

2026/2027

**Mid-Atlantic Commercial Vegetable
Production Recommendations**



F. Commodity Recommendations

Pesticide Use Disclaimer

THE LABEL IS THE LAW

A pesticide applicator is legally bound by the labeling found on and with the pesticide container in their possession. Before using a pesticide, check and always follow the labeling distributed with the product at the point of sale for legally enforceable rates and use restrictions and precautions.

Although labels are available on the Internet from electronic label services such as Proagrica's CDMS (<https://www.cdms.net/>), Greenbook (<https://www.greenbook.net/>), or Agworld DBX powered by Agrian (<https://www.agrian.com/labelcenter/results.cfm>) the information contained in these electronic labels may not be identical to the labeling distributed with the product. **Please be advised that these electronic label services provide use disclaimers, and in some cases legally binding *User Agreements* assigning ALL liability to user of service.** (See section D 3.1. Labels and Labeling for more detail.)

Guide to the Recommended Pesticide Tables in the Following Crop Sections:

1. Pesticides are listed by **group number or code based on chemical structure and mechanism of action**, as classified by the Herbicide Resistance Action Committee (HRAC, <https://hracglobal.com>) for herbicides, the Insecticide Resistance Action Committee (IRAC, <https://irac-online.org>) for insecticides, and the Fungicide Resistance Action Committee (FRAC, <https://www.frac.info/>) for fungicides. **In this guide, if the group number or code is in bold font, there are resistance concerns for the product.**
2. **Restricted use pesticides** are marked with a * in the Tables. These products may only be used by certified and/or licensed pesticide applicators, and when stated on the label, those making applications under their direct supervision. Some labels may restrict use solely to certified and/or licensed applicators. (See section D 3.2.1 Restricted Use Classification Statement for more detail).
3. **In addition to the pesticide products listed in the Commodity Recommendations below, other formulations or brands with the same active ingredient(s) may be commercially available. ALWAYS CHECK THE LABELING ON THE PRODUCT CONTAINER ITSELF:**
 - a) to ensure a pesticide is labeled for the same intended use,
 - b) to ensure the pesticide is labeled for the desired crop,
 - c) for differences in application rates and % active ingredient(s), and
 - d) additional restrictions.
4. All pesticide recommendations contained in this document are prescribed for spray applications to a **broadcast area of 1 acre** (43,560 square feet). **Adjust the rate accordingly for banded applications** (See section E 1.3. Calibrating Granular Applicators) **or for chemigation** (check labels for amounts per 1,000 feet).
5. Check the physical product label for and do not exceed the maximum amount of pesticide *per application* and the maximum number of applications *per year*.
6. **Bee Toxicity Rating (Bee TR):** N=nontoxic; L=minimum impact on bees; M=moderately toxic, can be used if dosage, timing, and method of application are correct, but should NOT be applied directly to the crop if bees are present; H=highly toxic, severe losses expected, -- = data not available.
7. In accordance with the USDA National Organic Program, the Organic Materials Research Institute (OMRI) maintains a directory of all products that OMRI has determined are allowed for use in organic production, processing, and handling. These products are catalogued online in the **OMRI Products List** (see <https://www.omri.org/omri-lists>).

If you are having a **medical emergency** after using pesticides, always **call 911** immediately.



In Case of an Accident

- Remove the person from exposure
- Get away from the treated or contaminated area immediately
- Remove contaminated clothing
- Wash with soap and clean water
- Call a physician and/or the National Poison Control Center (1-800-222-1222).
Your call will be routed to your State Poison Control Center.
- Have the pesticide label with you!
- Be prepared to give the EPA registration number to the responding center/agency

Tomatoes

Recommended Varieties (listed in alphabetical order within type)

Market Tomatoes

Type	Variety ¹	Color	Season	Culture	Use ²	Disease Resistance ³	Plant Habit ⁴
Globe	Amelia	Red	Mid	Field	LW, S	V,F,Tswv	D
	Bella Rosa	Red	Mid	Field	DM, LW, S	V,F,Asc,Gls,Tswv	D
	BHN 589	Red	Mid	Field, High Tunnel	DM, LW	V,F,Tomv	D
	BHN 602	Red	Mid, Late	Field	DM, LW, S	V,F,Tswv	D
	BHN 871	Yellow	Mid	Field, High Tunnel	DM, LW	V,F,Tomv	D
	BHN 964	Red	Mid	Field	DM, LW, S	V,F,Tomv,Eb	D
	BHN 1021	Red	Mid	Field, High Tunnel	DM, LW	V,F,Tomv, Tswv	D
	Biltmore	Red	Mid	Field	DM, LW,	V,F,Asc,Gls	D
	Camaro	Red	Mid	Field	LW, S	V,F,Gls, Asc, Tylc	D
	Carolina Gold	Yellow	Mid	Field	DM, LW	V,F	D
	Charger	Red	Mid	Field, High Tunnel	DM, LW, S	V,F,Gls,Asc,Tylc	D
	Defiant	Red	Mid	Field	DM, LW	V,F,Lb, Eb	D
	Dixie Red	Red	Mid	Field	DM, LW, S	V,F,N,Gls,Tswv,Asc	D
	Florida 47R	Red	Mid	Field	LW, S	V,F,Asc,Gls	D
	Florida 91	Red	Mid, Late	Field	DM, LW, S	V,F,Asc,Gls	D
	Grand Marshall	Red	Mid	Field, High Tunnel	DM, LW, S	V,F,Gls, Asc, Tylc	D
	Lemon Boy	Yellow	Mid	Field, High Tunnel	DM, LW	V,F,N	I
	Mountain Glory	Red	Mid	Field	DM, LW, S	V,F,Gls,Tswv	D
	Mountain Merit	Red	Mid	Field	DM, LW, S	V,F,N,Tswv, Lb,	D
	Mountain Spring	Red	Mid	Field	DM, LW	V,F	D
	Phoenix	Red	Mid, Late	Field	LW, S	V,F,Asc,Gls	D
	Primo Red	Red	Early	Field	DM, LW, S	V,F,Tomv	D
	Red Bounty	Red	Mid, Late	Field, High Tunnel	DM, LW	V,F,N,Gls,Tswv	D
	Red Defender	Red	Mid	Field	DM, LW, S	V,F,N,Tswv	D
	Red Deuce	Red	Mid	Field	DM, LW, S	V,F,Tomv,Gls,Asc	D
	Red Morning	Red	Mid	Field	DM, LW, S	V,F, Tomv, Tswv	D
	Red Mountain	Red	Mid	Field, High Tunnel	DM, LW, S	V,F,Tswv	D
	Red Snapper	Red	Mid, Late	Field	DM, LW, S	V,F,Asc,Gls,Tswv,Tylc	D
	Roadster	Red	Early	Field, High Tunnel	DM, LW, S	Asc, F, For, V, Gls, ToBRFV, Tswv	D
	Rocky Top	Red	Mid	Field, High Tunnel	DM, LW, S	V,F,Gls	D
	Scarlet Red	Red	Mid	Field, High Tunnel	DM, LW, S	V,F	D
	STM 2255	Red	Early	Field	DM, LW, S	V,F,Asc,Gls,Tswv,Tylc	D
	Sunbrite	Red	Early	Field, High Tunnel	DM, LW, S	Asc, V,F,Gls	D
	SV 7101	Red	Late	Field	DM, LW, S	V,F,Asc,Gls,Tswv	D
	Volante	Red	Mid	Field	DM, LW, S	V,F,Gls,Asc, Tswv	D

¹All varieties are hybrids. ²DM=Direct Market, LW=Local Wholesale, S=Shipping. ³Resistances or tolerances: Asc=Alternaria Stem Canker, Eb=Early Blight, F=Fusarium Wilt, For=*Fusarium oxysporum* f. sp. *radicis-lycopersici*, Gls=Gray Leaf Spot, Lb=Late Blight, N=Root-knot Nematode, ToBRFV=Tomato brown rugose fruit virus, Tomv=Tomato Mosaic Virus, Tswv=Tomato Spotted Wilt Virus, Tylc=Tomato Yellow Leaf Curl Virus, V=Verticillium Wilt. ⁴D=Determinate, I=Indeterminate.

Heirloom Tomatoes

Type	Variety	Color	Size	Maturity	Plant Habit
Beefsteak	Brandywine Red	Red skin, red flesh	Large	Late	I, potato leaf
	Mortgage Lifter	Pink skin, Pink flesh	Large	Late	I
Globe	Cherokee Purple	Burgundy	Medium-Large	Mid	I
	Prudens Purple	Deep pink skin and flesh	Large	Mid	I, potato leaf
Round	Eva Purple Ball	Deep pink skin and flesh	Medium	Mid	I
	Green Zebra	Yellow-gold with dark green strips	Medium	Mid	I
Small pear	Yellow Pear	Yellow skin and flesh	Small	Late	I

Cherry, Grape, Plum, and Cluster Tomatoes

Type	Variety	Color	Disease Resistance ²	Plant Habit ³
Cherry	Artemis	Red	F,Tmv,Tomv, N	
	BHN 762	Red	V,F	D
	Sun Gold	Orange	F, Tomv	I
	Sun Sugar	Orange	F, Tmv	I
	Sweet Treats	Pink	F,Tomv,Gls	I
Grape	BHN 784	Red	F	D
	Cupid	Red	F, Asc	I
	Jolly Girl	Red	V, F	D
	Mini Charm	Red	V,F,Tomv	I
	Mountain Honey	Red	V, F,Tswv, Lb	SD
	Smarty	Red	V, F	I
	Valentine ⁴	Red	Eb	I
Large Grape	Juliet	Red	Eb, Lb	I
Plum	Daytona	Red	Asc, F, N, V	D
	Mariana	Red	V,F,N,Asc	D
	Picus	Red	V,F,Asc,Gls,Tswv	D
	Plum Crimson	Red	V,F	D
	Plum Regal	Red	V,F,Lb,Tswv,	D
	Pony Express	Red	V,F,N,Tomv,Bs	D
Small cluster	Mt. Magic	Red	V,F,Lb	I

¹All varieties are hybrids. ²Resistances or tolerances: Asc=Alternaria Stem Canker, Bs=Bacterial Speck, Eb=Early Blight, F=Fusarium Wilt, GlS=Gray Leaf Spot, Lb=Late Blight, N=Root-Knot Nematode, Tmv=Tobacco Mosaic Virus, Tomv=Tomato Mosaic Virus, Tswv=Tomato Spotted Wilt Virus, V=Verticillium Wilt. ³D=Determinate, SD=Semi Determinate, I=Indeterminate. ⁴High lycopene.

Processing Tomatoes

Type	Variety	Season	Disease Resistance
Processing	H-3402	Mid	V,F,N,Bs
	H-3406	Full	V,F,Bs,Eb,Bc

All processing varieties are hybrids. Most plantings are contracted by processor; consult with processor to determine preferred varieties. Disease resistance or tolerance: Asc=Alternaria Stem Canker, Bs = Bacterial Speck, Bc=Bacterial Canker, Eb = Early Blight F=Fusarium Wilt, N=Root-knot Nematode, V=Verticillium Wilt.

Recommended Nutrients Based on Soil Tests

In addition to using the table below, check the suggestions on rate, timing, and placement of nutrients in your soil test report and Chapter B Soil and Nutrient Management. Your state's soil test report recommendations and/or your farm's nutrient management plan supersede the recommendations found below.

Tomatoes ^{1,2}		Soil Phosphorus Level				Soil Potassium Level				
		Low	Med	High (Opt)	Very High	Low	Med	High (Opt)	Very High	
	N (lb/A)	P ₂ O ₅ (lb/A)				K ₂ O (lb/A)				Nutrient Timing and Method
Bareground Fresh Market	80-90	200	150	100	0 ³	300	200	100	0 ³	Total nutrient recommended
	40-45	200	150	100	0 ³	300	200	100	0 ³	Broadcast and disk-in
	40-45	0	0	0	0	0	0	0	0	Sidedress when first fruits are set
Processing Machine Harvest	50-75	200	150	100	0 ³	250	150	100	0 ³	Total nutrient recommended
	25	200	150	100	0 ³	250	150	100	0 ³	Broadcast and disk-in
	25-50	0	0	0	0	0	0	0	0	Sidedress at first cultivation
Polyethylene Mulched Fresh Market	120-200	200	150	100	0 ³	300	200	100	0 ³	Total nutrient recommended
	0	200	150	100	0 ³	150	100	50	0	Broadcast and disk-in
	50	0	0	0	0	0	0	0	0	Incorporate into the plant bed before laying polyethylene mulch
	70-150	0	0	0	0	150	100	50	0 ³	Fertigate 0.5 to 2.5 lb/day. See chart and Drip/Trickle Fertilization section

¹Apply 1-2 lb/A of boron (B) with broadcast fertilizer; see also Table B-7. in Chapter B Soil and Nutrient Management. ²Apply 20-30 lb/A of sulfur (S) for most soils. ³In VA, crop replacement values of 50 lb/A of P₂O₅ and 50 lb/A of K₂O are recommended on soils testing Very High. ⁴Bareground includes organic mulches that allow irrigation or rainfall to reach the soil.

