop emergence or before transplanting. **DO NOT** apply Dual Magnum to the plastic mulch, or allow the spray to contact watermelon foliage. **DO NOT** preplant- incorporate Dual Magnum into the soil. Use the lower rate on fields with coarse-textured soils low in organic matter. Use the higher rates on fields with fine-textured soil and those with high organic matter. **Other generic versions of metolachlor and s-metolachlor may be available, and may or may not be labeled for use in the crop. Observe a minimum preharvest interval of 60 days.**

Terbacil--0.1 to 0.2 lb/A. Apply 2.0 to 4.0 dry ounces of Sinbar 80WP preemergence as a banded, shielded, directed spray between rows of plastic mulch to control many annual broadleaf weeds. Sinbar will not control pigweed species. Use the lower rate on fields with coarse-textured soils low in organic matter. Use the higher rates on fields with fine-textured soil and those with high organic matter. Sinbar may be used for direct seeded or transplanted watermelons. **DO NOT apply "over the top" or allow spray to contact crop foliage, or injury may result. Observe a 70 day PHI (PreHarvest Interval).**

Postemergence

Fomesafen--0.25 to 0.38 lb/A. **A Special Local-Needs Label 24(c) has been approved for this specific application timing of Reflex 2E to control weeds in watermelon in Delaware and Maryland ONLY. 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.** Apply 16 to 24 fl oz/A in Delaware or Maryland to row middles with shielded or hooded sprayers.

Make application before the vines begin to "run" off the plastic. Fomesafen should be tankmixed with additional herbicides 1.) to improve control of emerged weeds since it is weak on common lambsquarters and grass species and/or, 2.) if grass weeds are expected to emerge after application. Foliar application of Reflex will severely damage or kill watermelon. 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. Watermelon 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 and Maryland, 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 35 days of harvest.

Halosulfuron--0.023 to 0.031 lb/A. Apply 0.5 to 0.66 dry ounce Sandea 75WG as a banded, shielded, directed 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 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 1 year (12 month) period.**

Pendimethalin--1.0 lb/A. Apply 2.1 pints per acre Prowl H₂O as a banded directed shielded spray before transplanting, or before seeded crop has emerged. Activate with one-half inch of rainfall or sprinkler irrigation within 48 hours of application to control most annual grasses and certain broadleaf weeds emerging from seed (preemergence). Tank-mix with Gramoxone plus a nonionic surfactant or another recommended postemergence herbicide to control emerged weeds. **DO NOT apply "over the top" of the crop, or severe injury may occur. Observe a 35 day PHI (PreHarvest Interval).**

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 banded directed shielded spray between the rows of plastic mulch in Delaware, Maryland, New Jersey, Pennsylvania, and Virginia. Apply 2.4 pints per acre Gramoxone SL 2.0 or OLF as a banded directed shielded 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 (1.0 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 as a banded directed shielded spray 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. If rainfall does not occur, irrigate 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.

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.

Strategy is a **jug-mix** of ethalfluralin (Curbit 3E) and clomazone (Command 3ME). Refer to the chart under Ethalfluralin *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 ethalfluralin (Curbit) and clomazone (Command).

Fomesafen--0.16 to 0.25 lb/A. **A Special Local-Needs Label 24(c) has been approved for the use of Reflex 2E to control weeds in watermelon in Delaware, Maryland, and Virginia. 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 10 to 12 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 watermelon cracking the ground. Transplants: apply 10 to 12 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 watermelon. 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. Watermelon 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.

Halosulfuron--0.023 to 0.031 lb/A. Apply 0.5 to 0.75 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. 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 0.031 pound per acre, equal to 0.75 dry ounces of Sandea, applied preemergence, 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.**

Terbacil--0.1 to 0.2 lb/A. Apply 2.0 to 4.0 dry ounces of Sinbar 80WP preemergence to control many annual broadleaf weeds under the mulch and around the planting hole. Sinbar will not control pigweed species. Use the lower rate on fields with coarse-textured soils low in organic matter. Use the higher rates on fields with fine-textured soil and those with high organic matter. Sinbar may be used for direct seeded or transplanted watermelons. Apply to seeded watermelons after planting, but before emergence. Apply to transplanted watermelons before transplanting (PRE-transplant). **Do NOT apply "over the top" or allow spray to contact crop foliage, or injury may result. Observe a 70 day PHI (PreHarvest Interval).**

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 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 ft²).

Pollinators and Pesticides

Honeybees, squash bees, bumblebees and other wild bees are important for proper set and pollination. 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 hazard to bees.

