

Chapter 41.

Tomato Production in Florida

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BOTANY

Nomenclature

Family - Solanaceae

Tomato - *Lycopersicon esculentum*

Origin

Tomato is a New World vegetable being native to the west coast of South America in the area of Peru and Ecuador.

Related Species

Potato, pepper, and eggplant are other important vegetables in the Solanaceae family. Tomatillo and pepino, of much less importance, are also in this family. In addition, many plants in this family are used as ornamentals. Some, like tobacco, contain powerful alkaloids which may be addictive, poisonous, or useful as pharmaceuticals.

VARIETIES

Variety selection, often made several months before planting, is one of the most important management decisions made by the grower. Failure to select the most suitable variety or varieties may lead to loss of yield or market acceptability.

The following characteristics should be considered in selection of tomato varieties for use in Florida.

* **Yield** - The variety selected should have the potential to produce crops at least equivalent to varieties already grown. The average yield in Florida is currently about 1400 25-pound cartons per acre. The potential yield of varieties in use should be much higher than average.

* **Disease Resistance** - Varieties selected for use in Florida must have resistance to Fusarium wilt, race 1 and race 2; Verticillium wilt (race 1); gray leaf spot; and some tolerance to bacterial soft rot. Available resistance to other diseases may be important in certain situations

* **Horticultural Quality** - Plant habit, stem type and fruit size, shape, color, smoothness and resistance to defects should all be considered in variety selection.

* **Adaptability** - Successful tomato varieties must perform well under the range of environmental conditions usually encountered in the district or on the individual farm.

* **Market Acceptability** - The tomato produced must have characteristics acceptable to the packer, shipper, wholesaler, retailer and consumer. Included among these qualities are pack out, fruit shape, ripening ability, firmness, and flavor.

TOMATO VARIETIES FOR COMMERCIAL PRODUCTION

The varieties listed have performed well in University of Florida trials conducted in various locations.

LARGE FRUITED VARIETIES (FIG. 41-1)

Amelia. Vigorous determinate, main season, jointed hybrid. Fruit are firm and aromatic suitable for green or vine ripe. Good crack resistance. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1, 2 and 3), root-knot nematode, gray leaf spot and Tomato Spotted Wilt.

BHN 586. Midseason maturity. Fruit are large to extra-large, deep globed shaped with firm, uniform green fruits well suited for mature green or vine-ripe production. Determinate, medium to tall vine. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2) Fusarium Crown rot and root-knot nematode.

BHN-640. Early-midseason maturity. Fruit are globe shape and green shouldered. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1, 2 and 3), and Tomato Spotted Wilt.

Crista. Midseason maturity. Large, deep globe fruit with tall robust plants. Does best with moderate pruning and high fertility. Good flavor, color and shelf-life. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2,3), Tomato spotted wilt and root-knot nematode.

Crown Jewel. Uniform fruit have a deep oblate shape with good firmness, quality and uniformly-colored shoulders. Determinate with medium-tall bush. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2) Fusarium crown rot, Alternaria stem canker and Gray leaf spot.

Florida 47. A late midseason, determinate, jointed hybrid. Uniform green, globe-shaped fruit. Resistant: Fusarium wilt (race 1 and 2), Verticillium wilt (race 1), Alternaria stem canker, and gray leaf spot.

Florida 91. Uniform green fruit borne on jointed pedicels. Determinate plant. Good fruit setting ability under high temperatures. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1 and 2), Alternaria stem canker, and gray leaf spot.

HA 3073. A midseason, determinate, jointed hybrid. Fruit are large, firm, slightly oblate and are uniformly green. Resistant: Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1 and 2), gray leaf spot, Tomato Yellow Leaf Curl Virus and Tomato Mosaic Virus.

Linda. Main season. Large round, smooth, uniform shouldered fruit with excellent firmness and a small blossom end scar. Strong determinate bush with good cover. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2), Alternaria stem canker and Gray leaf spot.

Phoenix. Early mid-season. Fruit are large to extra-large, high quality, firm, globe-shaped and are uniformly-colored. "Hot-set" variety. Determinate, vigorous vine with good leaf cover for fruit protection. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2), Alternaria stem canker and Gray leaf spot.

Quincy. Full season. Fruit are large to extra-large, excellent quality, firm, deep oblate shape and uniformly colored. Very strong determinate plant. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2), Alternaria stem canker, Tomato spotted wilt and Gray leaf spot.

RPT 6153. Main season. Fruit have good eating quality and fancy appearance in a large sturdy shipping tomato and are firm enough for vine-ripe. Large determinate plants. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2) and Gray leaf spot.

Sanibel. Main season. Large, firm, smooth fruit with light green shoulder and a tight blossom end. Large determinate bush. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2), root-knot nematodes, Alternaria stem canker and Gray leaf spot.

Sebring. A late midseason, determinate, jointed hybrid with smooth, deep oblate, firm, thick walled fruit. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1, 2 and 3) Fusarium crown rot, gray leaf spot.

Solar Fire. An early, determinate, jointed hybrid. Has good fruit setting ability under high temperatures. Fruit are large, flat-round, smooth, firm, light green shoulder and blossom scars are smooth. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1, 2 and 3), gray leaf spot.

Solar Set. An early, green-shouldered, jointed hybrid. Determinate. Fruit set under high temperatures (92°F day/72°F night) is superior to most other commercial cultivars. Resistant: Fusarium wilt (race 1 and 2), Verticillium wilt (race 1), Alternaria stem canker, and gray leaf spot.

Solimar. A midseason hybrid producing globe-shaped, green shouldered fruit. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1 and 2), Alternaria stem canker, gray leaf spot.

Soraya. Full season. Fruit are high quality, smooth and tend toward large to extra-large. Continuous set. Strong, large bush. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2,3), Fusarium crown rot and Gray leaf spot.

Talledega. Midseason. Fruit are large to extra-large, globe to deep globe shape. Determinate bush. Has some hot-set ability. Performs well with light to moderate pruning. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2), Tomato spotted wilt and Gray leaf spot.

Tygress. A midseason, jointed hybrid producing large, smooth firm fruit with good packouts. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1 and 2), gray leaf spot, Tomato Mosaic Virus and Tomato Yellow Leaf Curl Virus.

PLUM TYPE VARIETIES

Bella Rosa. Heat tolerant determinate type. Produces firm, uniformly shaped fruit. Resistant: Tomato spotted wilt.

BHN 410. Midseason. Large, smooth, blocky, jointless fruit tolerant to weather cracking. Compact to small bush with concentrated high yield. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2), Bacterial speck (race 0) and Gray leaf spot.

BHN 411. Midseason. Large, smooth, jointless fruit is tolerant to weather cracks and has reduced tendency for graywall. Compact plant with concentrated fruit set. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2), Bacterial speck (race 0) and Gray leaf spot.

BHN 685. Midseason. Large to extra-large, deep blocky, globe shaped fruit. Determinate, vigorous bush with no pruning recommended. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2,3) and Tomato spotted wilt.

Marianna. Midseason. Fruit are predominately extra-large and extremely uniform in shape. Fruit wall is thick and external and internal color is very good with excellent firmness and shelf life. Determinate, small to medium sized plant with good fruit set. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2), root-knot nematode, Alternaria stem canker and tolerant to Gray leaf spot.

Monica. Midseason. Fruit are elongated, firm, extra-large and uniform green color. Vigorous bush with good cover. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2), Bacterial speck (race 0) and Gray leaf spot.

Plum Dandy. Medium to large determinate plants. Rectangular, blocky, defect-free fruit for fresh-market production. When grown in hot, wet conditions, it does not set fruit well and is susceptible to bacterial spot. For winter and spring production in Florida. Resistant: Verticillium wilt, Fusarium wilt (race 1), early blight, and rain checking.