Irrigation

The basic principle for an adequate irrigation plan is that the total amount of water applied to the crop should be equal to its requirement plus the volume lost through evaporation and runoff. Different methods are available for estimating crop water requirements. If available, a simple adjustment of the historic local reference evapotranspiration should give a good reference for the volume of water to apply. The reference evapotranspiration represents the fraction of the water lost via evaporation and transpiration from a soil surface covered with a reference crop. This reference can be adjusted using a crop-specific coefficient (K_c), which represents the transpiration portion of the system. A generally accepted range of crop coefficient for tomato is: Initial = 0.60 (1 to 4 weeks), mid-season = 1.15 (4 to 10 weeks), end of season = 0.90 (10 to 12 weeks). To facilitate the estimation of the evaporation, crop transpiration, and irrigation requirements, “Decision Support Systems” based on tomato crop growth models and water balance have been developed by academic institutions (*i.e.*, see <https://cropmanage.ucanr.edu/>) and private companies, and upon registration or subscription, offer site-specific and real-time recommendations, suggesting when and how much to irrigate, using minimum information inputs on soil texture and crop cycle. Other useful tools are soil-moisture sensors and tensiometers, which can help determine the adequate frequency and volume of irrigation. The sensors help maintain a specific range of plant available water within the soil profile. Soil-water sensors can measure the soil water potential and/or estimate the volumetric soil moisture content. Based on these indicators, plant-available water in the soil should be maintained below soil capacity and above the permanent wilting point. These two standards depend on the soil texture and should be identified before establishing an irrigation program.

Drip/Trickle Fertigation

Before laying plastic mulch, adjust soil pH to 6.5 and broadcast and disk-in preplant nutrients (see table above). Apply the balance of your needed K_2O that you do not plan to apply via fertigation as a modified broadcast application, treating only the mulched area. Nitrogen fertilizer should be incorporated into the bed or split between incorporated and a surface band bed treatment immediately before laying plastic mulch.

After laying plastic mulch and installing the trickle irrigation system, apply completely soluble fertilizer through the drip system weekly to supply additional N and K_2O throughout the season and adjust rates as necessary based on soil and tissue tests (see tables below). For more information, see **Fertigation Rates for Drip Irrigated Plasticulture Crops** in section C.3 Fertigation.

Fertigation Schedule Examples for Fresh Market Tomatoes

This table provides examples of fertigation schedules based on two common scenarios – sandy coastal plain soils and heavier upland soils. Modify according to specific soil tests and base fertility.

Fertigation recommendations for 150 lb N and 150 lb K_2O ^{1,2}								
For soils with organic matter content less than 2% or coarse texture and low to medium or deficient K								
Preplant (lb/A) ³			Nitrogen			Potash		
			50			125		
			N	N	N	K_2O	K_2O	K_2O
Stage and Description	Weeks	Days	lb/day	lb/week	lb/stage	lb/day	lb/week	lb/stage
1 Early vegetative	1-2	1-14	0.5	3.5	7	0.5	3.5	7
2 Late vegetative	3-4	15-28	0.7	4.9	9.8	0.7	4.9	9.8
3 Early flowering	5-6	29-42	1.0	7	14	1	7	14
4 Flowering and fruiting	7-8	43-56	1.5	10.5	21	1.5	10.5	21
5 Early harvest	9-11	57-77	2.2	15.4	46.2	2.2	15.4	46.2
6 Later harvest ⁴	12-14	78-98	2.5	17.5	52.5	2.5	17.5	52.5
Fertigation recommendations for 75 lb N and 75 lb K_2O ^{1,2}								
For soils with organic matter content greater than 2% or fine texture and high or optimum K								
Preplant (lb/A) ³			Nitrogen			Potash		
			50			50		
			N	N	N	K_2O	K_2O	K_2O
Stage and Description	Weeks	Days	lb/day	lb/week	lb/stage	lb/day	lb/week	lb/stage
1 Early vegetative	1-2	1-14	0.25	1.75	3.5	0.25	1.75	3.5
2 Late vegetative	3-4	15-28	0.35	2.45	4.9	0.35	2.45	4.9
3 Early flowering	5-6	29-42	0.5	3.5	7	0.5	3.5	7
4 Flowering and fruiting	7-8	43-56	0.75	5.25	10.5	0.75	5.25	10.5

Fertigation recommendations for 75 lb N and 75 lb K_2O ^{1,2} - continued next page

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Fertigation recommendations for 75 lb N and 75 lb K₂O^{1,2}

For soils with organic matter content greater than 2% or fine texture and high or optimum K - continued

5 Early harvest	9-11	57-77	1.1	7.7	23.1	1.1	7.7	23.1
6 Later harvest⁴	12-14	78-98	1.25	8.75	26.25	1.25	8.75	26.25

¹Rates above are based on 7,260 linear bed ft/A (6 ft bed spacing). If beds are closer or wider, fertilizer rates should be adjusted proportionally. Drive rows should not be used in acreage calculations. See section C 3. Fertigation for more information. ²Base overall application rate on soil test recommendations. ³Applied under plastic mulch to effective bed area using modified broadcast method. ⁴For extended harvest after 10 weeks continue fertigation at this rate.

Plant Tissue Testing

Plant tissue testing can be a valuable tool for assessing crop nutrient status during the growing season, aiding in-season fertility programs or evaluating potential deficiencies or toxicities. Critical tomato tissue test values for most recently matured leaves at first flower are: 2.8-4.0 %, P 0.2-0.4 %, K 2.5-4.0 %, Ca 1.0-2.0 %, Mg 0.25-0.5% and S 0.3-0.6%. For additional nutrients and other growth stages, consult a tissue testing laboratory or check the following University of Florida website: <https://edis.ifas.ufl.edu/publication/ep081>.

Plant Petiole Sap Testing

Plant petiole sap testing may also be used to assess crop nutrient status during the growing season, to aid with in-season fertility programs, or to evaluate potential deficiencies or toxicities. The plant petiole sap can be analyzed directly on the farm using rapid, portable tools, such as NO₃-N and K ion-selective electrodes, or sent to a commercial service lab for analysis. To obtain reliable information from the plant petiole sap testing, it is important to sample leaf petioles from multiple plants across the field, and be consistent with daily sampling time (to avoid the influence of daily variations in the composition of the plant sap), and in selecting leaves of the same age (to avoid variations of the nutrient concentration within the plants).

	Fresh Petiole Sap Concentration (ppm)	
Tomato Developmental Stage	NO₃-N	K
First buds	1000-1200	3500-4000
First open flowers	600-800	3500-4000
Tomato Developmental Stage	NO₃-N	K
Fruits 1 inch diameter	400-600	3000-3500
Fruits 2 inch diameter	400-600	3000-3500
First harvest	300-400	2500-3000
Second harvest	200-400	2000-2500

Seed Treatment

Purchase hot water treated seed if possible, or request hot water seed treatment. Hot water treatment is administered to eradicate bacterial pathogens. For more information, see Disease Control below. The germination rate of tomatoes is strongly influenced by temperature, with a minimum temperature for germination ranging from 48°F to 55°F, depending on the selected cultivar.

Grafting

Grafting of fresh-market tomatoes into rootstocks that confer resistance or tolerance to soil-borne pests and diseases is practiced as an alternative to chemical soil fumigation and may increase plant vigor, impacting water and nutrient requirements, plant density, pruning, and training, as well as fruit yield and quality. Although it would likely increase the overall production cost of the system, the return on investment of grafted plants should be estimated considering specific farm (soil-borne pest and pathogen, abiotic stressors, labor availability, crop cycle length, and earliness) conditions. Grafting tomato plants into vigorous rootstocks is also used to enhance plant tolerance to abiotic stress conditions, including non-optimal temperatures, excess or deficiency of nutrients, salinity, drought, or alkalinity stress. **To find rootstocks commonly used for tomatoes, and their disease resistance or susceptibility, go to:** <http://www.vegetablegrafting.org/resources/rootstock-tables/solanaceous-rootstocks/>

Hardening Transplants

Hardening seedlings before field planting is recommended. However, hardening by exposure to cool temperatures 60-65°F (16-18°C) day and 50-60°F (10-16°C) night for one week or more causes catfacing. No growth will occur below 53°F (12°C). Instead, harden plants by withholding N and reducing water; allow plants to wilt slightly between light waterings.

Fresh Market

The yield, fruit size, and quality of fresh market tomatoes are increased using plastic mulch in combination with trickle irrigation and fertigation. Form raised, dome-shaped beds to aid in disease control. Lay 4 ft wide black, white, or reflective plastic mulch tightly over the beds. Farmers in warmer areas of the Mid-Atlantic region should consider using white or reflective mulch, instead of black mulch. For early summer harvest of fresh-market tomatoes, start transplanting April 10-20 in southern or normally warmer areas, and May 10-25 in cooler, northern areas.

Ground Culture: Space determinate-vined varieties in rows 4-6 ft apart with plants 18-24 inches apart in the row. 24-inch spacing is recommended for grafted plants. For indeterminate varieties, space rows 5-6 ft apart with plants 24-36 inches apart in the row.

Stake Culture: Staking tomatoes is a highly specialized production system. Staking improves fruit quality by keeping plants and fruit off the ground and allows for better spray coverage. Staked tomatoes are easier to harvest than non-staked tomatoes. The recommendations below are for the short-stake cultural system using determinate cultivars that grow 3-4 ft tall. Row widths of 5-6 ft with in-row spacings of 18-24 inches between plants are recommended. Farmers should consider transitioning to fiberglass stakes over wooden stakes, given that they last longer, are easier to handle, weigh less, and do not harbor the inoculum of pathogens like the traditional wooden stakes, thus, facilitating their reutilization for multiple seasons. In high tunnels, determined tomato varieties may also be trellised using hanging metallic supports, or in the case of indeterminate tomato varieties, plants may be trellised using twine and hanging hooks.

Pruning is practiced to establish a desired balance between vine growth and fruit growth. Depending on the *variety*, little to no pruning results in a plant with a heavy load of smaller fruit. Moderate pruning results in fewer fruits that are larger and easier to harvest. Pruning can result in earlier maturity of the crown fruit, can facilitate harvest, and improve spray coverage and pest control. The pruning method is variety and fertility dependent. Less vigorous determinate cultivars generally require less or no pruning. Growers should experiment with several degrees of pruning on a small scale to determine pruning requirements for specific cultivars and cultural practices.

Removing all suckers up to the one immediately below the first flower cluster is adequate for most determinate cultivars. Removing the sucker immediately below the first flower cluster or pruning above the first flower cluster can result in severe leaf curling and stunting of the plant. Prune when the suckers are 2-4 inches long. A 2nd pruning may be required to remove suckers that are too small to be easily removed during the 1st pruning and to remove ground suckers that may develop. Pruning when suckers are too large requires more time and can damage the plants, delay maturity, and increase disease incidence. Do not prune plants when they are wet to avoid the spread of bacterial diseases. Pruning should be done before the first stringing because the string can slow down the pruning process.

For indetermined tomato varieties continuous pruning of the suckers is necessary to facilitate the growth of one or two leaders, and trellising is also needed to support the continuous growth of the plant. For some varieties pruning the fruit clusters may be necessary to optimize fruit size and ripening.

Staking involves setting up a series of wooden or fiberglass stakes with twine woven around the stakes to train the plants to grow vertically off the ground. Stakes 4-4½-ft long by 1-inch square are driven approximately 12 inches into the soil between the plants.

Vigorous cultivars may require larger and longer stakes. A stake placed between every other plant is adequate to support most determinate varieties. Placing an additional stake at an angle and tied to the end stake of each section or row can strengthen the trellis system. Stakes can be driven by hand with a homemade driving tool or with a commercially available, power-driven stake driving tool. Drive stakes to a consistent depth so that spray booms can be operated in the field without damaging the trellis system. Select "tomato twine" that is resistant to weathering and stretching and that binds well to the wooden or fiberglass stakes. Tomato twine is available in 3-4-lb boxes and approximately 30 lb/A are required. To make tying convenient, use a homemade stringing tool made from a length of metal conduit, PVC pipe, broom handle, or wooden dowel. With conduit or PVC pipe, the string is fed through the pipe. With a broom handle or wooden dowel, two small parallel holes, each approximately ½-1 inch from the end, must be drilled to feed the string through one hole along the length of the tool and through the other hole. The tool serves as an extension of the worker's arm (the length cut to the worker's preference) and helps to keep the string tight.

Stringing consists of tying the twine to an end stake passing the string along one side of the plants, looping the twine around each stake until you reach the end of a row or section (100-ft sections with alleys may be helpful for

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harvesting). The same process continues on the other side of the row. The string tension must be tight enough to hold the plants upright, but harvest can be difficult, and strings can scar fruit if they are too tight.

The first string should be strung 8-10 inches above the ground when plants are 12-15 inches tall and before they fall over. Run the next string 6-8 inches above the preceding string before plants start to fall over. Three to 4 stringing rounds are required for most determinate varieties. Stringing should be done when the foliage is dry to prevent the spread of bacterial diseases.

Processing Tomatoes

Transplanting:

Processing tomatoes can be transplanted starting April 15-20 in warmer, southern areas to May 5-10 in PA and normally cooler areas. Successive plantings can be made through early June. Space transplants 9-12 inches apart in single rows 5 ft. apart or to accommodate machine harvesters. Small, determinate varieties may be grown in double rows. Space double rows 12 inches apart and space plants 12-18 inches apart in each of the double rows.

Fruit Ripening:

Ethephon is a growth regulator labeled for use on processing tomatoes. Proper application increases earliness and yield and decreases sorting of green fruit in machine-harvested tomatoes. Rate and time of application are critical for successful use, see state fact sheets and check product label for details.