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

Seed Corn Maggot

Maggot problems can occur in the field and in transplant bedding trays in the greenhouse. An application of a soil-incorporated insecticide may be needed immediately before planting. Also, see Chapter E "Maggots" section in "Soil Pests--Their Detection and Control". **Note:** The use of imidacloprid at planting may reduce seed corn maggot populations.

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
dimethoate--0.5 to 1.0 pt/A Dimethoate 400 (or OLF)
flonicamid--2.0 to 2.8 oz/A Beleaf 50 SG
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 (or other labeled mixtures containing thiamethoxam like Durivo and Voliam Flexi)
zeta-cypermethrin+ avermectin B1-19.0 fl oz/A Gladiator

Beet Armyworm

chlorantraniliprole--soil/drip/foliar 3.5 to 5.0 fl oz/A Coragen 1.67SC
flubendiamide--1.5 fl oz/A Belt 4SC (or other labeled mixtures containing flubendiamide like Vetica)
indoxacarb--3.5 to 6.0 oz/A Avaunt 30WDG
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
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+ 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 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 (or other labeled mixtures containing chlorantraniliprole like Voliam flexi)
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 (or other labelled mixtures containing flubendiamide like 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 3.2EC (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**
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

Cucumber Beetle

Watermelons are resistant to bacterial wilt; however, control may be needed to prevent feeding damage to seedlings. Seeds pretreated with a neonicotinoid seed treatment such Farmore DI-400 should provide up to 21 days of control of cucumber beetle. Otherwise, treat with one of the following formulations when an average of two beetles per plant is found.

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
 fenprothrin--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)
 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
 permethrin--4.0 to 8.0 fl oz/A Perm-Up 3.2EC (or OLF)
 thiamethoxam--**soil** 1.66 to 3.67 oz/A Platinum 75SG, **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--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 the "Cutworms" section in Soil Pests--Their Detection and Control.)

Apply one of the following formulations:

beta-cyfluthrin--0.8 to 1.6 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 (or other labelled 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
 methomyl--(granulate cutworm) 1.5 to 3.0 pts/A Lannate LV
 permethrin--4.0 to 8.0 fl oz/A Perm-Up 3.2EC (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
 dimethoate--0.5 to 1.0 pt/A Dimethoate 400 (or OLF)
 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

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 75SG, **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 fl 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 Sevin, or the 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 lbs/A Acramite 50WS
 etoxazole--2.0 to 3.0 oz/A Zeal Miticide¹
 fenpyroximate--2.0 pts/A Portal XLO
 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. Use 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 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 (or other labeled mixtures containing flubendiamide like 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 3.2EC (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**
 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

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, 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 (or other labelled 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
- methoxyfenozide--4.0 to 10.0 fl oz/A Intrepid 2F
- spinetoram--5.0 to 10.0 fl oz/A Radiant 1SC
- spinosad--6.0 to 8.0 fl oz/A Entrust 2SC **OMRI listed**
- thiamethoxam +chlorantraniliprole—**soil** 10.0 to 13.0 fl oz/A Durivo, **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 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 **OMRI listed**
- 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 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

(table continued)

Pesticide (continued)	Use Category ¹	Hours to Reentry ²	Days to Harvest ³
INSECTICIDE (continued)			
bifenthrin	R	12	3
bifenazate	G	12	3
carbaryl	G	12	3
chlorantraniprole	G	4	1
clothianidin (soil/foliar)	G	12	21/7
cyfluthrin	R	12	0
cyromazine	G	12	0
dimethoate	G	48	3
dinotefuran (soil/foliar)	G	12	21/1
esfenvalerate	R	12	3
etoxazole	G	12	7
fenpropathrin	G	24	7
fenpyroximate	R	12	3
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
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+avermectinB1	R	12	7
zeta-cypermethrin+bifenthrin	R	12	3
FUNGICIDE (FRAC code)			
Actigard (Group P1)	G	12	0
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
Luna Experience (Groups 7 + 3)	G	12	7
Luna Sensation (Groups 7 + 11)	G	12	0
mancozeb (Group M3)	G	24	5
Merivon (Groups 11 + 7)	G	12	7
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
Quintec (Group 13)	G	12	3
Rally (Group 3)	G	24	0
Ranman (Group 21)	G	12	0

(table continued next page)

Pesticide	Use Category ¹	Hours to Reentry ²	Days to Harvest ³
FUNGICIDE (FRAC code) (continued)			
Reason (Group 11)	G	12	14
Revus (Group 40)	G	4	0
Ridomil Gold (Group 4)	G	48	5
Switch (Groups 9 + 12)	G	12	1
Tanos (Groups 11 + 7)	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 D-6.

¹ G = general, R = restricted.