Spectrum 882. Blocky, uniform-green shoulder fruit are produced on medium-large determinate plants. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1 and 2), root-knot nematode, bacterial speck (race 0), Alternaria stem canker, and gray leaf spot.

Sunoma. Main season. Fruit are medium-large, elongated and cylindrical. Plant maintains fruit size through multiple harvests. Determinate plant with good fruit cover. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2), Bacterial speck (race 0), root-knot nematodes, Tomato mosaic and Gray leaf spot.

CHERRY TYPE VARIETIES (FIG. 41-2)

BHN 268. Early. An extra firm cherry tomato that holds, packs and ships well. Determinate, small to medium bush with high yields. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1)

Camelia. Midseason. Deep globe, cocktail-cherry size with excellent firmness and long shelf life. Indeterminate bush. Outdoor or greenhouse production. Verticillium wilt (race 1), Fusarium wilt (race 1) and Tobacco mosaic.

Cherry Blossom. 70 days. Large cherry, holds and yields well. Determinate bush. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1,2), Bacterial speck (race 0), root-knot nematodes, Alternaria stem canker and Gray leaf spot.

Mountain Belle. Vigorous, determinate type plants. Fruit are round to slightly ovate with uniform green shoulders borne on jointless pedicels. Resistant: Fusarium wilt (race 1), Verticillium wilt (race 1).

Shiren. Compact plant with high yield potential and nice cluster. Resistant: Fusarium wilt (race 1,2), root-knot nematodes and Tomato mosaic.

Super Sweet 100 VF. Produces large clusters of round uniform fruit with high sugar levels. Fruit somewhat small and may crack during rainy weather. Indeterminate vine with high yield potential. Resistant: Verticillium wilt (race 1) and Fusarium wilt (race 1).

GRAPE TOMATOES

Grape tomatoes are elongated cherry tomatoes with very sweet fruit and fruit length about twice that of the diameter. The fruit usually weigh about 1/3 to 1/2 oz. The plant habit and fruit flavor are very similar to 'Sweet 100' and 'Sweet Million', two old indeterminate cherry varieties. These older varieties had limited commercial use due to plant growth habit and severe fruit cracking. The original "grape" tomato variety was 'Santa', a high quality, indeterminate variety. 'Santa' is a proprietary variety and has limited availability to growers. (Varieties are listed below.)

Brixmore. Very early. Indeterminate. Very uniform in shape and size, deep glossy red color with very high early and total yield. High brix and excellent firm flavor. Resistant: Verticillium wilt (race 1), root-knot nematodes and Tomato mosaic.

Cupid. Early. Vigorous, indeterminate bush. Oval-shaped fruit have an excellent red color and a sweet flavor. Resistant: Fusarium wilt (race 1,2), Bacterial speck (intermediate resistance race 0) and Gray leaf spot.

Jolly Elf. Early season. Determinate plant. Extended market life with firm, flavorful grape-shaped fruits. Average 10% brix. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 2) and cracking.

Santa. 75 days. Vigorous indeterminate bush. Firm elongated grape-shaped fruit with outstanding flavor and up to 50 fruits per truss. Resistant: Verticillium wilt (race 1), Fusarium wilt (race 1), root-knot nematodes and Tobacco mosaic.

St Nick. Mid-early season. Indeterminate bush. Oblong, grape-shaped fruit with brilliant red color and good flavor. Up to 10% brix.

Smarty. 69 days. Vigorous, indeterminate bush with short internodes. Plants are 25% shorter than Santa. Good flavor, sweet and excellent flavor.

Optimum in-row spacing is usually about 27 inches, closer spacing such as 24 inches crowds the plants and makes harvesting more difficult. Wider spacing such as 30 inches has resulted in incomplete canopy closure between plants and waste of space. Since most of the production is with the indeterminate varieties, tall stakes must be used. Most growers use 7 to 8-foot stakes placed between every plant. Fertility management would be similar to normal tomatoes on a daily basis, but end up with greater amounts due to the longer season.

Harvesting is usually done into buckets and then may be transferred to small field crates. Fruits must be handled carefully due to small size and tendency to split. The fruits are graded and separated into color groups. They are packed into pint containers, usually clamshells and placed into flats. There is also some bulk packing into 12 to 20 pound flats. The fruits must be harvested with color and the more color the better. The primary selling point has been the high sugar content of the fruit and growers have found that if they are picked green and gassed, the fruit are not very sweet.

SEEDING AND PLANTING

Planting dates and seeding information are given in Table 1.

FERTILIZER AND LIME

For mulched crops with subsurface irrigation, broadcast or band all P_2O_5 , micronutrients, and 20 to 25% of N

Table 1. Seeding and planting information for tomato.

Planting dates	
North Florida	July - Aug; Feb - Mar
Central Florida	Aug - Sept; Jan - Feb
South Florida	Aug - Feb
Seeding information	
Distance between rows (in)	48 - 72
Distance between plants (in)	12 - 32
Seeding depth (in)	0.5 - 0.75
Seed per acre, field (lb)	1 - 2
Seed per acre, transplant (lb)	0.25 - 0.5
Days to maturity from seed	90 - 115
Days to maturity from transplant	70 - 90
Plant population (per acre)	3,630 ¹
¹ Standard tomato spacing 24 inches in a row, 6-ft centers.	

and K_2O in the bed area. Banding P_2O_5 is preferred where only small amounts of P_2O_5 , are needed. Band remaining N and K_2O in grooves 2 to 3 inches deep in shoulders of bed. Supplemental N and K_2O at 30 lb and 20 lb, respectively, can be applied by liquid fertilizer injection wheel to replace leached N and K_2O . Soil test and fertilizer recommendations for mineral soils are given in Table 2.

For staked, mulched and drip-irrigated crops, broadcast all P_2O_5 , micronutrients, and 20 to 25% of N and K_2O in bed area (Fig. 41-3). Inject remaining N and K_2O through the tube using the schedule in Table 3.

PLANT TISSUE ANALYSIS

Plant tissue analysis information for tomato is given in Table 4. The analysis was done at first flower, using the most recently matured leaf.

PETIOLE SAP TESTING

Fresh sap can be pressed from leaf petioles and analyzed for nitrogen and potassium concentrations. Results can be used to make adjustments in the fertilization program. Sufficiency ranges for sap testing for tomato (field) are presented in Table 5.

PRUNING

In most short-stake culture systems some pruning is usually done. Pruning is the removal of suckers (axillary shoots) and can vary from no pruning to removal of all suckers up to the first fork (sucker immediately below the first bloom cluster). The cost of pruning ranges from \$0 to \$40/acre and comprises a very small part of the total production costs, but this operation can have a very large effect on yield and quality.

The degree of pruning is variety dependent. With short determinate varieties such as Solar Set, Equinox and plum types, only minimal pruning is necessary. With these varieties only the ground suckers, (those that form at cotyledons) need to be removed or none at all. Heavier pruning especially to the fork with these varieties will result in significant yield losses and can lead to increased sunburn fruit, blossom end rot and catfacing. With more vigorous determinate varieties such as Agriset 761, Florida 91 and Florida 47, heavier pruning such as removal of ground suckers plus two additional suckers may result in increased yields and fruit size. Again, heavy pruning (removal to fork) has caused reduced yields. As new varieties are available, growers will need to experiment as to the proper pruning for each variety. It is important to remove suckers when they are small to minimize damage to the plants.

Sanitation is very important, the tomatoes should never be pruned when the plants are wet. Working wet plants is an excellent way to transmit foliar diseases such as bacterial leaf spot. Other disease such as bacterial wilt and tobacco mosaic virus may also be transmitted through pruning.