Harvest and Post-Harvest Considerations

Depending on marketing requirement, tomatoes may be harvested at the **mature green stage** (when and after which the fruit cavity is filled by gel), **breaker stage** (just showing pink at the bottom of the fruit), **semi-ripe** (with different amounts of red pigmentation) or **fully ripe**. Tomato fruits are very perishable and subject to surface and internal damage and must be handled with care. Tomato fields should be harvested often and thoroughly to hasten the ripening of later fruits and reduce the range of ripeness if a specific stage is desired. Harvesting every day may be required during peak season. Remove all diseased, misshapen, and otherwise cull tomatoes from the vines as soon as they are discovered. Remove discarded tomatoes from the field to avoid the spread and buildup of diseases and insect pests. For standard slicing tomatoes, cherry tomatoes, and plum tomatoes, remove the stem during picking. Cluster tomatoes are harvested with the whole truss attached to fruits.

Tomatoes should be washed sufficiently to remove dust and foreign material, by hand or mechanically by spraying them with chlorinated water as they move over a set of soft brush rolls. The small amount of retained water may be removed by absorbent rollers alone or in combination with an overhead air-blast drier. The wash water should be several degrees warmer than the pulp temperature of the tomatoes to avoid drawing water and disease organisms into the fruit. The water should be chlorinated at the rate of 125 ppm. The chlorine level and pH (6 to 7) of the wash water should be checked at least hourly during the day with test papers or a meter. Tomatoes are then sized and separated by color and grade and carefully packed into 25 lb boxes.

Size Classification of Tomatoes

Size Designation	Minimum Diameter (inch)	Maximum Diameter (inch)
Extra small	1-28/32	2-4/32
Small	2-4/32	2-9/32
Medium	2-9/32	2-17/32
Large	2-17/32	2-28/32
Extra large	2-28/32	3-15/32

Color Classification of Tomatoes

Tomatoes may be graded into the following color classes (some classes may be combined).

Green	The surface of the tomato is completely green. The shade of green may vary from light to dark. Mature green fruits are typically ripened at the terminal market or by the repacker with ethylene gas.
Breakers	There is a definite break in the color from green to tannish yellow with pink or red skin covering not more than 10% of the surface.
Turning	More than 10% but not more than 30% of the surface, shows a definite change in color from green to tannish yellow, pink, red, or a combination of those colors.
Pink	More than 30% but not more than 60% of the surface shows pinkish red or red color.
Light Red	More than 60% but not more than 90% shows pinkish red or red color.
Red	More than 90 % of the surface shows red color.

Shipping

For long distance shipping, mature green harvest is the common practice. For local wholesale, harvest is usually at the breaker stage. For direct market, harvest is at the ripe stage. Store mature-green tomatoes at 55-70°F (13-21°C); breakers, partially ripe, and ripe fruit at 50°F (10°C) and at a relative humidity of 90-95%. Exposing tomatoes to temperatures below 50°F results in loss of color, shelf life, firmness, and flavor.

Tomato Disorders

Blossom-End Rot (BER):

This physiological disorder is caused by a deficiency and inadequate movement of calcium into the fruit. BER occurs at low soil moisture and is more severe when plants have small, shallow root systems. Symptoms occur first internally, and then extend to the external part of the fruit. Plastic mulch can restrict the movement of water to the root zone and increase BER. Hot, windy conditions increase water loss from the plant and increase the incidence of BER. Salinity and large proportions of $\text{NH}_4\text{-N}$ over $\text{NO}_3\text{-N}$ promote BER incidence as well.

Be sure soil calcium is sufficient and in balance with other essential plant nutrients. Test the soil and apply calcitic lime and fertilizer according to recommendations, then lay plastic mulch when soil moisture is optimal for planting. Apply irrigation to wet the root zone and encourage deep root development.

Blotchy Ripening, Graywall and Internal White Tissue:

These problems are a complex of physiological disorders and pathological diseases. Blotchy Ripening and Graywall often appear on shaded fruit growing in the interior of dense vegetative plants. Yellow-eye, a ring of yellow tissue surrounding the blossom scar, often occurs in fruit with blotchy ripening and internal white tissue.

Blotchy ripening is when areas of the fruit do not ripen or do so after the rest of the fruit is ripe. White or yellow blotches may appear on the surface of the fruit while the internal tissue is still hard. Usually, this disorder occurs on the upper portion of the fruit and there is no internal browning of the fruit. This disorder is more often seen during cool, wet, and cloudy conditions. It is worsened by too much or too little water. High N and/or low K will cause an increase in the disorder. Older varieties are often more susceptible to this disorder.

Research in California indicates that for proper fruit color development higher K levels than are necessary for yield alone are needed. Soils and plants with high K had lower levels of the disorder. Foliar applications of K were not totally effective in reducing the disorder. Work in Michigan suggests that soils high in organic matter (above 3.5%) helped to reduce the disorder in a tomato crop. In addition, soils with a pH of 6.4 had a low incidence of yellow shoulder while tomatoes grown on soils with a pH above 6.7 had a high incidence.

Growers should have K tissue levels of at least 3% before the fruit is one inch in diameter. In addition, the ratio of Magnesium (Mg) to Calcium (Ca) is important and a ratio of Mg:Ca of 1:4 to 1:6 should be maintained in the crop.

Graywall appears as grayish and sometimes sunken areas on a fruit. Internally the vascular tissue is brown resulting from collapse of the tissue. This can occur on the outer part of the fruit as well as in the center. It is usually more of a problem with cool, short days and often occurs in a late tomato crop. Graywall usually develops in green fruit but can occur as fruit is ripening. Fruit do not ripen properly and will have a blotchy appearance making them unmarketable. Graywall occurs on any part of the fruit. High N may increase the incidence of Graywall, and adequate K may reduce the problem. The disorder may also be caused by stress on the plants resulting from drought, excessive heat, root problems, severe nutrient deficiencies, etc. and there are varietal differences in susceptibility. This disorder is not clearly understood. Note that internal browning can also be caused by Tobacco Mosaic Virus.

Internal white tissue is a disorder where the fruit usually show no external symptoms. When a ripe, affected fruit is cut there will be white, hard areas found in the outer tissue and sometimes in the center of the fruit as well. High temperatures during ripening are believed to be the cause of this disorder. Maintaining adequate K in the soil may reduce but not eliminate it. Some varieties are more susceptible to this disorder, especially high colored varieties. This disorder can be severe enough to cause fruit to be unmarketable.

Catfacing:

Catfacing is where fruit are malformed and scarred, usually at the blossom end. It is caused by exposure of seedlings to 60-65°F (16-18°C) day temperatures and 50-60°F (10-16°C) night temperatures for 1 week, approximately 4 weeks before pollination. The first flower cluster is susceptible to low temperature-induced catfacing when

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seedlings have 4-5 true leaves. Fruit on later clusters will show catfacing if exposed to low temperatures in the field. Avoid hardening seedlings by exposure to low temperatures. Varieties differ in their susceptibility to the disorder.

Cracking:

Cracking is due to the rapid uptake of water, resulting in enlargement of cells and separation of the epidermis of the fruit. Water can be taken up through the roots or through the tissue around the stem scar. The type of cracking (concentric, radiating out from the stem, or diagonal or transverse cracks across the fruit) is determined primarily by fruit structure and variety. Different types of cracking may be present in a variety or an individual fruit.

The severity of cracking is determined by water availability, variety and maturity. As the fruit ripens, the bonding between cells progressively weakens, resulting in more severe cracking. High rainfall and irrigation, or frequent low to moderate rainfall, especially following a period of low soil moisture may increase cracking. To minimize cracking, select a crack-resistant variety, maintain a high calcium level in the soil and keep fruit growing at a uniform rate by maintaining uniform soil moisture levels. Maintain good fruit cover by proper fertilization and fungicide applications. Harvest fruit at the earliest stage of maturity that is acceptable by your market.

Puffiness:

Also known as boxiness or hollowness, this disorder creates flat-sided fruits or angular fruits with one or more seed cavities empty of tissue. Affected fruits are less dense and can be identified by flotation in water. Extremely low or elevated temperatures, high soil N concentrations, and low light conditions contribute to improper pollination which in turn contribute to the disorder.

Russetting:

Russetting, or weather checking of the surface of the fruit is caused by the presence of water on the fruit surface for extended periods of time when there are frequent light rainfalls, mist, fog, and dew. Wide fluctuations in temperature of exposed fruit also contribute to this disorder. Russetting can cause fruit to be unmarketable. Maintain good fruit cover by proper fertilization and fungicide applications. Use varieties that feature a dense canopy and resistance to foliar diseases.

Sunburn and Sunscald:

Sunburn and sunscald result from exposure to direct sunlight. Mild sunburn appears as yellowish or yellow-red color of fruit on the side exposed to the sun. Severe symptoms appear as whitish, water-soaked, scalded, or blistered areas. Sunscald is more severe on fruits that developed in shaded conditions but were exposed to direct sunlight after defoliation or harvesting. Under dry conditions, the white areas can become dry and leathery. Secondary infection can produce dark, dry rot. Under moist conditions, scalded areas can decay from secondary infections. To control sunburn and sunscald, select varieties with good fruit cover, supply sufficient water and nutrients to provide good vegetative growth and manage pests. Train workers to avoid turning vines during harvesting or to reposition vines to shade fruit. Kaolin clay may be sprayed on the crop to reduce sunscald.

Yellow Shoulders:

Yellowing may occur on the shoulders of fruit exposed to the sun, especially on varieties that have darker green shoulders when immature (those lacking the uniform ripening gene). The tissue beneath the yellow shoulder is usually corky and may vary from greenish white to pale yellow. Select varieties with the uniform ripening gene and provide good fruit cover as described above.

Weed Control

THE LABEL IS THE LAW-see the Pesticide Use Disclaimer on the first page of Chapter F.

Recommended Herbicides

1. Identify the weeds in each field and select recommended herbicides. More information is available in the "Herbicide Effectiveness on Common Weeds in Vegetables" (Table E-3) in Chapter E Pest Management.
2. Minimize herbicide resistance development. Identify the herbicide mode of action group number and follow recommended good management practices; **bolded group numbers in tables below are herbicides at higher risk for selecting resistant weed populations.** Include non-chemical weed control whenever possible.

Labeled Application Sites for Tomato									
Herbicide (* = Restricted Use)	HRAC group number	Plastic mulch production					Bareground production		
		Soil-Applied		Postemergence			Soil-applied	POST	Post-harvest
		Under Plastic	Row Middles	Over Plastic	Row Middles	Post-Harvest			
Sandea	2	YES ⁴	YES		YES		YES ²	YES	
League	2		YES		YES		row middle		
Prowl H2O	3		YES				YES ³		
Treflan	3		YES				YES ³		
Metribuzin	5	YES	YES		YES		YES	YES	
Devrinol	15	YES	YES				YES		
Dual	15	YES	YES				YES		
Select / Select Max Shadow 3EC	1			YES				YES	
Poast	1			YES				YES	
Matrix	2		YES		YES			YES	
Gramoxone* ¹	22				YES	YES			YES
Rely 280	10				YES				
Reglone ¹	22				YES	YES	YES ⁴		YES

¹Supplemental label, be sure it is registered for the specific state and for the intended use. ²Delay transplanting for 7 days after application; not labeled for direct seeding. ³Transplants only. ⁴Apply prior to planting or after seeding but prior to crop emergence.

1. Pre-Transplant Over Plastic

Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient	Active Ingredient Rate	PHI (d)	REI (h)
10	Rely 280 2.34L	29 to 43 fl oz/A	glufosinate	0.53 to 0.79 lb/A	30	12
-Ammonium sulfate (AMS) can be used at 1.5 lb/A to 3 lb/A. -Control is best when applied to weeds less than 4 inches, temperatures are above 80, high humidity, and bright sunlight. -Transplants can be injured if they come in contact with herbicide remaining on the plastic. Allow at least 3 days between application and transplanting. At least 0.5 inches of precipitation is needed to wash Rely off the plastic. Do not transplant within 27 days of application if no precipitation occurs. -DO NOT transplant into or within 6 inches of holes in the plastic mulch that were present at time of application. -Two applications can be made prior to transplanting. Do not apply more than 64 fl oz/A prior to transplanting; maximum number of applications is three per season. -Rainfastness is 4 h.						
22	Gramoxone SL 3.0*	1.3 to 2.7 pt/A	paraquat	0.5 to 1.0 lb/A	30	24
-Gramoxone can be used for preplant weed control over the top of plastic mulch. Sufficient rainfall or sprinkler irrigation is needed to wash off the Gramoxone prior to planting to prevent damage to the crop. -Restricted-use pesticide. Only certified applicators, who successfully complete the paraquat-specific training, can mix, load, or apply paraquat. Application of paraquat "under the direct supervision" of a certified applicator is no longer allowed. Required training link (https://campus.extension.org/enrol/index.php?id=2201); certified applicators must repeat training every three years. -Do not exceed 8 pt/A per season. -Rainfastness is 30 min.						

2. Soil Applied

Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient	Active Ingredient Rate	PHI (d)	REI (h)
2	Sandea 75DF	0.5 to 1.0 oz/A	halosulfuron	0.023 to 0.047 lb/A	30	12
-Plasticulture: under plastic application is labeled delay transplanting 7 days after herbicide application. Apply in a band under the plastic, immediately before laying the mulch; use on transplants only (not for seeded tomatoes), avoid herbicide treated soil from moving into the holes during transplanting. Plasticulture: labeled for row middle application with directed/shield application. -Bareground: for transplants only: apply preplant incorporated 7 days before transplanting; use on transplants only (not for seeded tomatoes), avoid herbicide treated soil from moving into the holes during transplanting. -Bareground: for directed-seeded apply as directed/shielded application to row middles -Suppresses or controls yellow nutsedge and certain broadleaf weeds. Sandea provides both residual and postemergence control of susceptible weed species. Effective postemergence control requires an adjuvant. -Sandea is an ALS inhibiting herbicide and resistant weed populations are common in the region. Do not use Group 2 herbicides repeatedly in the same field. 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. -Maximum Sandea applications per year is 2 and do not exceed 2 oz/A during the crop season.						