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

³ AP = At plant

Nematode Control

See Chapter E "Nematodes" section of Soil Pests-Their Detection and Control. Use fumigants listed in the "Soil Fumigation" in the same section or apply 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 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 480DP/100 pounds) and an approved commercially available insecticide.

Damping-Off

Apply the following in a 7-inch band at planting. Use formula 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 6F applied in transplant water, drip irrigation, or directed to the base of the plants and soil.

Bacterial Fruit Blotch (BFB)

Obtain seed or seedlings that were tested and found to have "no evidence" of the pathogen, which will reduce the risk of BFB development. Practice good sanitation during transplant production. Segregate different seed lots in the transplant house to reduce the chance of cross contamination. Scout seedlings daily, have suspect plants tested and destroy all diseased plants. Use only transplants from houses in which there were no seedling symptoms or fruit blotch disease. If BFB is detected after transplanting, always work infested fields at the end of the day. Rotate to allow 2 years between watermelon plantings and control volunteers during those years. Apply one of the following fungicide

schedules beginning before the first flower is open and continuing until three weeks after flowering. Subsequent fruit sets must also be protected.

copper, fixed--at labeled rates

copper plus Actigard--0.5 to 1.0 oz 50WG/A (Actigard applications must begin one or two weeks prior to flowering to be effective)

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.

Viruses (WMV2, PRSV, ZYMV, and CMV)

The most prevalent virus in the mid-Atlantic region is WMV2 followed by PRSV, ZYMV, and CMV. Plant fields as far away from existing cucurbit plantings as possible to help reduce the chances of aphid transmission of viruses from existing fields to new fields.

Ozone Injury

Ozone is a common air pollutant. When present in high concentrations in the atmosphere, ozone will cause chlorosis and upper surface bronzing and scorching on the older leaves, which leads to defoliation. 'Sugar Baby' is one of the more sensitive varieties.

Fusarium Wilt

Use a long rotation of at least 5 years and resistant varieties when possible. Several newly released seedless varieties have resistance to Fusarium wilt caused by race 1. However, their level of resistance is lower than in resistant seeded varieties and race 2 also occurs in our region. Some pollinizers have good resistance to Fusarium wilt caused by race 1.

Application of Proline--5.7 fl oz 480 SC/A through drip irrigation or as a post-plant drench, may reduce Fusarium wilt early season.

Anthracnose

Excellent resistance is available in some varieties and should be used when possible. Begin fungicide applications when vines run or earlier if symptoms are detected.

Under light or moderate disease pressure:

Alternate:

chlorothalonil--2.0 to 3.0 pt 6F/A or OLF (Use low rate early in season)

With:

chlorothalonil--2.0 to 3.0 pt 6F/A *plus* thiophanate-methyl--0.5 lb 70WP/A

mancozeb--2.0 to 3.0 lb 80DF/A *plus* thiophanate-methyl--0.5 lb 70WP/A

Under high disease pressure, tank-mix:

chlorothalonil--2.0 to 3.0 pt 6F/A

with one of the following fungicides:

Cabrio--12.0 to 16.0 oz 20EG/A

Fontelis--16 fl oz 1.6SC/A

Pristine--18.5 oz 38WG/A

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

Tanos--8.0 oz 50DF/A

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

And rotate every 7 days with:

chlorothalonil--2.0 to 3.0 pt 6F/A *plus* thiophanate-methyl--0.5 lb 70WP/A

mancozeb--2.0 to 3.0 lb 80DF/A or OLF *plus* thiophanate-methyl--0.5 lb 70WP/A

If resistance to FRAC code 11 (strobilurin) fungicides has been detected in the area, do not use Quadris, Quadris Top, Tanos or Cabrio.

Downy Mildew

Scout fields for disease incidence on a regular basis. Begin targeted sprays when 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 fungicide such as chlorothalonil--1.5 to 2.0 pt 6F/A or OLF):

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)

Zampro--14.0 fl oz 525SC/A

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

Previcur Flex--1.2 pt 6F/A

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

Forum 6.0 fl oz 4.17SC/A

Tanos--8.0 oz 50DF/A ,

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

Curzate--3.2 oz 60DF/A

Zing!--36 fl oz 4.9 SC/A

Presidio--4.0 fl oz 4SC/A

Materials with different Modes of Action (FRAC groups) should be alternated.

Sprays should be applied on a 7-day schedule when disease is forecast or present in region. Under severe disease conditions and conducive weather, spray interval may be reduced if label allows.

Alternaria Leaf Blight.

Begin sprays when vines begin to run.