IRRIGATION

Initial water requirements (see Chapter 8, *Principles and Practices of Irrigation Management for Vegetables*, Tables 4 to 6) of staked tomato plants (transplants) range from 20% of ETo to 50% of ETo. Lower values are associated with drip irrigated plants on raised, plastic mulched beds. Higher values are associated with production systems that have wet or moist row middle conditions. Water requirements increase during rapid growth and development to range from 90% to 115% of ETo (see Chapter 8, *Principles and Practices of Irrigation Management for Vegetables*, Table 3). As fruit are harvested, water requirements will decrease to between 75% and 100% of ETo. Uniformly available soil moisture through proper irrigation management is essential to ensure high fruit quality and proper sizing of fruit.

WEED MANAGEMENT

Herbicides labeled for weed control in tomatoes are listed in Table 6.

DISEASE MANAGEMENT

Chemicals approved for disease management in tomato are listed in Table 7.

INSECT MANAGEMENT

Table 8 outlines the insecticides approved for use on insects attacking tomato.

PRODUCTION COSTS

Sample breakeven production costs for tomato crops grown in different parts of Florida are given in Table 8 through Table 12. The example year is 1998-99.

- Table 9 Dade County
- Table 10 Manatee/Ruskin, fall crop
- Table 11 Manatee Ruskin, spring crop
- Table 12 Southwest Florida

Table 2. Soil test and fertilizer recommendations for mineral soils for tomato on 6-foot centers.¹

Target pH	N lb/A	P_2O_5					K_2O				
		VL	L	M	H	VH	VL	L	M	H	VH
		(lb/A/crop season)									
6.5	200	150	120	100	0	0	225	150	100	0	0

¹ See Chapter 2 section on supplemental fertilizer application and best management practices, pg 11.

Table 3. Fertilization recommendations for tomato grown in Florida on sandy soils testing very low in Mehlich-1 potassium (K₂O)

Production system	Nutrient	Recommended-Base fertilization ^z							Recommended-Supplemental fertilization ^z		
		Total (lbs/A)	Preplant ^y (lbs/A)	Injected ^x (lbs/A/day)					Leaching rain ^{r,s}	Measured "low" plant nutrient content ^{u,s}	Extended harvest season ^s
				1-2	3-4	5-11	12	13			
Drip irrigation, raised beds, and polyethylene mulch (on deep sands or on soils with shallow impermeable layer)	N	200	0-70	1.5	2.0	2.5	2.0	1.5	n/a	1.5 to 2 lbs/A/day for 7 days ^t	1.5 to 2 lbs/A/day ^p
	K ₂ O	220	0-70	2.5	2.0	3.0	2.0	1.5	n/a	1.5 to 2 lbs/A/day for 7 days ^t	1.5 to 2 lbs/A/day ^p
Seepage irrigation, raised beds, and polyethylene mulch (on soils with shallow impermeable layer)	N	200	200 ^v	0	0	0	0	0	30 lbs/A ^q	30 lbs/A ^t	30 lbs/A ^p
	K ₂ O	220	220 ^v	0	0	0	0	0	20 lbs/A ^q	20 lbs/A ^t	20 lbs/A ^p

^z A=7,260 linear bed feet per acre (6-ft bed spacing); for soils testing "very low" in Mehlich 1 potassium (K₂O) Seeds and transplants may benefit from applications of a starter solution at a rate no greater than 10 to 15 lbs/acre for N and P₂O₅, and applied through the plant hole or near the seeds.

^y Applied using the modified broadcast method (fertilizer is broadcast where the beds will be formed only, and not over the entire field). Preplant fertilizer cannot be applied to double/triple crops because of the plastic mulch; hence, in these cases, all the fertilizer has to be injected.

^x This fertigation schedule is applicable when no N and K₂O are applied preplant. Reduce schedule proportionally to the amount of N and K₂O applied preplant. Fertilizer injections may be done daily or weekly. Inject fertilizer at the end of the irrigation event and allow enough time for proper flushing afterwards.

^v For standard 13 week-long, transplanted tomato crop.

^v Some of the fertilizer may be applied with a fertilizer wheel though the plastic mulch during the tomato crop when only part of the recommended base rate is applied preplant. Rate may be reduced when a controlled-release fertilizer source is used.

^u Plant nutritional status may be determined with tissue analysis or fresh petiole-sap testing, or any other calibrated method. The "low" diagnosis needs to be based on UF/IFAS interpretative thresholds.

^t Plant nutritional status must be diagnosed every week to repeat supplemental fertilizer application.

^s Supplemental fertilizer applications are allowed when irrigation is scheduled following a recommended method (see chapter 8 on irrigation scheduling in Florida). Supplemental fertilizations is to be applied in addition to base fertilization when appropriate. Supplemental fertilization is not to be applied "in advance" with the preplant fertilizer.

^r A leaching rain is defined as a rainfall amount of 3 inches in 3 days or 4 inches in 7 days.

^q Supplemental amount for each leaching rain

^p Plant nutritional status must be diagnosed after each harvest before repeating supplemental fertilizer application.

Table 4. Plant tissue analysis for tomato at first flower stage. Dry wt. basis.

Status	N	P	K	Ca	Mg	S	Fe	Mn	Zn	B	Cu	Mo
	Percent						Parts per million					
Deficient	<2.8	0.2	2.5	0.8	0.3	0.3	40	30	25	15	5	0.2
Adequate range	2.8 -4.0	0.2 -0.4	2.5 -4.0	0.8 -2.0	0.3 -0.5	0.3 -0.8	40 -100	30 - 100	25 -40	15 -30	5 - 10	0.2 - 0.6
High	>4.0	0.4	4.0	2.0	0.5	0.8	100	100	40	40	15	0.6
Toxic								>1500	>300	>250		

Table 5. Sufficiency ranges for petiole sap testing for tomato.

Crop development stage	Fresh petiole sap concentrations (ppm)	
	NO ₃ -N	K
First buds	1000-1200	3500-4000
First open flowers	600-800	3500-4000
Fruits one-inch diameter	400-600	3000-3500
Fruits two-inch diameter	400-600	3000-3500
First harvest	300-400	2500-3000
Second harvest	200-400	2000-2500

Table 6. Chemical weed controls: tomatoes.