2. Soil Applied - continued next page

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2. Soil Applied - continued

2	League 75WDG	4 to 6.4 oz/A	imazosulfuron	0.19 to 0.3 lb/A	21	12
-Local research has only evaluated League as a row middle application for plasticulture and directed application between the rows for bareground production. -For control of emerged weeds be sure to include appropriate adjuvant (see label). -Movement of soil may reduce residual control. -Avoid rainfall or overhead irrigation (0.5 to 1 inch) within 12 hours of application. However, rainfall or irrigation within 5 days of application is needed to activate League. -League controls a limited number of species including common purslane and hairy galinsoga. -League is an ALS inhibiting herbicide and resistant weed populations are common in the region. -Do not use Group 2 herbicides repeatedly in the same field. -Do not apply League to crops treated with a soil applied organophosphate insecticide, or 21 days before a foliar applied organophosphate insecticide or 7 days after a organophosphate application. -Maximum League applications per year is 1 and do not exceed 6.4 oz/A during the crop season.						
3	Prowl H2O 3.8CS	1.0 to 3.0 pt/A	pendimethalin	0.48 to 1.42 lb/A	70	24
-Plasticulture: recommended for row middles only. Labeled for under plastic, but no local data or experience with this application. -Bareground: broadcast preplant or preplant incorporated before transplanting; not labeled for direct-seeded crop. -Avoid root contact with Prowl-treated soil when placing transplants into furrow or hole or injury may occur. -Prowl labeled for directed application to transplanted or established direct-seeded tomatoes; avoid contact with leaves or stems. -Prowl will not control emerged weeds, only provides residual control; row middle applications may be made with Gramoxone using shielded sprayers. Use the lower rate on coarse-textured or sandy soils. Activate with ½ inch of rainfall or sprinkler irrigation within 48 h of application to control most annual grasses and certain broadleaf weeds.-Maximum Prowl H2O application per season is 3 pt/A.						
3	Treflan 4E	1 to 2 pt/A	trifluralin	0.5 to 1.0 lb/A	--	12
-Plasticulture: labeled for row middles only. -Bareground: broadcast preplant or preplant incorporated before transplanting; not labeled for direct-seeded crop. All applications need to be mechanically incorporated. -Stunting may occur if the weather is cool and damp at time of transplanting. -Maximum application per season: not specified.						
5	Metribuzin 75DF Metribuzin 4L	0.33 to 0.66 lb/A 0.5 to 1 pt/A	metribuzin	0.25 to 0.5 lb/A	7	12
-Plasticulture: under plastic application is labeled; apply in a band under the plastic, immediately before laying the mulch; use on transplants only (not for seeded tomatoes), roots of the transplants need to be placed below the zone of treated soil. There is no local data and limited experience with this use. Plasticulture: labeled for row middle application with directed/shield application. -Bareground: broadcast preplant or preplant incorporated before transplanting; use on transplants only (not for seeded tomatoes), roots of the transplants need to be placed below the zone of treated soil. -Metribuzin primarily controls broadleaf weeds and is weak on grasses; tank mix to improve grass control. -Metribuzin has some postemergence activity. To get consistent control, apply metribuzin before weeds are 1 inch tall. -Rainfastness is 6 h. -Maximum for metribuzin 75DF: 1.33 lb/A per crop season; metribuzin 4L: 2 pt/A per crop season.						
15	Devrinol 2-XT 2EC Devrinol DF-XT 50DF	2 to 4 qt/A 2 to 4 lb/A	napropamide	1.0 to 2.0 lb/A	--	24
-Plasticulture: under plastic is labeled for seeded or transplanted tomatoes; apply in a band under the plastic, immediately before laying mulch. Use lower rate on coarse textured or sandy soil. Condensation that forms on the underside of the mulch will activate the herbicide. Plasticulture: row middles application is labeled. -Bareground: apply as broadcast, preemergence treatment for seeded and transplanted tomatoes. Rainfall or irrigation within 24 h after application improves performance (½ inch sprinkler irrigation). -Annual grasses and certain annual broadleaf weeds will be suppressed or controlled. May reduce stand and yield of fall planted small grain crop. Moldboard plowing will reduce the risk of injury. -Maximum Devrinol application per season: 4 qt/A (2-XT) or 4 lb/A (DF-XT).						
15	Dual Magnum 7.62E	1.0 to 2.0 pt/A	s-metolachlor	0.95 to 1.9 lb/A	30 to 90	24
-Plasticulture: under plastic is labeled transplanted tomatoes; apply in a band under the plastic, immediately before laying mulch. Use lower rate on coarse textured or sandy soil. Condensation that forms on the underside of the mulch will activate the herbicide. Plasticulture: row middles application is labeled. -Bareground: apply for preplant incorporated or broadcast, preemergence treatment before transplanting tomatoes. Seeded tomatoes can be treated when at least 4 inches tall at time of application and spray is directed at the soil and minimal amounts of herbicide contact tomato plants. Avoid moving treated soil into transplant holes. -Use lower rates on coarse-textured soils low in organic matter and higher rates on fine-textured soils with greater organic matter. -Application to varieties with unknown tolerance to Dual Magnum may result in crop injury. Transplants weakened by any cause may be injured by Dual Magnum. Plant healthy transplants and avoid planting when wet, cool, or unfavorable growing conditions exist. -Delaying transplanting for 7 days or more can reduce the risk of injury. -Do not harvest within 90 days of application if more than 1.33 pt/A was used per season; PHI is 30 days if 1.33 pt/A or less is used. -Do not exceed 2 applications per growing season.						
5+14	Authority MTZ Preview 2.1	Refer to labels for specific rates.	metribuzin + sulfentrazone	Refer to labels for specific rates.	--	--
-Processing tomatoes only. -Authority MTZ and Preview 2.1 are two prepackaged mixtures of sulfentrazone plus metribuzin, labeled for transplanted processing tomatoes only; preplant application only. The ratio of metribuzin and sulfentrazone differs for these two products, see table E-6 for specific ratios. -Local research has shown potential injury with sulfentrazone. -These rates of sulfentrazone will not provide extended residual control.						

3. Postemergence						
Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient	Active Ingredient Rate	PHI (d)	REI (h)
1	Shadow 3EC	4 to 10.67 fl oz/A	clethodim	0.07 to 0.24 lb/A	20	24
	Select 2EC	6 to 8 fl oz/A				
	Select Max 0.97EC	9 to 16 fl oz/A				
	Poast 1.5EC	1 to 1.5 pt/A	sethoxydim	0.2 to 0.28 lb/A	20	12
-Select 2EC: use crop oil concentrate (COC) at 1% v/v (1 gal/100 gal of spray solution). Select Max 0.97EC: use nonionic surfactant (NIS) at 0.25% v/v (1 qt/100 gal of spray solution). Shadow 3EC: use crop oil concentrate (COC) at 1% v/v (1 gal/100 gal of spray solution) for large or stressed grasses; use nonionic surfactant (NIS) at 0.25% v/v (1 qt/100 gal of spray solution) when crop safety is a concern. Poast 1.5EC: Apply with COC at 1.0% v/v. -General comments: -The use of COC may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, switch to NIS when grasses are small and soil moisture is adequate. -Use lower labeled rates for annual grass control and higher labeled rates for perennial grass control. For best results, treat annual grasses when they are actively growing and before tillers are present. -Yellow nutsedge, wild onion, wild garlic, and broadleaf weeds will not be controlled with these herbicides. -These herbicides control many annual and certain perennial grasses. Clethodim is best on annual bluegrass; while Poast is preferred for goosegrass control. -Repeated applications may be necessary to control certain perennial grasses. If repeat applications are necessary, allow 14 days between applications. -Rainfastness is 1 h. -Do not tank mix with or apply within 2 to 3 days of any other pesticide, unless labeled, as this may increase the risk of crop injury or reduce the control of grasses. -Do not apply more than 8 fl oz/A of Select 2EC in a single application and do not exceed 2 pt/A for the season; do not apply more than 16 fl oz/A of Select Max in a single application and do not exceed 4 pt/A for the season. -Do not apply more than 10.67 fl oz/A of Shadow 3EC in a single application and do not exceed 21.33 fl oz/A for the season. -Do not apply more than 1.5 pt/A Poast 1.5EC in a single application and do not exceed 4.5 pt/A for the season.						
2	Matrix 25DF	1.0 to 2.0 oz/A	rimisulfuron	0.0156 to 0.0312 lb/A	45	4
-Apply early postemergence but not before the crop has at least 2 full-sized true leaves (label allows applications as early as cotyledon stage of tomatoes; but no local data are available at that stage). Not recommended for over the top application with plasticulture. -Apply with nonionic surfactant at 0.25% v/v (1.0 qt/100 gal of spray solution); use of an adjuvant may cause temporary chlorosis, but symptoms usually disappear within 5 to 15 days. -Controls many weeds including foxtail species, pigweed species, wild mustard, and wild radish. Suppresses common lambsquarters, common ragweed, jimsonweed, morningglory species, and yellow nutsedge. Optimum performance is obtained when weeds are less than 1 inch in height and are actively growing. Tank mix with metribuzin to improve broadleaf weed control. -Best results occur with 0.5 inches of rainfall or irrigation no sooner than 4 h but not more than 5 days after application. -Matrix provides both residual and postemergence control of susceptible weed species. -Matrix is an ALS inhibiting herbicide and resistant weed populations are common in the region. Do not use Group 2 herbicides repeatedly in the same field. -Rainfastness is 4 h. -Maximum for Matrix: 4 oz/A per year.						
2	Sandea 75DF	0.5 to 1.0 oz/A	halosulfuron	0.023 to 0.047 lb/A	30	12
-Apply over the top, post directed, or with crop shields; not recommended for over the top application with plasticulture. -Apply to tomato plants that are established, actively growing and a minimum of 14 days after transplanting or after the 4th leaf stage of seeded tomatoes. Applications during bloom can cause bloom drop under certain environmental conditions. -Apply with nonionic surfactant at 0.25% v/v (1.0 qt/100 gal). -Provides control of yellow nutsedge and certain annual broadleaf weeds. Control of weeds taller than 3 inches may not be adequate. -Sandea provides both residual and postemergence control of susceptible weed species. -Sandea is an ALS inhibiting herbicide and resistant weed populations are common in the region. Do not use Group 2 herbicides repeatedly in the same field. 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. -Rainfastness is 4 h. -Do not apply more than 2 applications, or more than 2 oz/A of product, per crop cycle; do not exceed 2 oz/A per 12 month period.						
5	Metribuzin 75DF	0.33 to 0.66 lb/A	metribuzin	0.25 to 0.5 lb/A	7	12
	Metribuzin 4L	0.5 to 1 pt/A				
-Apply over the top, post directed, or with crop shields; not recommended for over the top application with plasticulture. The maximum rate for over the top application is 0.67 lb (75DF) or 1 pt (4L); and maximum rate for post directed is 1.33 lb (75DF) or 2 pt (4L). -Apply postemergence to transplants with at least 5 true leaves and have recovered from transplant shock (new growth evident) or at least 2 weeks after transplanting. Transplants with fewer than 5 true leaves are at greater risk of herbicide injury. -Do not use hot caps on tomatoes within 7 days before or after application. -Do not apply within 3 days after periods of cool, wet, or cloudy weather or crop injury will occur. -Do not apply within 24 h of applications of other pesticides. -Allow at least 14 days between applications or severe crop injury may occur. -Metribuzin primarily controls broadleaf weeds and is weak on grasses. -Metribuzin has some postemergence activity. To get consistent control, apply metribuzin before weeds are 1 inch tall. -Tank mix with appropriate postemergence herbicides if weeds are emerged at time of application. -Rates up to 1.3 lb of metribuzin 75DF or 2 pt of metribuzin 4L are labeled for directed applications, refer to label. -Maximum for metribuzin 75DF: 1.33 lb/A per crop season; metribuzin 4L: 2 pt/A per crop season.						