Alternate one of the following:

chlorothalonil--2.0 to 3.0 pt 6F/A, or OLF (Use low rate early in season),

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

With:

Pristine--12.5 to 18.5 oz 38W/A,

a tank-mix of chlorothalonil *plus* one of the following every 14 days:

azoxystrobin--11.0 to 15.5 fl oz 2.08F/A or OLF (do not apply near apples, see label for details)

Cabrio--12.0 to 16.0 oz 20EG/A

Reason--5.5 fl oz 500SC/A

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

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

Luna Sensation--7.6 fl oz 4.25SC/A

If resistance to FRAC code 11 fungicides exist in the area, do not use Cabrio, Pristine, Quadris, Quadris Top

or Luna Sensation. Use a fungicide with a different FRAC code.

Gummy Stem Blight

Fungicide solo products within the FRAC code 11 (Cabrio, Quadris and Flint) are not recommended in the mid-Atlantic region. Pristine or Luna Sensation, which contain both FRAC code 11 and 7 components should always 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. Begin sprays when vines begin to run, apply the following:

Under low disease pressure:

chlorothalonil--2.0 to 3.0 pt 6F/A every 7 days

Under high disease pressure:**Alternate:**

chlorothalonil--2.0 to 3.0 pt 6F/A

With:

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

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

Proline--5.7 fl oz 480SC/A

tebuconazole--8.0 fl oz 3.6F/A or OLF **Note: reduced sensitivity of the pathogen to this fungicide has occurred in the Southern U.S.**

Fontelis--12.0 to 16.0 oz 1.67SC/A

Luna Experience--10.0 to 17.0 fl oz 3.34SC/A

Pristine--12.5 to 18.5 oz 38WG/A

Switch--11.0 to 14.0 oz 62.5WG/A

Merivon--5.5 fl oz 500SC/A

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

Phytophthora Crown and Fruit Rot

Multiple practices should be used to minimize the occurrence of this disease. Watermelon should be grown on raised beds and fields should be adequately drained to ensure that water does not accumulate around the base of the plants. Rotate away from susceptible crops (such as cucurbits, peppers, lima and snap beans, eggplants and tomatoes) for as long as possible. Preplant fumigants also will suppress disease. In addition, when the vines begin to run, subsoil between rows to allow for faster drainage following rainfall. Apply one of the following and always tank mix with fixed copper at labeled rates when conditions favor disease development (for suppression only):

Revus--8.0 fl oz 2.08 F/A

Ranman--2.75 fl oz 400SC (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

Zampro--14 fl oz 525SC/A

Tanos--8.0 to 10.0 oz 50DF/A *plus* mancozeb

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

Presidio may also be applied through the drip irrigation (see supplemental label for details). Soil drench followed by

drip application has given good results in some trials on crown rot caused by *Phytophthora capsici*.

Powdery mildew

This disease was observed for the past few seasons in Delaware and Maryland and could occur in other States. Detection of powdery mildew is more difficult in watermelons than in other cucurbits because sporulation is sparse and masked by leaf color. Look for chlorotic spots on upper leaf surface of young, fully expanded leaves, and then inspect the corresponding lower leaf surface with a hand lens to confirm presence of the fungus.

The fungus that causes cucurbit powdery mildew can develop 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.

Powdery mildew generally occurs from mid-July until the end of the season. Observe fields for the presence of powdery mildew. If one lesion is found on the underside of 45 old leaves, begin the following fungicide program:

Tank mix one of the following with chlorothalonil:

Quintec--6.0 fl oz 2.08SC/A *plus* chlorothalonil 2.0 or 3.0 pt 6F/A

Proline--5.7 fl oz 480 SC/A *plus* chlorothalonil 2.0 or 3.0 pt 6F/A

Torino--3.4 fl oz 0.85SC/A *plus* chlorothalonil 2.0 or 3.0 pt 6F/A

Vivando--15.4 fl oz 2.5SC/A *plus* chlorothalonil 2.0 or 3.0 pt 6F/A

Luna Experience--10.0 to 17.0 fl oz 3.34SC/A *plus* chlorothalonil 2.0 or 3.0 pt 6F/A

Luna Sensation--7.6 fl oz 4.25SC/A ***and alternate with one of the following:***

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 6 F/A

Rally--5.0 oz 40WSP/A *plus* chlorothalonil 2.0 to 3.0 pt 6 F/A

tebuconazole--4.0 to 6.0 fl oz 3.6F/A or OLF) *plus* chlorothalonil 2.0 to 3.0 pt 6 F/A

or

Fontelis--12.0-16.0 fl oz 1.67SC /A *plus* chlorothalonil--2.0 to 3.0 pt 6F/A

Materials with different modes of action (FRAC codes) should always be alternated.