Herbicide	Labeled crops	Time of application to crop	Rate (lbs. AI./Acre)	
			Mineral	Muck
Carfentrazone (Aim)	(All)	Preplant Directed-hooded Row-middles	0.031	
Remarks: Aim may be applied as a preplant burndown treatment and/or as a post-directed hooded application to row middles for the burn-down of emerged broadleaf weeds. May be tank mixed with other registered herbicides. May be applied at up to 2 oz (0.031 lb ai). Use a quality spray adjuvant such as crop oil concentrate (coc) or non-ionic surfactant at recommended rates.				
Clethodem (Select 2 EC)	Tomatoes	Postemergence	0.94-0.125	---
Remarks: Postemergence control of actively growing annual grasses. Apply at 6-8 fl oz/acre. Use high rate under heavy grass pressure and/or when grasses are at maximum height. Always use a crop oil concentrate at 1% v/v in the finished spray volume. Do not apply within 20 days of tomato harvest.				
DCPA (Dacthal W-75) (non-mulched)	Established Tomatoes	Posttransplanting after crop establishment	6.0-8.0	---
Remarks: Controls germinating annuals. Apply to weed-free soil 6 to 8 weeks after crop is established and growing rapidly or to moist soil in row middles after crop establishment. Note label precautions of replanting non-registered crops within 8 months.				
Glyphosate (Roundup, Durango Touchdown, Glyphomax)		Chemical fallow Preplant, pre emergence, Pre transplant	0.3 - 1.0	
Remarks: Roundup, Glyphomax and Touchdown have several formulations. Check the label of each for specific labeling directions.				
Halosulfuron (Sanda)	Tomatoes	Pre-transplant Postemergence Row middles	0.024 - 0.036	
Remarks: A total of 2 applications of Sandea may be applied as either one pre-transplant soil surface treatment at 0.5-0.75 oz. product; one over-the-top application 14 days after transplanting at 0.5-0.75 oz. product; and/or postemergence application(s) of up to 1 oz. product (0.047 lb ai) to row middles. A 30-day PHI will be observed. For postemergence and row middle applications, a surfactant should be added to the spray mix.				
S-Metolachlor (Dual Magnum)	Tomatoes	Pretransplant Row middles	1.0 - 1.3	---
Remarks: Apply Dual Magnum preplant non-incorporated to the top of a pressed bed as the last step prior to laying plastic. May also be used to treat row-middles. Label rates are 1.0-1.33 pts/A if organic matter is less than 3%. Research has shown that the 1.33 pt may be too high in some Florida soils except in row middles. Good results have been seen at 0.6 pts to 1.0 pints especially in tank mix situations under mulch. Use on a trial basis.				
Metribuzin (Sencor DF) (Sencor 4)	Tomatoes	Postemergence Posttransplanting after establishment	0.25 - 0.5	---
Remarks: Controls small emerged weeds after transplants are established direct-seeded plants reach 5 to 6 true leaf stage. Apply in single or multiple applications with a minimum of 14 days between treatments and a maximum of 1.0 lb ai/acre within a crop season. Avoid applications for 3 days following cool, wet or cloudy weather to reduce possible crop injury.				

Table 6. Continued.

Herbicide	Labeled crops	Time of application to crop	Rate (lbs. AI./Acre)	
			Mineral	Muck
Metribuzin (Sencor DF) (Sencor 4)	Tomatoes	Directed spray in row middles	0.25 - 1.0	---
Remarks: Apply in single or multiple applications with a minimum of 14 days between treatments and maximum of 1.0 lb ai/acre within crop season. Avoid applications for 3 days following cool, wet or cloudy weather to reduce possible crop injury. Label states control of many annual grasses and broadleaf weeds including, lambsquarter, fall panicum, amaranthus sp., Florida pusley, common ragweed, sick-lepod, and spotted spurge.				
Napropamid (Devrinol 50DF)	Tomatoes	Preplant incorporated	1.0 - 2.0	---
Remarks: Apply to well worked soil that is dry enough to permit thorough incorporation to a depth of 1 to 2 inches. Incorporate same day as applied. For direct-seeded or transplanted tomatoes.				
Napropamid (Devrinol 50DF)	Tomatoes	Surface treatment	2.0	---
Remarks: Controls germinating annuals. Apply to bed tops after bedding but before plastic application. Rainfall or overhead-irrigate sufficient to wet soil 1 inch in depth should follow treatment within 24 hours. May be applied to row middles between mulched beds. A special Local Needs 24(c) Label for Florida. Label states control of weeds including Texas panicum, pigweed, purslane, Florida pusley, and signal-grass.				
Oxyfluorfen (Goal 2XL) (Goaltender)	Tomatoes	Fallow bed	0.25 - 0.5	
Remarks: Must have a 30 day treatment-planting interval. Apply as a preemergence broadcast or banded treatment at 1-2 pt/A or 1/2 to 1 pt/A to preformed beds. Mulch may be applied any time during the 30-day interval.				
Paraquat (Gramoxone Inteon) (Firestorm)	Tomatoes	Preemergence; Pretransplant	0.62 - 0.94	---
Remarks: Controls emerged weeds. Use a non-ionic spreader and thoroughly wet weed foliage.				
Paraquat (Gramoxone Inteon)	Tomatoes	Post directed spray in row middle	0.47	---
Remarks: Controls emerged weeds. Direct spray over emerged weeds 1 to 6 inches tall in row middles between mulched beds. Use a non-ionic spreader. Use low pressure and shields to control drift. Do not apply more than 3 times per season.				
Paraquat (Gramoxone Inteon)	Tomato	Postharvest desiccation	0.62-0.93	0.46-0.62
Remarks: Broadcast spray over the top of plants after last harvest. Use a nonionic surfactant at 1 pt/100 gals to 1 qt/100 gals spray solution. Thorough coverage is required to ensure maximum herbicide burndown. Do not use treated crop for human or animal consumption.				
Pelargonic Acid (Scythe)	Fruiting Vegetable (tomato)	Preplant Preemergence Directed-Shielded	3-10% v/v	---
Remarks: Product is a contact, nonselective, foliar applied herbicide. There is no residual control. May be tank mixed with several soil residual compounds. Consult the label for rates. Has a greenhouse and growth structure label.				
Rimsulfuron (Matrix)	Tomato	Posttransplant and directed-row middles	0.25 - 0.5 oz.	---
Remarks: Matrix may be applied preemergence (seeded), postemergence, posttransplant and applied directed to row middles. May be applied at 1-2 oz. product (0.25-0.5 oz ai) in single or sequential applications. A maximum of 4 oz. product per acre per year may be applied. For post (weed) applications, use a non-ionic surfactant at a rate of 0.25% v/v. for preemergence (weed) control, Matrix must be activated in the soil with sprinkler irrigation or rainfall. Check crop rotational guidelines on label.				
Sethoxydim (Poast)	Tomatoes	Postemergence	0.188 - 0.28	---
Remarks: Controls actively growing grass weeds. A total of 42 pts. product per acre may be applied in one season. Do not apply within 20 days of harvest. Apply in 5 to 20 gallons of water adding 2 pts. of oil concentrate per acre. Unsatisfactory results may occur if applied to grasses under stress. Use 0.188 lb ai (1 pt.) to seedling grasses and up to 0.28 lb ai (12 pts.) to perennial grasses emerging from rhizomes etc. Consult label for grass species and growth stage for best control.				
Trifloxysulfuron (Envoke)	Tomatoes (transplanted)	Postdirected	0.5	---
Remarks: Envoke can be applied at 0.1 to 0.2 oz product/A post-directed to transplanted tomatoes for control of nutsedge, morningglory, pigweeds and other weeds listed on the label. Applications should be made prior to fruit set and at least 45 days prior to harvest. A non-ionic surfactant should be added to the spray mix.				

Table 6. Continued.

Herbicide	Labeled crops	Time of application to crop	Rate (lbs. AI./Acre)	
			Mineral	Muck
Trifluralin (Treflan HFP) (Treflan TR-10)	Tomatoes (except Dade County)	Pretransplant incorporated	0.5	---
Remarks: Controls germinating annuals. Incorporate 4 inches or less within 8 hours of application. Results in Florida are erratic on soils with low organic matter and clay contents. Note label precautions of planting non-registered crops within 5 months. Do not apply after transplanting.				

Table 7. Disease management for tomato.