3. Postemergence - continued next page

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3. Postemergence - continued

10	Rely 280 2.34L	29 to 62 fl oz/A	glufosinate	0.53 to 1.13 lb/A	30	12
-Hooded spray application between the rows. -Ammonium sulfate (AMS) can be used at 1.5 lb/A to 3 lb/A. -Do not allow spray to come in contact with crop foliage or damage will occur. -Control is best when applied to weeds less than 4 inches, temperatures are above 80, high humidity, and bright sunlight. -Separate sequential applications by at least 14 days. -Do not apply more than 62 fl oz/A in a single application, do not apply more than 87 fl oz/A per season; maximum number of applications is three per season. -Rainfastness is 4 h.						
22	Reglone 2SL	1 qt/A	diquat	0.5	30	24
-Special Local Needs Label 24(c) in NJ (label has expired at the time of publication of these recommendations, check for update). -Apply as post-directed application to the row middles either prior to transplanting or with a hooded sprayer to row middles when transplants are well established. Do not allow spray to contact crop foliage. -Always include non-ionic surfactant at 2 pt/100 gal. Spray coverage is essential for optimum effectiveness. -Rainfastness 30 min. -A maximum of 2 applications during the growing season are allowed.						
22	Gramoxone SL 3.0*	1.3 pt/A	paraquat	0.49 lb/A	14	24
-Supplemental Label for postemergence weed control in DE, MD, NJ, PA, and VA. Row middles as a shielded application. -Apply as a directed spray in a minimum of 20 gal spray mix/A to control emerged weeds between the rows after crop establishment. Include a nonionic surfactant at 0.25% v/v. -Use shields or hoods to prevent spray contact with the crop and low spray pressure (maximum of 30 psi) to reduce small droplets that are prone to drift. See the label for additional information and warnings. -Rainfastness is 30 min. A maximum of 3 applications per year are allowed. -Restricted-use pesticide. Only certified applicators, who successfully complete the paraquat-specific training, can mix, load, or apply paraquat. Application of paraquat "under the direct supervision" of a certified applicator is no longer allowed. Required training link (https://campus.extension.org/enrol/index.php?id=2201); certified applicators must repeat training every three years.						

4. Postharvest

Group	Product Name (*=Restricted Use)	Product Rate	Active Ingredient	Active Ingredient Rate	PHI (d)	REI (h)
22	Reglone 2SL	1.5 pt/A	diquat	0.375	--	24
-Special Local Needs Label 24(c) for NJ for postharvest application to desiccate the crop (label has expired at the time of publication of these recommendations, check for update). -Apply after the last harvest for bareground or plasticulture. Always include non-ionic surfactant at 1 to 2 pt/100 gal. -Spray coverage is essential for optimum effectiveness, label recommends 60 to 100 gal/A. -Rainfastness 30 min.						
22	Gramoxone SL 3.0*	1.6 to 2.5 pt/A	paraquat	0.6 to 0.94 lb/A	--	24
-Apply after the last harvest for bareground or plasticulture. Always include an adjuvant. -Spray coverage is essential for optimum effectiveness. See the label for additional information and warnings. -Rainfastness 30 min. -A maximum of 2 applications for crop desiccation are allowed. -Restricted-use pesticide. Only certified applicators, who successfully complete the paraquat-specific training, can mix, load, or apply paraquat. Application of paraquat "under the direct supervision" of a certified applicator is no longer allowed. Required training link (https://campus.extension.org/enrol/index.php?id=2201); certified applicators must repeat training every three years.						

5. Other Labeled Herbicides These products are labeled but limited local data are available; and/or are labeled but not recommended in our region due to potential crop injury concerns.

Group	Product Name (*=Restricted Use)	Active Ingredient
2	Envoke	trifloxysulfuron
14	Aim (hooded or directed application only)	carfentrazone
14 + 5	Authority MTZ (transplant only)	sulfentrazone + metribuzin
14	Vida	pyraflufen
14	Spartan	sulfentrazone
14	Zeus	sulfentrazone

Insect Control

THE LABEL IS THE LAW-see the Pesticide Use Disclaimer on the first page of Chapter F. Recommended Insecticides Field Tomatoes (Fresh Market and Processing Tomatoes)

Note: For **premises**, the group number (representing the mode of action) and active ingredient that contributes the most to control is generally listed first. In some cases, only one ingredient in a premix provides control.

Aphids

Tomatoes in the Mid-Atlantic U.S. can suffer late-season infestations from green peach aphids or potato aphids. Frequent pyrethroid applications are often the cause of outbreaks of green peach aphid. Adequate coverage of the undersides of leaves is important for effective aphid control.

Apply one of the following formulations (thorough spray coverage between leaves is important):						
Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
1A	Lannate LV*	1.5 to 3.0 pt/A	methomyl	3	48	H
4A	Neonicotinoid insecticides registered for use on Tomatoes: see table at the end of Insect Control.					
4C	Transform WG	0.75 to 1.0 oz/A	sulfoxaflor	1	24	H
4C + 3A	Ridgeback*	5.5 to 13.8 fl oz/A	sulfoxaflor + bifenthrin	1	24	H
4D	Sivanto Prime	21.0 to 28.0 fl oz/A	flupyradifurone - soil	45	4	M
4D	Sivanto Prime	10.5 to 14.0 fl oz/A	flupyradifurone - foliar	1	4	M
9B	Fulfill 50WDG	2.75 oz/A	pymetrozine	0	12	L
9B	PQZ	2.4 to 3.2 fl oz/A	pyrifluquinazon	1	12	L
9D	Sefina	3.0 fl oz/A	afidopyropen	0	12	L
21A	Torac	17.0 to 21.0 fl oz/A	tolfenpyrad	1	12	H
23	Boxadon 360	2.1 to 3.4 fl oz/A	spirotetramat	1	24	L
23	Movento	4.0 to 5.0 fl oz/A	spirotetramat	1	24	L
23 + 7C	Senstar	8.0 to 10.0 fl oz/A	spirotetramat + pyriproxyfen	1	24	L
28 + 6	Minecto Pro* ¹	10.0 fl oz/A	cyantraniliprole + abamectin	7	12	H
29	Beleaf 50SG	2.8 to 4.3 oz/A	flonicamid - foliar & chemigation	0	12	L

¹Use of a non-sticker adjuvant is required.

Caterpillar “Worm” Pests Including:

Corn Earworms (=Tomato Fruitworms) (CEW), European Corn Borers (ECB), Beet Armyworms (BAW), Cabbage Loopers (CL), Hornworms, and Other Armyworms

Tomatoes are frequently attacked by various lepidopteran pest species. CEW (or Tomato Fruitworm) is the most important pest species, but a mix of any of the above-listed pest species can also contribute to “worm” damage on tomatoes. Local pheromone or blacklight traps are effective for monitoring key moth pest populations. Consult your Extension Agent or IPM alerts for information about trap catches. Also, visually inspecting plants and fruit or beat sheeting can help determine the presence or absence of lepidopteran pests. There is no reliable economic threshold. Note that not all lepidopteran pest species are listed on all the insecticide labels below, but, unless noted, these products have activity on all caterpillars. **Pyrethroid (Group 3A) resistance is common in BAW and CEW. There are resistance concerns with diamides (Group 28) on BAW. Caution should be used when using these insecticide classes; rotation within a season is strongly recommended.**

Apply one of the following formulations:						
Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
1A	Lannate LV*	1.5 to 3.0 pt/A	methomyl	3	48	H
3A ³	Pyrethroid insecticides registered for use on Tomatoes: see table at the end of Insect Control.					
5	Entrust SC (OMRI)	3.0 to 6.0 fl oz/A	spinosad	1	4	H
5	Radiant SC	5.0 to 10.0 fl oz/A	spinetoram	1	4	H
6	Proclaim 5SG*	2.4 to 4.8 oz/A	emamectin benzoate	7	12	H
11A	DiPel DF, others (OMRI)	1.0 to 2.0 lb/A	<i>Bacillus thuringiensis kurstaki</i>	0	4	N
11A	XenTari (OMRI)	0.5 to 2.0 lb/A	<i>Bacillus thuringiensis aizawai</i>	0	4	N
15	Rimon 0.83EC	9.0 to 12.0 fl oz/A	novaluron	1	12	M
15+4A	Cormoran	9.0 to 12.0 fl oz/A	novaluron + acetamiprid	7	12	M
18	Confirm 2F	6.0 to 8.0 fl oz/A (early season); 8.0 to 16.0 fl oz/A (late season)	tebufenozide (not labeled for CEW)	7	4	M
18	Intrepid 2F	4.0 to 8.0 fl oz/A (early season); 8.0 to 16.0 fl oz/A (late season) (ECB, HW, CL only)	methoxyfenozide	1	4	L
22	Avaunt 30WDG, Avaunt eVo	2.5 to 6.0 oz/A (HW, CL); 3.5 to 6.0 oz/A (CEW)	indoxacarb	3	12	H
28 ¹	Coragen 1.67SC Coragen eVo	2.0 to 7.5 fl oz/A 0.7 to 2.5 fl oz/A	chlorantraniliprole	1	4	L

Caterpillar “Worm” Pests - continued next page

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Caterpillar “Worm” Pests - continued

28 ¹	Exirel	7.0 to 13.5 fl oz/A (CEW, HW, ECB); 10.0 to 17.0 fl oz/A (CL)	cyantraniliprole	1	12	H
28 ¹	Verimark	5.0 to 10.0 fl oz/A (CEW, HW); 6.75 to 10.0 fl oz/A (CL)	cyantraniliprole soil	1	4	H
28 ¹ +3A ³	Besiege*	5.0 to 9.0 fl oz/A	chlorantraniliprole + lambda cyhalothrin	5	24	H
28 ¹ +3A ³	Elevest*	5.6 to 9.6 fl oz/A	chlorantraniliprole + bifenthrin	7	12	H
28 ¹ + 6	Minecto Pro* ²	7.5 to 10.0 fl oz/A	cyantraniliprole + abamectin	7	12	H
30	Incipio	5.1 fl oz/A	isocycloseram	1	12	H

¹Resistance concerns with beet armyworm. ²Use of a non-sticker adjuvant is required. ³Resistance is common in BAW and CEW.

Colorado Potato Beetles (CPB)

Rotation to crops other than potato, tomato, and eggplant is extremely important in reducing CPB problems. Also, transplants placed into no-till fields, mulches or other crop residue will reduce or delay potato beetle infestations. Look for CPB adults shortly after seedling emergence or transplanting. Early season populations tend to be concentrated in areas where tomatoes or potatoes were previously grown. Thoroughly scout tomato fields and spray only when necessary. For established direct-seeded or transplant tomatoes, begin treatment if the population level exceeds 15 CPB adults per 10 plants throughout the field. If early treatment is not applied, wait for egg hatch and spray when larvae are young and exceed 20 CPB larvae and/or adults per 10 plants. Reassess after each treatment. Avoid the application of late-season sprays to prevent the buildup of insecticide-resistant beetles.

Apply one of the following formulations:						
Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
1A	Vydate L*	2.0 to 4.0 pt/A	oxamyl - foliar	7	48	H
4A	Neonicotinoid insecticides registered for use on Tomatoes: see table at the end of Insect Control.					
4D	Sivanto Prime	10.5 to 14.0 fl oz/A	flupyradifurone - foliar	1	4	M
5	Entrust SC (OMRI)	3.0 to 6.0 fl oz/A	spinosad	1	4	H
5	Radiant SC	5.0 to 10.0 fl oz/A	spinetoram	1	4	H
6	Agri-Mek SC* ¹	1.75 to 3.5 fl oz/A	abamectin	7	12	H
11A	Trident (OMRI)	3.0 to 6.0 qt/A	<i>Bacillus thuringiensis tenebrionis</i>	0	4	L
15	Rimon 0.83EC	9.0 to 12.0 fl oz/A	novaluron	1	12	M
21A	Torac	17.0 to 21.0 fl oz/A	tolfenpyrad	1	12	H
28	Coragen 1.67SC Coragen eVo	3.5 to 7.5 fl oz/A 1.2 to 2.5 fl oz/A	chlorantraniliprole - soil and foliar	1	4	L
28	Exirel	7.0 to 13.5 fl oz/A	cyantraniliprole	1	12	H
28	Harvanta 50SL	10.9 to 16.4 fl oz/A	cyclaniliprole	1	4	H
28	Verimark	5.0 to 10.0 fl oz/A	cyantraniliprole	1	4	H
28 + 3A	Besiege*	6.0 to 9.0 fl oz/A	chlorantraniliprole + lambda cyhalothrin	5	24	H
28 + 3A	Elevest*	7.0 to 9.6 fl oz/A	chlorantraniliprole + bifenthrin	7	12	H
28 + 6	Minecto Pro* ¹	5.5 to 10.0 fl oz/A	cyantraniliprole + abamectin	7	12	H
30	Incipio	2.1 to 4.1 fl oz/A	isocycloseram	1	12	H

¹Use of a non-sticker adjuvant is required.

Cutworms See also section E 3.1. Soil Pests - Detection and Control.

Apply one of the following formulations:						
Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Pre-planting field treatment. just before seeding or transplanting, broadcast on the soil surface the following:						
1B	Diazinon AG500*	2.0 to 4.0 qt/A	diazinon	n/a	48	H
Post-planting treatment. if control is required after seedling emergence or after transplanting, treat soil thoroughly beneath plants with the following:						
3A	Pyrethroid insecticides registered for use on Tomatoes: see table at the end of Insect Control.					

Flea Beetles

Are small dark beetles that feed by chewing round holes into leaves. They usually only pose a problem to small tomato plants. Heavy feeding on small plants during hot dry periods can result in stand loss. Watch for flea beetle feeding on transplanted tomatoes. If needed one insecticide application is usually all that is needed for control.

(continued next page)

Flea Beetles - continued

Apply one of the following formulations:						
Group	Product Name (*= Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
3A	Pyrethroid insecticides registered for use on Tomatoes: see table at the end of Insect Control.					
4A	Neonicotinoid insecticides registered for use on Tomatoes: see table at the end of Insect Control.					
21A	Torac	17.0 to 21.0 fl oz/A	tolfenpyrad	1	12	H
28	Verimark	6.75 to 13.5 fl oz/A	cyantraniliprole - soil only	1	4	H
30	Incipio	2.1 to 4.1 fl oz/A	isocycloseram	1	12	H

Leafminers

Leafminers are generally not a significant problem in most fields. Adults are small, black and yellow flies that insert their eggs into leaves and the larvae feed between leaf surfaces, creating a meandering track. A few of these tracks per leaf will not affect yield.