Chemical	Fungicide Group ¹	Maximum Rate/Acre/ Application	Season	Min. Days to Harvest	Pertinent Diseases or Pathogens	Remarks ²
Manex 4 F (maneb)	M3	2.4 qts.	16.8 qts.	5	Early blight	See label
Dithane, Manzate or Penncozeb 75 DFs (mancozeb)	M3	3 lbs.	22.4 lbs.	5	Late blight Gray leaf spot Bacterial spot ³	
Maneb 80 WP (maneb)	M3	3 lbs	21 lbs.	5		
Dithane F 45 or Manex II 4 FLs (mancozeb)	M3	2.4 pts.	16.8 qts.	5		
Dithane M-45, Penncozeb 80, or Manzate 80 WPs (mancozeb)	M3	3 lbs.	21 lbs.	5		
Maneb 75 DF (maneb)	M3	3 lbs.	22.4 lbs.	5		See label for details
Equus 720 ⁴ , Echo 720, Chloro Gold 720 6 FIs (chlorothalonil)	M5	3 pts. or 2.88 pts.	20.1 pts.	2	Early blight Late blight Gray leaf spot	Use higher rates at fruit set and lower rates before fruit set, see label
Echo 90 DF or Equus 82.5DF (chlorothalonil)	M5	2.3 lbs.		2	Target spot	
Ridomil Gold Bravo 76.4 W (chlorothalonil +mefenoxam)	4 / M5	3 lbs.	12 lbs	14	Early blight Late blight Gray leaf spot Target Spot	Limit is 4 appl./crop, see label
Amistar 80 DF (azoxystrobin)	11	2 ozs	12 ozs	0	Early blight Late blight Sclerotinia	Limit is 2 sequential appl. or 6 application total. Alternate or tank mix with a multi-site effective fungicide (FRAC code M), see label
Quadris (azoxystrobin)	11	6.2 fl.ozs.	37.2 fl.ozs.	0	Powdery mildew Target spot	
Cabrio 2.09 F (pyraclostrobin)	11	16 fl oz	96 fl oz	0	Buckeye rot	
Flint (trifloxystrobin)	11		16 oz	3	Early blight Late blight Gray leaf spot	See label for details
Ridomil Gold EC (mefenoxam)	4	2 pts. / trtd. acre	3 pts / trtd / acre	28	Pythium diseases	See label for details
Ridomil MZ 68 WP (mefenoxam + mancozeb)	4 / M3	2.5 lbs.	7.5 lbs.	5	Late blight	Limit is 3 appl./crop, see label
Ridomil Gold Copper 64.8 W (mefenoxam + copper hydroxide)	4 / M1	2 lbs.		14	Late blight	Limit is 3 appl. /crop. Tank mix with maneb or mancozeb fungicide, see label
JMS Stylet-Oil (paraffinic oil)		3 qts.			Potato Virus Y Tobacco Etch Virus CMV	See label for restrictions and use (e.g. use of 400 psi spray pressure)
Aliette 80 WDG (fosetyl-al)	33	5 lbs.	20 lbs.	14	Phytophthora root rot	Using potassium carbonate or Diammonium phosphate, the spray of Aliette should be raised to a pH of 6.0 or above when applied prior to or after copper fungicides, see label

Table 7. Continued.

Chemical	Fungicide Group ¹	Maximum Rate/Acre/ Application Season	Min. Days to Harvest	Pertinent Diseases or Pathogens	Remarks ²
Bravo Ultrex (chlorothalonil)	M5	2.6 lbs. 18.3 lbs	2	Early blight Late blight Gray leaf spot Target spot Botrytis Rhizoctonia fruit rot	Use higher rates at fruit set, see label
Bravo Weather Stik (chlorothalonil)	M5	2 ¾ pts. 20 pts	2		
Botran 75 W (dichloran)	14	1 lb. 4 lbs.	10	Botrytis	<u>Greenhouse use only.</u> Limit is 4 applications. Seedlings or newly set transplants may be injured, see label
Nova 40 W (myclobutanil)	3	4 ozs. 1.25 lbs.	0	Powdery mildew	Note that a 30 day plant back restriction exists, see label
Sulfur (many brands)	M2		1	Powdery mildew	Follow label closely, it may cause phytotoxicity.
Actigard (acibenzolar-S-methyl)	P	1/3-3/4 oz 4 ozs.	14	Bacterial spot Bacterial speck Tomato spotted wilt – a viral disease (use in combination of UV-reflective mulch and vector thrips specific insecticides).	Do not use highest labeled rate in early sprays to avoid a delayed onset of harvest. See label for details.
ManKocide 61.1 DF (mancozeb + copper hydroxide)	M3 / M1	5 lbs. 112 lbs.	5	Bacterial spot Bacterial speck Late blight Early blight Gray leaf spot	See label
Gavel 75DF (mancozeb + zoaximide)	M3 / 22	2.0 lbs 16 lbs	5	Buckeye rot Early blight Gray leaf spot Late blight Leaf mold	See label
Previcur Flex (propamocarb hydrochloride)	28	0.7-1.5 pints (see Label)	7.5 pints 5	Late blight	Only in a tank mixture with chlorothalonil, maneb or mancozeb, see label
Curzate 60DF (cymoxanil)	27	5 oz 30 oz per 12 month	3	Late Blight	Do not use alone, see label for details
Tanos (famoxadone + cymoxanil)	11 / 27	8 oz 72 oz	3	Early blight Late blight Target spot Bacterial spot (suppression)	See label for details
Acrobat 50 WP (dimethomorph)	15	6.4 oz 32 oz	4	Late blight	See label for details
K-phite (Phosphorous acid)	33	2 qts. in a minimum of 100 gal.	0	Phytophthora sp. (root rot) Pythium sp. (Damping-off)	Dosage given is for drip application. See label for restrictions and details
Scala SC (pyrimethanil)	9	7 fl oz 0.27 lbs 35 fl oz 1.4 lbs	1	Early blight Botrytis	Use only in a tank mix with another effective fungicide (non FRAC code 9), see label

Table 7. Continued.

Chemical	Fungicide Group ¹	Maximum Rate/Acre/ Application	Season	Min. Days to Harvest	Pertinent Diseases or Pathogens	Remarks ²
Endura (boscalid)	7	3.5 oz	21	0	Target spot (Corynespora cassiicola) Early Blight (Alternaria solani)	Alternate with non-FRAC code 7 fungicides, see label
Terraclor 75 WP (PCNB)	14	See Label	See Label	Soil treatment at planting	Southern blight (Sclerotium rolfsii)	See label for application type and restrictions
Fix (Copper +mancozeb or maneb)	M1 / M3			5	Bacterial spot Bacterial speck	Mancozeb or maneb enhances bactericidal effect of fix copper compounds, see label
Kocide 101 or Champion 77 WPs (copper hydroxide)	M1	4 lbs.		2		
Kocide 4.5 LF (copper hydroxide)	M1	2 2/3 pts		1		
Kocide 2000 53.8 DF (copper hydroxide)	M1	3 lbs.		1		
Champ 57.6 DP (copper hydroxide)	M1	1 1/3 lbs		1		
Basicop 53 WP	M1	4 lbs.		1		
Kocide 61.4 DF(copper hydroxide)	M1	4 lbs				
Cuprofix Disperss 36.9 DF(copper hydroxide)	M1	6 lbs				
Allpro Exotherm Termil (20 % chlorothalonil)	M5	1 can / 1000 sq. ft.		7	Botrytis Leaf mold Late blight Early blight Gray leaf spot Target spot	<u>Greenhouse use only.</u> Allow can to remain overnight and then ventilate. Do not use when greenhouse temperature is above 75 F, see label
Reason 500SC (fenamidone)	11	5.5-8.2 oz	24.6 lb	14	Early blight Late blight Septoria leaf spot	See label for details
Ranman 400SC (cyazofamid)	21	2.1-2.75 oz	16 oz	0	Late Blight	Limit is 6 appl./crop, see label
Serenade Serenade ASO Serenade Max Sonata (Bacillus subtilis)	Biological material	See label	See label	0	Bacterial spot	mix with copper compounds, see label

¹ FRAC code (fungicide group): Numbers (1-37) and letters (M, U, P) are used to distinguish the fungicide mode of action groups. All fungicides within the same group (with same number or letter) indicate same active ingredient or similar mode of action. This information must be considered for the fungicide resistance management decisions. M = Multi site inhibitors, fungicide resistance risk is low; U = Recent molecules with unknown mode of action; P = host plant defense inducers. Source: <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any chemical. The use of brand names and any mention or listing of commercial products or services in the publication does not imply endorsement by the University of Florida Cooperative Extension Service nor discrimination against similar products or services not mentioned.