Group	Product Name (*= Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Treat with one of the following formulations when first mines appear and repeat every 7 days or as needed.						
1B	Dimethoate 400EC	0.5 to 1.0 pt/A	dimethoate	7	48	H
4A	Neonicotinoid insecticides registered for use on Tomatoes: see table at the end of Insect Control.					
5	Entrust SC (OMRI)	6.0 to 10.0 fl oz/A	spinosad	1	4	H
5	Radiant SC	6.0 to 10.0 fl oz/A	spinetoram	1	4	H
6	Agri-Mek SC* ¹	1.75 to 3.5 fl oz/A	abamectin	7	12	H
15	Rimon 0.83EC	12 fl oz/A	novaluron	1	12	M
17	Trigard 75WSP	2.66 oz/A	cyromazine	0	12	H
28	Coragen 1.67SC Coragen eVo	5.0 to 7.5 fl oz/A 1.7 to 2.5 fl oz/A	chlorantraniliprole - soil and foliar, larvae only	1	4	L
28	Exirel	13.5 to 20.5 fl oz/A	cyantraniliprole	1	12	H
28	Harvanta 50SL	10.9 to 16.4 fl oz/A	cyclaniliprole	1	4	H
28	Verimark	6.75 to 13.5 fl oz/A	cyantraniliprole (at planting)	1	4	H
28 + 6	Minecto Pro* ¹	5.5 to 10.0 fl oz/A	cyantraniliprole + abamectin	7	12	H
30	Incipio	2.1 to 4.1 fl oz/A	isocycloseram	1	12	H

¹Use of a non-sticker adjuvant is required.

Mites

Spider mite infestations generally begin around field margins, grassy areas, and windbreaks during hot dry periods that favor the mites. Beginning infestations are sometimes caused by infested transplants that were produced in GHs with bedding plants - be sure to check transplants for mites. **DO NOT** mow or maintain grassy areas after mid-summer since this causes mites into the crop. Localized infestations can be spot treated. Watch for mite feeding, *i.e.*, stippling of leaves, in mid-summer. The use of dimethoate for other pests can reduce spider mite populations. Thresholds are 2-4 mites per upper canopy leaflet. **Note:** Other mite species that can cause problems in tomatoes are russet mites and broad mites. Consult the label to determine for which mite species a miticide is labeled.

Apply one of the following formulations (Note: Thorough spray coverage beneath leaves is important.):						
Group	Product Name (*= Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
6	Agri-Mek SC* ¹	1.75 to 3.5 fl oz/A	abamectin	7	12	H
10A	Onager 1EC	12 to 24 fl oz/A	hexythiazox	1	12	N
20B	Kanemite 15SC	31 fl oz/A	acequinocyl	1	12	L
21A	Portal	2.0 pt/A	fenpyroximate	1	12	L
21A	Torac	14.0 to 21.0 fl oz/A	tolfenpyrad - broad mites only	1	12	H
21A	Magister SC	24.0 to 36.0 fl oz/A	fenazaquin	3	12	H
23	Boxadon 360	2.1 to 3.4 fl oz/A	spirotetramat - broad mite and tomato russet mite	1	24	L
23	Movento	4.0 to 5.0 fl oz/A	spirotetramat - broad mite and tomato russet mite	1	24	L
23	Oberon 2SC	8.5 fl oz/A	spiromesifen	1	12	M
20D	Acramite 50WS	0.75 to 1.0 lb/A	bifenazate	3	12	M
25	Nealta	13.7 fl oz/A	cyflumetofen	3	12	L
28 + 6	Minecto Pro* ¹	5.5 to 10.0 fl oz/A	cyantraniliprole + abamectin	7	12	H
30	Incipio	2.1 to 4.1 fl oz/A	isocycloseram	1	12	H
N/A	Sulfur 80WG (OMRI)	3 to 20 lb/A	sulfur	0	24	M

¹Use of a non-sticker adjuvant is required.

F. Tomatoes

Pinworms

This pest is introduced on southern transplants. Begin sprays if leaf damage is observed. Late evening sprays may be most effective when moths are active.

Apply one of the following formulations:						
Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
1A	Lannate LV*	1.5 to 3.0 pt/A	methomyl	1	48	H
3A	Pyrethroid insecticides registered for use on Tomatoes: see table at the end of Insect Control.					
5	Entrust SC (OMRI)	4.0 to 8.0 fl oz/A	spinosad	1	4	H
5	Radiant SC	5.0 to 10.0 fl oz/A	spinetoram	1	4	H
6	Agri-Mek SC* ¹	3.5 fl oz/A	abamectin	7	12	H
6	Proclaim 5SG*	2.4 to 4.8 oz/A	emamectin benzoate	7	12	H
15	Rimon 0.83EC	9.0 to 12.0 fl oz/A	novaluron	1	12	M
15 + 4A	Cormoran	9.0 to 12.0 fl oz/A	novaluron + acetamiprid	7	12	M
22	Avaunt 30WDG, Avaunt eVo	3.5 to 6.0 oz/A	indoxacarb	3	12	H
28	Coragen 1.67SC Coragen eVo	3.5 to 7.5 fl oz/A 1.2 to 2.5 fl oz/A	chlorantraniliprole	1	4	L
28	Exirel	7.0 to 13.5 fl oz/A	cyantraniliprole	1	12	H
28	Harvanta 50SL	10.9 to 16.4 fl oz/A	cyclaniliprole	1	4	H
28	Verimark	5.0 to 10.0 fl oz/A	cyantraniliprole (soil)	1	4	H
28 + 6	Minecto Pro* ¹	10.0 fl oz/A	cyantraniliprole + abamectin	7	12	H
n/a	NoMate TPW Spiral ²	200 to 400 spirals/A	mating disruption hormone	n/a	n/a	n/a

¹Use of a non-sticker adjuvant is required. ²NoMate uses a disruption pheromone for preventing mating of emerging adults from young transplants. The pheromone is applied to a hard plastic matrix formed into a hanging "spiral" for dispersal into the air. Apply at first sign of pinworm larvae in leaves.

Stink Bugs

Several different species of stink bugs feed on tomatoes, but they produce similar damage. Adult stink bugs are shield shaped and usually brown or green sometimes having colored markings. Adults overwinter on the ground under leaves, or other protected areas. Feeding damage appears as dark pinpricks, surrounded by a white area that turns yellow on ripe fruit (cloudy spot). Because stinkbugs are so mobile and are quick to drop to the ground when the plant is disturbed there is no good scouting program for them. Watch the edges of fields for the first sign of cloudy spot to appear on green fruit. High spray gallonages and pressures are needed to penetrate the plant canopy to reach stinkbugs (especially immatures) that are hiding in the interior of the plant.

Note: Brown and brown marmorated stink bugs are less susceptible to pyrethroids than green and southern green stink bugs. Careful pyrethroid selection is advised, consult your local Cooperative Extension Service for recommendations for your area.

Apply one of the following formulations:						
Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
1A	Lannate LV*	3.0 pt/A	methomyl - brown marmorated stink bug only	1	48	H
3A	Pyrethroid insecticides registered for use on Tomatoes: see table at the end of Insect Control.					
4A	Neonicotinoid insecticides registered for use on Tomatoes: see table at the end of Insect Control.					
30	Incipio	2.1 to 4.1 fl oz/A	isocycloseram	1	12	H

Thrips

Very high numbers of thrips can cause damage with their feeding, which distorts plant growth, deforms flowers, and causes small white marks (stippling) on emerging leaves that often have tiny black fecal specks in them. Several species of thrips also spread Tomato Spotted Wilt Virus. Watch for the first symptom of thrips which is stippling on leaves or the first sign which is adults in flowers. Stippling marks or 3-5 thrips/flower indicate treatment may be necessary. Do not produce vegetable transplants with bedding plants in the same greenhouse.

Apply one of the following formulations:						
Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
3A ¹	Pyrethroid insecticides registered for use on Tomatoes: see table at the end of Insect Control.					
4A ²	Neonicotinoid insecticides registered for use on Tomatoes: see table at the end of Insect Control.					

Thrips - continued next page

Thrips - continued

5	Entrust SC (OMRI)	4.0 to 8.0 fl oz/A	spinosad	1	4	H
5	Radiant SC	6.0 to 10.0 fl oz/A	spinetoram	1	4	H
15	Rimon	12.0 fl oz/A	novaluron – immature thrips only	1	12	M
21A	Torac	21.0 fl oz/A	tolfenpyrad	1	12	H
28	Harvanta 50SL	10.9 to 16.4 fl oz/A	cyclaniliprole	1	4	H
30	Incipio	3.1 to 5.1 fl oz/A	isocycloseram	1	12	H

¹Resistance concerns for Western flower thrips. ²Resistance concerns with tobacco thrips.

Whiteflies

Usually are only a problem late in the season on field tomatoes. However, if they become a more frequent problem then avoid the use of broad-spectrum pesticides early in the season. Check field margins for whiteflies; these areas are usually infested first. Allow beneficials an opportunity to control light whitefly infestations. If higher populations are present at the field margins than the field centers, then treat only the field margins.

Apply one of the following formulations:						
Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
4A	Neonicotinoid insecticides registered for use on Tomatoes: see table at the end of Insect Control.					
4C	Transform WG	2.0 to 2.25 oz/A	sulfoxaflor	1	24	H
4C + 3A	Ridgeback*	5.5 to 13.8 fl oz/A	sulfoxaflor + bifenthrin	1	24	H
4D	Sivanto Prime	21.0 to 28.0 fl oz/A	flupyradifurone - soil	45	4	M
4D	Sivanto Prime	10.5 to 14.0 fl oz/A	flupyradifurone - foliar	1	4	M
7C	Knack	8.0 to 10.0 fl oz/A	pyriproxyfen	1	12	L
9B	Fulfill 50WDG	2.75 oz/A	pymetrozine	0	12	L
9B	PQZ	2.4 to 3.2 fl oz/A	pyrifluquinazon	1	12	L
9D	Sefina	14.0 fl oz/A	afidopyropen	0	12	L
16	Courier SC	9.0 to 13.6 fl oz/A	buprofezin	1	12	L
23	Boxadon 360	2.1 to 3.4 fl oz/A	spirotetramat	1	24	L
23	Movento	4.0 to 5.0 fl oz/A	spirotetramat	1	24	L
23	Oberon 2SC	8.5 fl oz/A	spiromesifen	1	12	M
23+7C	Senstar	8.0 to 10.0 fl oz/A	spirotetramat + pyriproxyfen	1	24	L
28 + 6	Minecto Pro* ¹	10.0 fl oz/A	cyantraniliprole + abamectin	7	12	H
n/a	Requiem EC	2.0 to 3.0 qt/A	<i>Chenopodium</i> extract	0	4	L

¹Use of a non-sticker adjuvant is required.

Group 3A Pyrethroid Insecticides Registered for Use on Tomatoes					
Apply one of the following formulations (check if the product label lists the insect you intend to spray; the label is the law):					
Note: resistance concerns with this class of insecticide with western flower thrips, BAW, and CEW					
Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Asana XL*	2.9 to 9.6 fl oz/A	esfenvalerate	1	12	H
Baythroid XL*	1.6 to 2.8 fl oz/A	beta-cyfluthrin	0	12	H
Brigade 2EC*, Brigade eVo*	2.1 to 5.2 fl oz/A	bifenthrin	1	12	H
Danitol 2.4EC*	10.67 fl oz/A	fenpropathrin	3	24	H
Hero*	4.0 to 10.3 fl oz/A	zeta-cypermethrin + bifenthrin	1	12	H
Lambda-Cy 1EC*, others	1.92 to 3.84 fl oz/A	lambda-cyhalothrin	5	24	H
Mustang Maxx*	2.24 to 4.0 fl oz/A	zeta-cypermethrin	1	12	H
Proaxis*	1.92 to 3.84 fl oz/A	gamma-cyhalothrin	5	24	H
Tombstone*	1.6 to 2.8 fl oz/A	cyfluthrin	0	12	H
Warrior II*	0.96 to 1.92 fl oz/A	lambda-cyhalothrin	5	24	H
Combo products containing a pyrethroid					
Besiege*	5.0 to 9.0 fl oz/A	lambda-cyhalothrin + chlorantraniliprole (Group 28)	5	24	H
Brigadier*	3.8 to 9.85 fl oz/A	bifenthrin + imidacloprid (Group 4A) - foliar	1	12	H
Elevest*	5.6 to 9.6 fl oz/A	bifenthrin + chlorantraniliprole (Group 28)	7	12	H
Endigo ZC and ZCX*	4.0 to 4.5 fl oz/A	lambda-cyhalothrin + thiamethoxam (Group 4A)	5	24	H
Leverage 360*	3.8 to 4.1 fl oz/A	beta-cyfluthrin + imidacloprid (Group 4A)	0	12	H
Ridgeback*	5.5 to 13.8 fl oz/A	bifenthrin + sulfoxaflor (Group 4C)	1	24	H
Savoy EC*, others	3.6 to 9.6 fl oz/A	bifenthrin + acetamiprid (Group 4A)	1	12	H

Group 4A Neonicotinoid Insecticides Registered for Use on Tomatoes					
Apply one of the following formulations (check if the product label lists the insect you intend to spray; the label is the law):					
Note: resistance concerns with this class of insecticide with tobacco thrips					
Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Actara 25WDG	2.0 to 5.5 oz/A	thiamethoxam	0	12	H
Admire Pro	7.0 to 10.5 fl oz/A	imidacloprid - soil	21	12	H
Admire Pro	1.3 to 2.2 fl oz/A	imidacloprid - foliar	0	12	H
Assail 30SG	1.5 to 4.0 oz/A	acetamiprid	7	12	M
Platinum 75SG	1.66 to 3.67 oz/A	thiamethoxam	30	12	H
Scorpion 35SL	9.0 to 10.5 fl oz/A	dinotefuran - soil	21	12	H
Scorpion 35SL	2.0 to 7.0 fl oz/A	dinotefuran - foliar	1	12	H
Venom 70SG	5.0 to 7.5 oz/A	dinotefuran - soil	21	12	H
Venom 70SG	1.0 to 4.0 oz/A	dinotefuran - foliar	1	12	H
Combo products containing a neonicotinoid					
Brigadier*	3.8 to 9.85 fl oz/A	imidacloprid + bifenthrin (Group 3A) - foliar	1	12	H
Cormoran	9.0 to 12.0 fl oz/A	acetamiprid + novaluron (Group 15)	7	12	M
Durivo	10.0 to 13.0 fl oz/A	thiamethoxam + chlorantraniliprole (Group 28)	30	12	H
Endigo ZC* and ZCX*	4.0 to 4.5 fl oz/A	thiamethoxam + lambda-cyhalothrin (Group 3A)	5	24	H
Leverage 360*	3.8 to 4.1 fl oz/A	imidacloprid + beta-cyfluthrin (Group 3A)	7	12	H
Savoy EC*	3.6 to 9.6 fl oz/A	acetamiprid + bifenthrin (Group 3A)	1	12	H
Voliam Flexi	4.0 to 7.0 oz/A	thiamethoxam + chlorantraniliprole	1	12	H

Disease Control

THE LABEL IS THE LAW-see the Pesticide Use Disclaimer on the first page of Chapter F.
Recommended Fungicides

Nematodes See sections E 1.5. Soil Fumigation and E 1.6. Nematode Control.