³ Tank mix of mancozeb or maneb enhances bactericidal effect of copper compounds.

Table 8. Selected insecticides approved for use on insects attacking tomatoes.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
Acramite-50WS (bifenazate)	0.75-1.0 lb	12	3	twospotted spider mite	2	One application per season.
Admire 2F (imidacloprid)	16-24 fl oz	12	21	aphids, Colorado potato beetle, flea beetles, leafhoppers, thrips (foliar feeding thrips only), whiteflies	4A	Most effective if applied to soil at transplanting. Limited to 24 oz/acre. Admire Pro limited to 10.5 fl oz/acre.
Admire Pro	7-10.5 fl oz					
Admire 2F (imidacloprid)	1.4 fl oz/1000 plants	12	0 (soil)	aphids, whiteflies	4A	Greenhouse Use: 1 application to mature plants, see label for cautions.
Admire Pro	0.6 fl oz/1000 plants					
Admire 2F (imidacloprid)	0.1 fl oz/1000 plants	12	21	aphids, whiteflies	4A	Planthouse: 1 application. See label.
Admire Pro	0.44 fl oz/10,000 plants					
Agree WG (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11B1	Apply when larvae are small for best control. Can be used in greenhouse. OMRI-listed ² .
*Agri-Mek 0.15EC (abamectin)	8-16 fl oz	12	7	Colorado potato beetle, <i>Liriomyza</i> leafminers, spider mite, tomato pinworms, tomato russet mite	6	Do not make more than 2 sequential applications. Do not apply more than 48 fl oz per acre per season.
*Ambush 25W (permethrin)	3.2-12.8 oz	12	up to day of harvest	beet armyworm, cabbage looper, Colorado potato beetle, granulate cutworms, hornworms, southern armyworm, tomato fruitworm, tomato pinworm, vegetable leafminer	3	Do not use on cherry tomatoes. Do not apply more than 1.2 lb ai/acre per season (76.8 oz). Not recommended for control of vegetable leafminer in Florida.
*Asana XL (0.66EC) (esfenvalerate)	2.9-9.6 fl oz	12	1	beet armyworm (aids in control), cabbage looper, Colorado potato beetle, cutworms, flea beetles, grasshoppers, hornworms, potato aphid, southern armyworm, tomato fruitworm, tomato pinworm, whiteflies, yellowstriped armyworm	3	Not recommended for control of vegetable leafminer in Florida. Do not apply more than 0.5 lb ai per acre per season, or 10 applications at highest rate.
Assail 70WP (acetamiprid)	0.6-1.7 oz	12	7	aphids, Colorado potato beetle, thrips, whiteflies	4A	Do not apply to crop that has been already treated with imidacloprid or thiamethoxam at planting. Begin applications for whiteflies when first adults are noticed. Do not apply more than 4 times per season or apply more often than every 7 days.
Assail 30 SG	1.5-4.0 oz					

Table 8. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
Avaunt (indoxacarb)	2.5-3.5 oz	12	3	beet armyworm, hornworms, loopers, southern armyworm, tomato fruitworm, tomato pinworm, suppression of leafminers	22	Do not apply more than 14 ounces of product per acre per crop. Minimum spray interval is 5 days.
Aza-Direct (azadirachtin)	1-2 pts, up to 3.5 pts, if needed	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, mites, stink bugs, thrips, weevils, whiteflies	26	Antifeedant, repellent, insect growth regulator. OMRI-listed ² .
Azatin XL (azadirachtin)	5-21 fl oz	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, weevils, whiteflies	26	Antifeedant, repellent, insect growth regulator.
*Baythroid 2 (cyfluthrin)	1.6-2.8 fl oz	12	0	beet armyworm ⁽¹⁾ , cabbage looper, Colorado potato beetle, dipterous leafminers, European corn borer, flea beetles, hornworms, potato aphid, southern armyworm ⁽¹⁾ , stink bugs, tomato fruitworm, tomato pinworm, variegated cutworm, western flower thrips, whitefly ⁽²⁾	3	(¹) 1st and 2nd instars only (²) suppression Do not apply more than 0.26 lb ai per acre per season. Maximum number of applications: 6.
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11B2	Treat when larvae are young. Good coverage is essential. Can be used in the greenhouse. OMRI-listed ² .
BotaniGard 22 WP, ES (<i>Beauveria bassiana</i>)	WP: 0.5-2 lb/100 gal ES: 0.5-2 qts 100/gal	4	0	aphids, thrips, whiteflies	--	May be used in greenhouses. Contact dealer for recommendations if an adjuvant must be used. Not compatible in tank mix with fungicides.
*Capture 2EC (bifenthrin)	2.1-5.2 fl oz	12	1	aphids, armyworms, corn earworm, cutworms, flea beetles, grasshoppers, mites, stink bug spp., tarnished plant bug, thrips, whiteflies	3	Make no more than 4 applications per season. Do not make applications less than 10 days apart.
CheckMate TPW, TPW-F (pheromone)	TPW: 200 dispenser TPW-F: 1.2-6.0 fl oz	0	0	tomato pinworm	--	For mating disruption - See label. TPW formulation. OMRI-listed ² .
Confirm 2F (tebufenozide)	6-16 fl oz	4	7	armyworms, black cutworm, hornworms, loopers	18	Product is a slow-acting IGR that will not kill larvae immediately. Do not apply more than 1.0 lb ai per acre per season.
Courier 70WP, 40SC (buprofezin)	70WP: 6-9 oz 40SC: 9-13.6 fl oz	12	1	whitefly nymphs	16	See label for plantback restrictions. Apply when a threshold is reached of 5 nymphs per 10 leaflets from the middle of the plant. Product is a slow-acting IGR that will not kill nymphs immediately. No more than 2 applications per season. Allow at least 28 days between applications.

Table 8. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
Crymax WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11B2	Use high rate for armyworms. Treat when larvae are young.
*Danitol 2.4 EC (fen- prothrin)	10.67 fl oz	24	3 days, or 7 if mixed with Monitor 4	beet armyworm, cabbage looper, fruitworms, potato aphid, silverleaf whitefly, stink bugs, thrips, tomato pinworm, twospotted spi- der mites, yellowstriped armyworm	3	Use alone for control of fruit- worms, stink bugs, twospotted spider mites, and yellowstriped armyworms. Tank-mix with Monitor 4 for all others, espe- cially whitefly. Do not apply more than 0.8 lb ai per acre per season. Do not tank mix with copper.
Deliver (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11B2	Use higher rates for army- worms. OMRI-listed ² .
*Diazinon AG500; 4E; *50 W (diazinon)	AG500, 4E: 0.5-1.5 pts 50W: 0.5-1.5 lb	24	1	aphids, beet armyworm, banded cucumber beetle, <i>Drosophila</i> , fall armyworm, dipterous leafminers, southern armyworm	1B	Will not control organophos- phate-resistant leafminers. Do not apply more than five times per season.
	AG500, 4E: 1-4 qts 50W: 2-8 lb	24	preplant	cutworms, mole crickets, wireworms		
Dimethoate 4 EC, 2.67 EC (dimethoate)	4EC: 0.5-1.0 pt 2.67: 0.75-1.5 pt	48	7	aphids, leafhoppers, leafminers	1B	Will not control organophos- phate-resistant leafminers.
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11B2	Treat when larvae are young. Good coverage is essential. OMRI-listed ² .
Endosulfan 3EC (endosulfan)	0.66-1.33 qt	24	2	aphids, blister beetle, cabbage looper, Colorado potato beetle, flea beetles, hornworms, stink bugs, tomato fruitworm, tomato russet mite, whiteflies, yel- lowstriped armyworm	2	Do not exceed a maximum of 3.0 lb active ingredient per acre per year or apply more than 6 times. Can be used in green- house.
Entrust (spinosad)	0.5-2.5 oz	4	1	armyworms, Colorado potato beetle, flower thrips, hornworms, <i>Liriomyza</i> leafminers, loopers, other caterpillars, tomato fruit- worm, tomato pinworm	5	Do not apply more than 9 oz per acre per crop. OMRI-listed ² .
Esteem Ant Bait (pyriproxyfen)	1.5-2.0 lb	12	1	red imported fire ant	7D	Apply when ants are actively foraging.
Extinguish (S)-methoprene)	1.0-1.5 lb	4	0	fire ants	7A	Slow-acting IGR (insect growth regulator). Best applied early spring and fall where crop will be grown. Colonies will be reduced after three weeks and eliminated after 8 to 10 weeks. May be applied by ground equipment or aerially.