Seed Treatment

Purchase hot water treated seed or request hot water treatment. Heat treatment is a non-chemical alternative to conventional chlorine treatments that only kills pathogens on the surface of the seed coat. Heat treatment has the additional benefit of killing pathogens within the seed coat and is particularly useful for crops that are prone to seed-borne bacterial infections such as tomato and pepper. Seed heat treatment follows a strict time and temperature protocol and is best done with thermostatically controlled water baths. Two baths are required: one for pre-heating, and a second for the effective (pathogen killing) temperature. Seeds are packaged in bags that are typically made of a porous mesh like cheesecloth or fine window screen to hold seeds loosely for submersion in water and even heat exposure. Seed bag should not touch the bottom of the water bath. Seeds stay in the first bath at 100°F (38°C) for 10 minutes, and in the second bath at 122°F (50°C) for 25 minutes. Immediately after removal from the second bath, seeds should be thoroughly rinsed with cool water, and dried on a screen or paper.

Alternatively, soak seeds in a mixture of 1 part Alcide (sodium chlorite), 1 part lactic acid, and 18 parts water for 1-2 minutes under constant agitation, and rinse for 5 minutes in cool running water. Do not use pelleted seeds because moisture results in the loss of coating material.

Only treat seed that will be used during the current production season. Following heat or chlorine treatment, dust dried seed with Captan 50WP or Thiram 480DP at 1 level tsp/lb seed (3.0 oz/100 lb).

Damping-off and Root Rots

Greenhouse: Use seed treatment and plant in a disease-free mix.

Field: At planting apply one of the fungicides via drip or banded spray. Additional field applications may be made as needed, see label for specific instructions.

Code	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
4	MetaStar 2E AG	2.0-4.0 pt/A	metalaxyl	AP	48	N
4	Ridomil Gold 4SL ¹	1.0-2.0 pt/A ¹	mefenoxam	AP	48	N
4	Ultra Flourish 2E ¹	2.0-4.0 pt/A ¹	mefenoxam	AP	48	N

Damping-off and Root Rots - continued next page

Damping-off and Root Rots - continued

P07	Aliette 80WDG	2.5 to 5.0 lb/A	fosetyl-Al	14	12	N
28	Previcur Flex 6F	1.5 pt/A	propamocarb	5	12	N
49 + 4	Orondis Gold	28.0 to 55.0 fl oz/A	oxathiapiprolin + mefenoxam	7	4	--

¹Apply in a 7-inch band at transplanting. Determine the amount of Ridomil Gold or Ultra Flourish per acre using the calibration formula for changing from broadcast to band application (see the section E1.3 Calibrating Granular Applicators in chapter E Pest Management).

Bacterial Diseases**Bacterial Canker**

Use certified transplants. Rotate to allow 3 years between plantings. When producing transplants, use Clorox or heat-treated seed and treat used flats with sodium hypochlorite (bleach) (see section A 5. Transplant Production). Stakes from bacterial canker infested fields should be power washed, soaked in a 20% (1part bleach plus 4 parts water) commercial bleach solution for at least 30 minutes, and power wash a second time prior to use. Avoid pruning and stringing when foliage is wet as this will promote the spread of the disease in infested fields. Applications of Actigard 50WG (0.33 oz/A increasing to 0.75 oz/A when plants are full size, see label) PLUS fixed copper (1.5 lb active/A) have been shown to reduce bacterial canker symptoms on fruit.

Bacterial Speck and Bacterial Spot

When producing transplants, use Clorox or heat-treated seed as described above under Seed Treatment. Apply streptomycin sprays (Agri-Mycin 17, Agri-Strep, 1.0 lb/100gal, 1.25 tsp/gal) when the first true leaves appear and continue every 45 days until transplanting. Streptomycin cannot be used after transplanting. Limit handling of plants and keep greenhouse moisture levels low.

Rotate to allow 2 -3 years between plantings. Use only certified transplants. Cultural practices discussed in the bacterial canker section will also suppress levels of Bacterial Speck and/or Spot. Bacterial Speck and/or Spot occur more often on southern-produced transplants. Strains of copper resistant Bacterial Spot are common in some areas of the Mid-Atlantic particularly on the Eastern Shore of VA. Use Actigard alone or in conjunction with copper-containing materials. Where disease is present or anticipated, do not work in fields when plant surfaces are wet.

Code	Product Name (* =Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Tank mix the following beginning shortly after transplanting and repeat every 7 days.						
M01	copper (OMRI)	1.0 lb ai/A	copper	0	see label	N
M03	mancozeb 75DF	1.5 lb/A	mancozeb	5	12/24	N
And rotate with or apply the following:						
M01+M03	ManKocide 61WP	2.5 to 5.0 lb/A	copper hydroxide + mancozeb	5	48	N
The following is a plant defense activator and preventative applications should begin prior to the onset of symptoms.						
P01	Actigard 50WG ¹	0.33 to 0.75 oz/A (see label)	acibenzolar-S-methyl	14	12	N

¹Use in areas where copper resistance is known. See label for rates and times of use.

Bacterial Wilt Avoid growing tomatoes in fields where bacterial wilt has occurred. Crop rotation to non-host crops is the best measure to reduce levels of bacterial wilt. In particular, avoid planting where tomatoes or peppers were grown in the preceding year. Grafting onto resistant rootstocks will also suppress disease levels. Avoid irrigating from a surface water source (*i.e.*, pond, river), when possible, especially for water sources that are adjacent to previously diseased fields as they may be contaminated with the causal agent.

Fungal Diseases**Botrytis Fruit Rot (Gray Mold)**

Gray Mold is a problem during the fall in fields with dense foliage and poor drainage. For fall production, select fields with good drainage. Facilitate air movement and sunlight penetration through acceptable plant spacing, staking and limited pruning.

Code	Product Name (* =Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Shortly before harvest or when conditions are wet and cool, rotate the following as long as weather conditions favor disease development:						
M05	chlorothalonil 6F	2.0 to 2.75 pt/A	chlorothalonil	0	12	M

Botrytis Fruit Rot (Gray Mold) - continued next page

F. Tomatoes

Botrytis Fruit Rot (Gray Mold) - continued

7	Endura 70WG	9.0 to 12.5 oz/A	boscalid	0	12	--
7	Fontelis 1.67SC	16.0 to 24.0 fl oz/A	penthiopyrad	0	12	L
9	Scala SC	7.0 fl oz/A	pyrimethanil	1	12	--
11	Cabrio 20EG	12.0 to 16.0 fl oz/A	pyraclostrobin	0	12	N
7 + 9	Luna Tranquility 4.16SC	11.2 fl oz/A	fluopyram + pyrimethanil	1	12	--
7 + 3	Luna Flex 3.13SC	8.0 to 13.6 fl oz/A	fluopyram + difenoconazole	0	12	--
7 + 11	Luna Sensation 4.25SC	7.6 fl oz/A	fluopyram + trifloxystrobin	3	12	--
7 + 11	Priaxor Xemium	4.0 to 8.0 fl oz/A	fluxapyroxad + pyraclostrobin	7	12	--
7 + 12	Miravis Prime	11.4 fl oz/A	pydiflumetofen + fludioxonil	0	12	--
3 + 9	Inspire Super 2.82EW	16.0 to 20.0 fl oz/A	difenoconazole + cyprodinil	0	12	--
9 + 12	Switch 62.5WG	11.0 to 14.0 oz/A	cyprodinil + fludioxonil	0	12	L

Buckeye Rot caused by *Phytophthora parasitica*, *P. capsici*

Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Apply one of the following as a soil surface application under the vines 4 to 8 weeks before harvest. Apply broadcast or banded (adjust amount). Irrigate after application.						
4	Ridomil Gold 4SL	1.0 pt/A	mefenoxam	AP	48	N
4	Ultra Flourish 2E	1.0 qt/A	mefenoxam	AP	48	N
4 + 49	Orondis Gold	28.0 55.0 fl oz/A	mefenoxam + oxathiapiprolin	AP	4	--
Rotate the following beginning when crown fruit are one-third their final size and prior to disease development or as long as weather conditions favor disease development.						
4 + M01	Ridomil Gold Copper 65WP	2.0 lb/A	mefenoxam + copper	14	48	N
4 + M05	Flouronil 76WP	2.0 lb/A	mefenoxam + chlorothalonil	14	48	M
4 + M05	Ridomil Gold Bravo 76WP	2.0 lb/A	mefenoxam + chlorothalonil	14	48	M
4 + 49	Orondis Gold	28 to 55 fl oz/A	mefenoxam + oxathiapiprolin	7	48	--
49 + M05	Orondis Opti	1.75 to 2.5 pt/A	oxathiapiprolin + chlorothalonil	0	12	--
49 + 40	Orondis Ultra 2.33SC	5.5 to 8.0 fl oz/A	oxathiapiprolin + mandipropamid	1	4	--
43	Presidio 4SC	3.0 to 4.0 fl oz/A	fluopicolide	2	12	L
11 + 27	Tanos 50DF	8.0 oz/A	famoxadone + cymoxanil	3	12	--
22+M03	Gavel 75DF	1.5 to 2.0 lb/A	zoxamide + mancozeb	5	48	--

Fusarium Wilt and Verticillium Wilt

Select varieties with resistance to Fusarium and Verticillium Wilt. For Fusarium Wilt, select cultivars that are resistant to Races 1, 2, and 3 as all are prevalent on in the Mid-Atlantic region. Soil fumigation and proper crop rotation are essential components of a successful management program. Miravis Prime is labeled for the suppression only of Fusarium wilt.

Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
7 + 12	Miravis Prime	11.4 fl oz/A	pydiflumetofen + fludioxonil	0	12	--

Late Blight

Use disease free transplants. If possible, produce your own transplants since transplants obtained from other regions may increase the risk of late blight infestation. A strong scouting program, preventative fungicide applications when warranted, and microclimate management to reduce levels of free moisture on foliage are essential to help reduce the potential for disease development. Tomato cultivars with resistance to Late blight are available.

Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
When plants are 6 inches tall, apply one of the following protectant fungicides and repeat every 7 days.						
M03	mancozeb 75DF	3.0 lb/A	mancozeb	5	12,24	N
M03+22	Gavel 75DF	1.5 to 2.0 lb/A	mancozeb + zoxamide	5	48	--
M05	chlorothalonil 6F	1.0 to 3.0 pt/A	chlorothalonil	0	12	M
M05+22	Zing! 4.9SC	36.0 fl oz/A	chlorothalonil + zoxamide	7	12	M

Late Blight - continued next page

Late Blight - continued

Protectant fungicides should only be applied preventatively. Monitor the movement of the disease via local online Extension resources. Once late blight is detected in your area, TANK MIX one of the following translaminar fungicides which can move into and through leaves WITH A PROTECTANT FUNGICIDE such as chlorothalonil, Gavel, or mancozeb. Products containing mefenoxam should not be used unless your extension professional or the aforementioned website are certain that current strains are sensitive. To achieve the best control, rotate between one of the following options:						
3 + 40	Revus Top 4.16SC	5.5 to 7.0 fl oz/A; also offers protection from Leaf Spots; not for use on small-fruited varieties.	difenoconazole + andipropamid	1	12	M
49+M05	Orondis Opti	1.75 to 2.5 pt/A; also offers protection from Leaf Spots	oxathiapiprolin + chlorothalonil	0	12	--
49 + 40	Orondis Ultra 2.33SC	5.5 to 8.0 fl oz/A	oxathiapiprolin + andipropamid	1	4	--
11	Reason 500SC	5.5 to 8.2 fl oz/A	fenamidone	14	12	--
11+27	Tanos 50DF	8.0 oz/A; also offers protection from Leaf Spots	famoxadone + cymoxanil	3	12	--
21	Ranman 400SC	2.10 to 2.75 fl oz/A	cyazofamid	0	12	L
27	Curzate 60DF	3.2 to 5.0 oz/A	cymoxanil	3	12	N
28	Previcur Flex 6F	1.5 pt/A	propamocarb HCl	5	12	N
40	Revus 2.08F	8 fl oz/A	mandipropamid	1	4	--
40 + 3	Revus Top	5.5 to 7.0 fl oz/A	mandipropamid + difenoconazole	1	12	M
40	Forum 4.17SC	6.0 fl oz/A	dimethomorph	4	12	N
40 + 45	Zampro 525SC	14 fl oz/A	dimethomorph + ametocctradin	4	12	--
43	Presidio 4SC	3.0 to 4.0 fl oz/A	fluopicolide	2	12	L
GREENHOUSE USE: Consult fungicide labels to ensure greenhouse applications are permitted. The following materials permit greenhouse applications and can offer suppression. Apply one of the following:						
M05+P07	Catamaran 5.3F	5.5 to 7.0 pt/A	chlorothalonil + phosphite	0	12	M
11	Heritage 50WG	1.6 to 2.0 oz/A	azoxystrobin	0	4	N

Leaf Mold

Leaf Mold is caused by the fungus *Passalora fulva* (previously called *Fulvia fulva* or *Cladosporium fulvum*). Leaf Mold may occur during periods of high moisture particularly within the canopy. Leaf old is primarily damaging in greenhouse and high tunnel tomato settings with long periods of high relative humidity. Vent structures regularly to reduce humidity and leaf wetness. See Table E-14 for fungicides labeled for use in greenhouses.

Code	Product Name (*Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Apply or rotate between the following fungicides as long as conditions are favorable for disease development:						
M05+P07	Catamaran 5.3F	4.5 to 7.0 pt/A	chlorothalonil + phosphite	4	12	M
3 + 40	Revus Top 4.16SC	5.5 to 7.0 fl oz/A	difenoconazole + mandipropamid	1	12	M
3 + 11	Quadris Top 1.67SC	8.0 fl oz/A	difenoconazole + azoxystrobin	0	12	--
3 + 7	Aprovia Top 1.62EC	10.5 to 13.5 fl oz/A	difenoconazole + benzovindiflupyr	0	12	--
3 + 7	Luna Flex 3.13SC	8.0 to 13.6 fl oz/A	difenoconazole + fluopyram	0	12	--
3 + 9	Inspire Super 2.82EW	16.0 to 20.0 fl oz/A	difenoconazole + cyprodinil	0	12	--

Leaf Spots caused by Early blight and Septoria leaf spot and Fruit Rots caused by Anthracnose and Early blight:

Follow a crop rotation with at least 2 years without tomatoes or potatoes. Use disease-free transplants and disease resistant varieties when possible. In high elevated areas, in fields not rotated away from tomatoes, or in late planted fields begin sprays shortly after transplanting. In all other areas, follow a regular (7-day) spray schedule.

Code	Product Name (*Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Alternate or tank mix one of the following protectant fungicides:						
M03	mancozeb 75DF	3.0 lb/A (also for Gray Leaf Spot and Leaf Mold)	mancozeb	5	12/24	N
M03+22	Gavel 75DF	1.5 to 2.0 lb/A	mancozeb + zoxamide	5	48	--
M05	chlorothalonil 6F (other trade names available)	2.0 to 3.0 pt/A (also for Gray Leaf Spot, Black Mold, and Soil Rot)	chlorothalonil	0	12	M
M05+22	Zing! 4.9SC	36.0 fl oz/A	chlorothalonil + zoxamide	7	12	M

Leaf Spots, Septoria Leaf Spot, and Fruit Rots - continued next page

F. Tomatoes

Leaf Spots, Septoria Leaf Spot, and Fruit Rots - continued

WITH one of the following fungicides (fungicides from different FRAC codes should be rotated to help reduce the chances for fungicide resistance development):						
3	Cevya	3.0 to 5.0 fl oz/A	mefentrifluconazole	0	12	--
3	Mettle 125ME	6.0 to 8.0 fl oz/A	Tetraconazole	0	12	--
3	Rhyme	5.0 to 7.0 fl oz/A	flutriafol	0	12	--
3	Mettle 125ME	6.0 to 8.0 fl oz/A	tetraconazole	0	12	--
3 + 7	Aprovia Top 1.62EC	10.5 to 13.5 fl oz/A	difenoconazole + benzovindiflupyr	0	12	--
3 + 9	Inspire Super 2.82EW	16.0 to 20.0 fl oz/A	difenoconazole + cyprodonil	0	12	--
3 + 11	Quadris Top 1.67SC	8.0 fl oz/A	difenoconazole + azoxystrobin	0	12	--
3 + 40	Revus Top 4.16SC	5.5 to 7.0 fl oz/A	difenoconazole + mandipropamid	1	12	M
3 + 11	Topguard EQ4.29SC	4.0 to 8.0 fl oz/A	flutriafol + azoxystrobin	0	12	--
7	Endura 70WG	2.5 to 3.5 oz/A (also for <i>Botrytis</i> at 9.0 to 12.5 oz/A)	boscalid	3	12	--
7	Fontelis 1.67SC	16.0 to 24.0 fl oz/A	penthioopyrad	0	12	L
7 + 3	Luna Flex 3.13SC	8.0 to 13.6 fl oz/A	fluopyram + difenoconazole	0	12	--
7 + 9	Luna Tranquility	11.2 fl oz/A	fluopyram + pyrimethanil	1	12	--
7 + 11	Luna Sensation 4.25SC	5.0 to 7.6 fl oz/A	fluopyram + trifloxystrobin	3	12	--
7 + 11	Priaxor 4.17SC	4.0 to 8.0 fl oz/A	fluxapyroxad + pyraclostrobin	7	12	N
7 + 12	Miravis Prime	9.2 to 11.4 fl oz/A	pydiflumetofen + fludioxonil	0	12	--
9	Scala SC	7.0 fl oz/A	pyrimethanil	1	12	--
11	azoxystrobin 2.08F	5.0 to 6.2 fl oz/A (also for Black Mold and Buckeye Rot)	azoxystrobin (Do not apply near apples, see label)	0	4	N
11	Cabrio 20EG	8.0 to 12.0 oz/A	pyraclostrobin	0	12	N
11	Flint Extra 500SC	3.0-3.8 fl oz/A	trifloxystrobin (Do not apply near Concord grapes, see label)	3	12	N
11	Reason 500SC	5.5 to 8.2 fl oz/A	fenamidone	14	12	--
11	Aftershock, Evito 480 SC	2.0 to 5.7 fl oz/A	fluoxastrobin	3	12	--
11 + M5	Quadris Opti 5.5SC	1.6 pt/A	azoxystrobin + chlorothalonil	0	12	M
11 + 27	Tanos 50DF	8.0 oz/A <i>PLUS</i> protectant fungicide (also for Buckeye Rot suppression and Gray Leaf Spot).	famoxadone + cymoxanil	3	12	--

Powdery Mildew

Code	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
At first appearance of the disease, rotate between the following fungicides¹:						
FIELD, repeat every 7 to 14 days:						
3	Rally 40WSP	2.5 to 4.0 oz/A	myclobutanil	0	12	N
3	Rhyme	5.0 to 7.0 fl oz/A	flutriafol	0	12	--
3	Mettle 125ME	6.0 to 8.0 fl oz/A	tetraconazole	0	12	--
3 + 7	Aprovia Top 1.62EC	10.5 to 13.5 fl oz/A	difenoconazole + benzovindiflupyr	0	12	--
3 + 9	Inspire Super 2.82EW	16.0 to 20.0 fl oz/A	difenoconazole + cyprodonil	0	12	--
3 + 11	Topguard EQ	4.0 to 8.0 fl oz/A	flutriafol + azoxystrobin	0	12	--
3 + 40	Revus Top 4.16SC	5.5 to 7.0 fl oz/A	difenoconazole + mandipropamid	1	12	M
7 + 3	Luna Flex 3.13SC	8.0 to 13.6 fl oz/A	fluopyram + difenoconazole	0	12	--
7 + 11	Luna Sensation 4.25SC	5.0 to 7.6 fl oz/A	fluopyram + trifloxystrobin	3	12	--
7 + 11	Priaxor Xemium	4.0 to 8.0 fl oz/A	fluxapyroxad + pyraclostrobin	7	12	--
7 + 12	Miravis Prime	9.2 to 11.4 fl oz/A	pydiflumetofen + fludioxonil	0	12	--
11 + 3	Quadris Top 1.67SC	8.0 fl oz/A	azoxystrobin + difenoconazole	0	12	--
9 + 12	Switch 62.5WG	11.0 to 14.0 oz/A	cyprodinil + fludioxonil	0	12	L
11	Cabrio 20EG	8.0 to 12.0 oz/A	pyraclostrobin	0	12	N
50	Proливо	4.0 to 5.0 l oz/A	pyriofenone	0	4	--
M2	Various	See label	sulfur	See label	24	--
GREENHOUSE², thoroughly cover upper and lower leaf surfaces and repeat every 7 days:						
--	JMS Stylet-Oil	1.0 to 2.0 gal/100 gal	paraffinic oil	--	--	--
9	Scala 5SC	7.0 fl oz/A	pyrimethanil	1	12	--

¹ Fungicides from different FRAC codes should be rotated to help reduce the chances for fungicide resistance development. ² Powdery mildew can cause serious problems in greenhouse and high tunnel settings. See Table E-14 for additional fungicides labeled for use in greenhouses.

Southern Blight (*Sclerotium rolfsii*)

Southern Blight is most commonly seen in the southern part of the Mid-Atlantic region. High soil moisture and temperatures favor disease, while long crop rotations with corn and small grains help reduce disease incidence. Weed control is important as *Sclerotium rolfsii* can infect several common weeds in the Mid-Atlantic region. Soil fumigation and staking will greatly reduce disease incidence. Applications of fungicides in transplant water, chemigation or as an in-furrow treatment may suppress the disease but check labels for permitted use patterns.

Code	Product Name (*Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
14	Blocker 4F	See label	pentachloronitrobenzene (PCNB)	AP	12	H
7	Fontelis 1.67SC	1.0 to 1.6 fl oz/1000 row ft	penthiopyrad	0	12	L
7 + 3	Aprovia Top 1.62EC	10.5 to 13.5 fl/A	benzovindiflupyr + difenoconazole	0	12	--
7 + 11	Luna Sensation 4.25SC	7.6 fl oz/A	fluopyram + trifloxystrobin	3	12	--
7 + 11	Priaxor Xemium	4.0 to 8.0 fl oz/A	fluxapyroxad + pyraclostrobin	0	12	--
11	Aftershock, Evito 480 SC	2.0 to 5.7 fl oz/A	fluoxastrobin	3	12	--
11	Cabrio 20EG	12 to 169 fl oz/A	pyraclostrobin	0	12	N

Timber Rot (*Sclerotinia sclerotiorum*)

Tomato timber rot, also known as sclerotinia stem rot, is a fungal disease caused by *Sclerotinia sclerotiorum*. Rotate away from fields where snap or lima beans, peas, peanuts, lettuce, or cucurbits were grown in the past. -- Timber rot occurs during prolonged wet periods and cooler temperatures (<80°F). Check labels for permitted use patterns in hoop houses.

Code	Product Name (*Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
7	Endura 70WG	12.5 oz/A	boscalid	0	12	--
7 + 11	Priaxor Xemium	4.0 to 8.0 fl oz/A	fluxapyroxad + pyraclostrobin	0	12	--
11	Cabrio 20EG	12 to 169 fl oz/A	pyraclostrobin	0	12	N
44	Contans 5.3WG (OMRI)	1 to 4 lb/A	<i>Coniothyrium minitans</i> strain CON/M/91-08	0	12	N

Viruses: Tomato Spotted Wilt Virus (TSWV)

TSWV can result in severely stunted plants. TSWV cannot be passed from infected females to eggs; and TSWV is not transmitted in seed. The virus is spread by thrips from ornamental flowering plants, vegetables, field crops, and weeds to tomatoes. Use resistant varieties when available. Resistance-breaking TSWV strains have been reported in the Mid-Atlantic. Please contact your local Extension agent if you planted a TSWV-resistant tomato cultivar and experience a disease outbreak. Do not grow any ornamental bedding plants in the same greenhouse as tomato transplants. Control weeds in and around greenhouses, high tunnels, or transplant areas. Monitor greenhouses and tomato fields for thrips and begin an insecticide control program once observed. Use of reflective mulch can help repel thrips. If tomato crops are near wheat or barley fields be aware of increased thrips pressure once these crops start to turn brown in the spring. Remove infected plants immediately as soon as a positive diagnosis is obtained to prevent spread to the healthy plants.

Post-Harvest Rots

Avoid harvesting when the foliage is wet. To prevent rots in mature green tomatoes, avoid washing freshly harvested fruit in cold water. To prevent movement of bacteria into the stem end of the fruit, do not allow water temperatures in flumes and tanks of more than 10°F above fruit temperature. Use a minimum of 100 ppm free chlorine and keep pH between 6.5-7.0 in the flume. Store at 55°F (13°C) with relative humidity of 80%. For more information on post-harvest tomato diseases, see <http://edis.ifas.ufl.edu/HS131>.