Table 8. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
Fulfill (pymetrozine)	2.75 oz	12	0 - if 2 applica- tions 14 - if 3 or 4 applica- tions	green peach aphid, potato aphid, suppression of whiteflies	9B	Do not make more than four applications. 24(c) label for growing transplants also.
Intrepid 2F (methoxyfenozide)	4-16 fl oz	4	1	beet armyworm, cabbage looper, fall armyworm, hornworms, southern armyworm, tomato fruit- worm, true armyworm, yellowstriped armyworm	18	Do not apply more than 64 fl oz acre per season. Product is a slow-acting IGR that will not kill larvae immedi- ately.
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.5 lb	4	0	most caterpillars, but not Spodoptera species (army- worms)	11B2	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
Kelthane MF 4 (dicofol)	0.75-1.5 pt	12	2	tomato russet mites, twospotted and other spider mites	20	Do not apply more than twice a season or more than 1.6 pts per year.
Knack IGR (pyriproxyfen)	8-10 fl oz	12	14	immature whiteflies	7D	Apply when a threshold is reached of 5 nymphs per 10 leaflets from the middle of the plant. Product is a slow-acting IGR that will not kill nymphs immediately. Make no more than two applications per season.
Kryocide; (cryolite)	8-16 lb	12	14	blister beetle, cabbage looper, Colorado potato beetle larvae, flea beetles, hornworms, tomato fruit- worm, tomato pinworm	9A	Minimum of 7 days between applications. Do not apply more than 64 lbs per acre per season. Not for cherry tomatoes.
*Lannate LV, *SP (methomyl)	LV: 0.75-3.0 pt SP: 0.25-1.0 lb	48	1	aphids, armyworms, beet armyworm, fall armyworm, hornworms, loopers, southern armyworm, tomato fruitworm, tomato pinworm, variegated cut- worm	1A	Do not apply more than 6.3 lb ai/acre per crop.
Lepinox WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	1.0-2.0 lb	12	0	for most caterpillars, including beet armyworm (see label)	11B2	Treat when larvae are small. Thorough coverage is essential.
Malathion 8 F (malathion)	1.5-2 pt	12	1	aphids, Drosophila, mites	1B	Can be used in greenhouse.
*Monitor 4EC (meth- amidophos) [24(c) labels]	1.5-2 pts	48	7	aphids, fruitworms, leafminers, tomato pin- worm ⁽¹⁾ , whiteflies ⁽²⁾	1B	(1) Suppression only (2) Use as tank mix with a pyre- throid for whitefly control. Do not apply more than 8 pts per acre per crop season, nor within 7 days of harvest.
M-Pede 49% EC (Soap, insecticidal)	1-2% V/V	12	0	aphids, leafhoppers, mites, plant bugs, thrips, white- flies	--	OMRI-listed ² .

Table 8. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
*Mustang Max (zeta-cypermethrin)	2.24-4.0 oz	12	1	beet armyworm, cabbage looper, Colorado potato beetle, cutworms, fall armyworm, flea beetles, grasshoppers, green and brown stink bugs, hornworms, leafminers, leafhoppers, Lygus bugs, plant bugs, southern armyworm, tobacco budworm, tomato fruitworm, tomato pinworm, true armyworm, yellowstriped armyworm. Aides in control of aphids, thrips and whiteflies.	3	Not recommended for vegetable leafminer in Florida. Do not make applications less than 7 days apart. Do not apply more than 0.3 lb ai per acre per season.
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, hornworms, psyllids, Colorado potato beetle, cutworms, leafminers, loopers, tomato fruitworm (corn earworm), tomato pinworm, whiteflies	18A	IGR, feeding repellent. OMRI-listed ² .
NoMate MEC TPW (pheromone)		0	0	tomato pinworm	--	For mating disruption - See label.
Oberon 2SC (spiromesifen)	7.0-8.5 fl oz	12	7	broad mite, twospotted spider mite, whiteflies (eggs and nymphs)	23	Maximum amount per crop: 25.5 fl oz/acre. No more than 3 applications.
Platinum (thiamethoxam)	5-8 fl oz	12	30	aphids, Colorado potato beetles, flea beetles, whiteflies	4A	Soil application. See label for rotational restrictions.
*Pounce 3.2 EC (permethrin)	2-8 oz	12	0	beet armyworm, cabbage looper, Colorado potato beetle, dipterous leafminers, granulate cutworm, hornworms, southern armyworm, tomato fruitworm, tomato pinworm	3	Do not apply to cherry or grape tomatoes (fruit less than 1 inch in diameter). Do not apply more than 1.2 lb ai per acre per season.
*Proaxis Insecticide (gamma-cyhalothrin)	1.92-3.84 fl oz	24	5	aphids ⁽¹⁾ , beet armyworm ⁽²⁾ , blister beetles, cabbage looper, Colorado potato beetle, cucumber beetles (adults), cutworms, hornworms, fall armyworm ⁽²⁾ , flea beetles, grasshoppers, leafhoppers, plant bugs, southern armyworm ⁽²⁾ , spider mites ⁽¹⁾ , stink bugs, thrips ⁽¹⁾ , tobacco budworm, tomato fruitworm, tomato pinworm, vegetable weevil (adult), whiteflies ⁽¹⁾ , yellowstriped armyworm ⁽²⁾	3	(1) Suppression only. (2) First and second instars only. Do not apply more than 2.88 pints per acre per season.
*Proclaim (emamectin benzoate)	2.4-4.8 oz	48	7	beet armyworm, cabbage looper, fall armyworm, hornworms, southern armyworm, tobacco budworm, tomato fruitworm, tomato pinworm, yellowstriped armyworm	6	No more than 28.8 oz/acre per season.

Table 8. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
Prokil Cryolite 96 (cryolite)	10-16 lb	12	14	blister beetle, cabbage looper, Colorado potato beetle larvae, flea beetles, hornworms	9A	Minimum of 7 days between applications. Do not apply more than 64 lbs per acre per season. Not for cherry tomatoes.
Provado 1.6F (imidacloprid)	3.8 oz	12	0	aphids, Colorado potato beetle, leafhoppers, whiteflies	4A	Do not apply to crop that has been already treated with imidacloprid or thiamethoxam at planting. Do not apply more than 18.75 oz per acre as foliar spray.
Pyrellin EC (pyrethrin + rotenone)	1-2 pt	12	12 hours	aphids, Colorado potato beetle, cucumber beetles, flea beetles, flea hoppers, leafhoppers, leafminers, loopers, mites, plant bugs, stink bugs, thrips, vegetable weevil, whiteflies	3, 21	
Sevin 80S; XLR; 4F (carbaryl)	80S: 0.63-2.5 XLR; 4F: 0.5-2.0 A	12	3	Colorado potato beetle, cutworms, fall armyworm, flea beetles, lace bugs, leafhoppers, plant bugs, stink bugs ⁽¹⁾ , thrips ⁽¹⁾ , tomato fruitworm, tomato hornworm, tomato pinworm, sowbugs	1A	⁽¹⁾ suppression Do not apply more than seven times. Do not apply a total of more than 10 lb or 8 qt per acre per crop.
SpinTor 2SC (spinosad)	1.5-8.0 fl oz	4	1	armyworms, Colorado potato beetle, flower thrips, hornworms, Liriomyza leafminers, loopers, Thrips palmi, tomato fruitworm, tomato pinworm	5	Do not apply to seedlings grown for transplant within a greenhouse or shadehouse. Leafminer and thrips control may be improved by adding an adjuvant. Do not apply more than three times in any 21 day period. Do not apply more than 29 ozs per acre per crop.
Sulfur (many brands)	See label	24	see label	tomato russet mite	--	
*Telone C-35 (dichloropropene + chloropicrin)	See label	5 days (See label)	preplant	garden centipedes (symphylans), wireworms	--	See supplemental label for restrictions in certain Florida counties.
*Telone II (dichloropropene)						
Trigard (cyromazine)	26.6 oz	12	0	Colorado potato beetle (suppression of), leafminers	17	No more than 6 applications per crop.
Trilogy (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	26	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .
Ultra Fine Oil, JMS Stylet-Oil, and others (oil, insecticidal)	3-6 qts/100 gal (JMS)	4	0	aphids, beetle larvae, leafhoppers, leafminers, mites, thrips, whiteflies, aphid-transmitted viruses (JMS)	--	Do not exceed four applications per season. Organic Stylet-Oil is OMRI-listed ² .
Venom (dinotefuran)	foliar: 1-4 oz soil: 5-6 oz	12	foliar: 1 soil: 21	Colorado potato beetle, green peach aphid, flea beetles, leafhoppers, leafminers, potato aphid thrips, whiteflies	4A	Use only one application method (soil or foliar). Limited to three applications per season. Do not use on grape or cherry tomatoes.

Table 8. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
*Vydate L 2EC (oxamyl)	foliar: 2-4 pt	48	3	aphids, Colorado potato beetle, leafminers (except <i>Liriomyza trifolii</i>), whiteflies (suppression only)	1A	Do not apply more than 32 pts per acre per season.
*Warrior (lambda-cyhalothrin)	1.92-3.84 fl oz	24	5	aphids ⁽¹⁾ , beet armyworm ⁽²⁾ , cabbage looper, Colorado potato beetle, cutworms, fall armyworm ⁽²⁾ , flea beetles, grasshoppers, hornworms, leafhoppers, leafminers ⁽¹⁾ , plant bugs, southern armyworm ⁽²⁾ , stink bugs, thrips ⁽³⁾ , tomato fruitworm, tomato pinworm, whiteflies ⁽¹⁾ , yellowstriped armyworm ⁽²⁾	3	(1) suppression only (2) for control of 1st and 2nd instars only. Do not apply more than 0.36 lb ai per acre per season. (3) Does not control western flower thrips.
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2 lb	4	0	caterpillars	11B1	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production. OMRI-listed ² .

The pesticide information presented in this table was current with federal and state regulations at the time of revision. The user is responsible for determining the intended use is consistent with the label of the product being used. Use pesticides safely. Read and follow label instructions.

¹ Mode of Action codes for vegetable pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v.3.3 October 2003. 1A. Acetylcholine esterase inhibitors, Carbamates 1B. Acetylcholine esterase inhibitors, Organophosphates

- 2A. GABA-gated chloride channel antagonists
- 3. Sodium channel modulators
- 4A. Nicotinic Acetylcholine receptor agonists/antagonists, Neonicotinoids
- 5. Nicotinic Acetylcholine receptor agonists (not group 4)
- 6. Chloride channel activators
- 7A. Juvenile hormone mimics, Juvenile hormone analogues
- 7D. Juvenile hormone mimics, Pyriproxifen
- 9A. Compounds of unknown or non-specific mode of action (selective feeding blockers), Cryolite
- 9B. Compounds of unknown or non-specific mode of action (selective feeding blockers), Pymetrozine
- 11B1. Microbial disruptors of insect midgut membranes, *B.t. var aizawai*
- 11B2. Microbial disruptors of insect midgut membranes, *B.t. var kurstaki*
- 12B. Inhibitors of oxidative phosphorylation, disruptors of ATP formation, Organotin miticide
- 15. Inhibitors of chitin biosynthesis, type 0, Lepidopteran
- 16. Inhibitors of chitin biosynthesis, type 1, Homopteran
- 17. Inhibitors of chitin biosynthesis, type 2, Dipteran
- 18. Ecdysone agonist/disruptor
- 20. Site II electron transport inhibitors
- 21. Site I electron transport inhibitors
- 22. Voltage-dependent sodium channel blocker
- 23. Inhibitors of lipid biosynthesis
- 25. Neuroactive (unknown mode of action)
- 26. Unknown mode of action, Azadirachtin

² OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

*** Restricted Use Only**

Table 9. Breakeven production costs for tomato at various yield levels in the Miami-Dade County area, 2004-2005.

	Cost per acre	Yield (ctn/acre)				
		1,150	1,300	1,450	1,600	1,750
Variable Costs	\$4,979.74	\$4.33	\$3.83	\$3.43	\$3.11	\$2.85
Fixed Costs	\$2,933.29	\$2.55	\$2.26	\$2.02	\$1.83	\$1.68
Harvest Cost/unit		\$3.64	\$3.64	\$3.64	\$3.64	\$3.64
Total Cost/unit		\$10.52	\$9.73	\$9.10	\$8.59	\$8.16

Table 10. Breakeven production costs for fall tomatoes at various yield levels in the Manatee/Ruskin area, 2004-2005.

	Cost per acre	Yield (ctn/acre)				
		1,000	1,150	1,300	1,450	1,600
Variable Costs	\$5,023.34	\$5.02	\$4.37	\$3.86	\$3.46	\$3.14
Fixed Costs	\$2,294.43	\$2.29	\$2.00	\$1.76	\$1.58	\$1.43
Harvest Cost/unit		\$3.44	\$3.44	\$3.44	\$3.44	\$3.44
Total Cost/unit		\$10.76	\$9.80	\$9.07	\$8.48	\$8.01

Table 11. Breakeven production costs for spring tomatoes at various yield levels in the Manatee/Ruskin area, 2004-2005.

	Cost per acre	Yield (ctn/acre)				
		1,000	1,200	1,400	1,600	1,800
Variable Costs	\$4,752.17	\$4.75	\$3.96	\$3.39	\$2.97	\$2.64
Fixed Costs	\$2,158.61	\$2.16	\$1.80	\$1.54	\$1.35	\$1.20
Harvest Cost/unit		\$3.39	\$3.39	\$3.39	\$3.39	\$3.39
Total Cost/unit		\$10.30	\$9.15	\$8.33	\$7.71	\$7.23

Table 12. Breakeven production costs for spring tomatoes at various yield levels in the southwest Florida area, 2004-2005.

	Cost per acre	Yield (ctn/acre)				
		1,400	1,500	1,600	1,700	1,800
Variable Costs	\$5,500.61	\$3.93	\$3.67	\$3.44	\$3.24	\$3.06
Fixed Costs	\$1,744.64	\$1.25	\$1.16	\$1.09	\$1.03	\$0.97
Harvest Cost/unit		\$3.59	\$3.59	\$3.59	\$3.59	\$3.59
Total Cost/unit		\$8.77	\$8.42	\$8.12	\$7.85	\$7.62