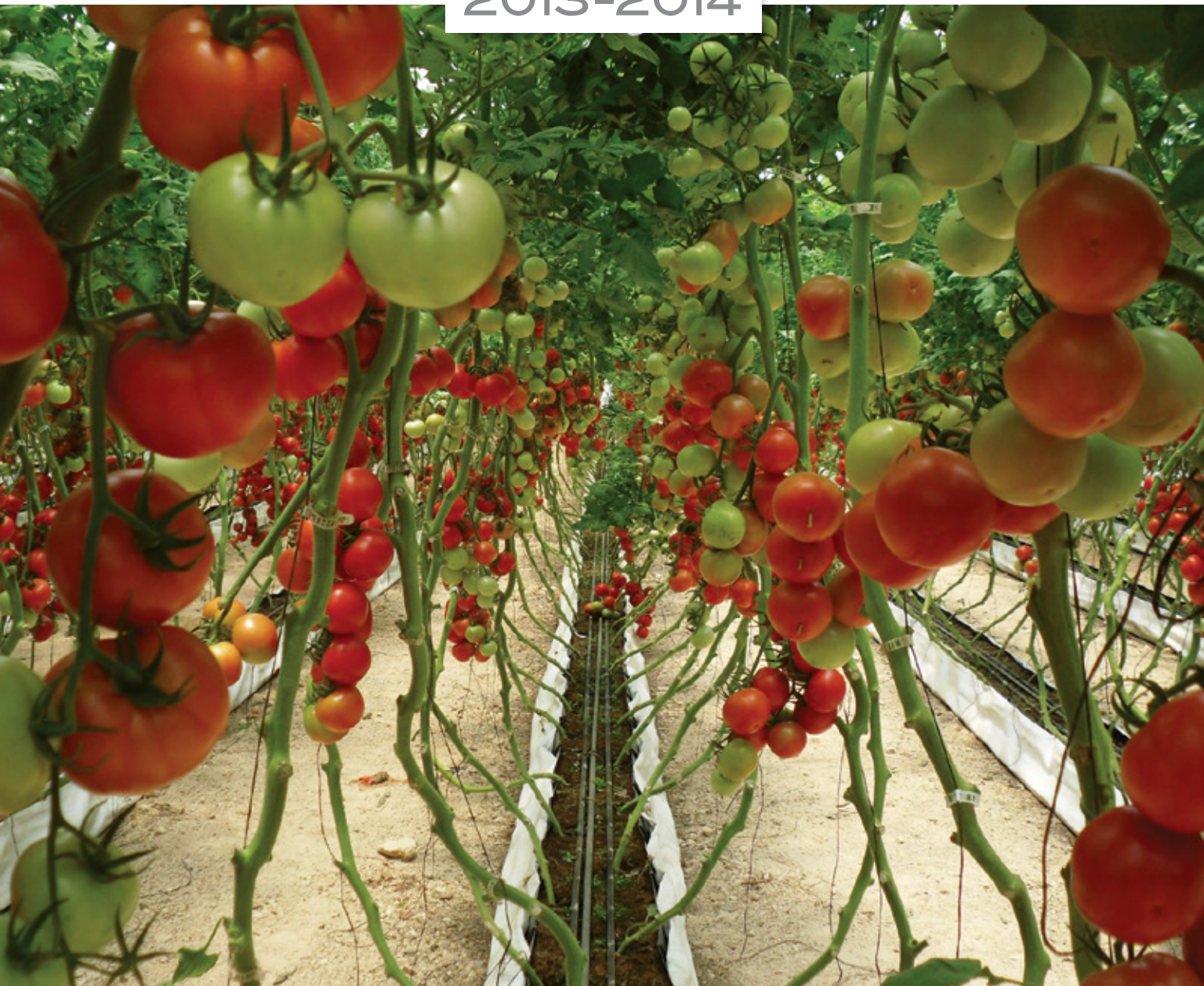


Vegetable

PRODUCTION HANDBOOK *for* FLORIDA

2013-2014



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THE GROWER'S
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Acknowledgements

The purpose of this book is to provide the best and most up-to-date information available to the primary users of this book - the Florida vegetable industry. This is possible because of the efforts of many University of Florida faculty in several locations around the state. The editors gratefully acknowledge their contributions. The editors also wish to acknowledge the contributions of the following faculty who have retired or are no longer involved in extension: Richard P. Cromwell, Kent E. Cushman, Craig K. Chandler, James P. Gilreath, George Hochmuth, Chad Hutchinson, Freddie Johnson, Thomas A. Kucharek, Andrew MacRae, Donald N. Maynard, O.N. Nesheim, Kenneth Pernezny, James Price, Kenneth D. Shuler, Allen G. Smajstrla, William M. Stall, David Sui, Charles Vavrina.

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Chapter 1. Vegetable Production in Florida

Bielinski M. Santos, Gary E. Vallad, Stephen M. Olson, Guodong Liu, Eric H. Simonne, Michael D. Dukes, Lincoln Zotarelli, Joseph W. Noling, Daniel A. Botts, Peter J. Dittmar and Scott A. Smith

Introduction and Objective

Vegetable production in Florida, including melons and strawberry, occurred in approximately 176,000 acres and generated more than \$1.5 billion in gross sales in 2011, which ranks second among all the states (13% of the total U.S. value). Growing seasons are well defined by the peninsula geography, allowing Florida to serve as the main vegetable supplier during late fall, winter, and early spring months to the U.S. Although more than 40 vegetable crops are commercially-planted in the state, Florida ranks in the top three on production value of tomato, bell pepper, snap bean, squash, sweet corn, watermelon, cabbage, cucumber, and strawberry (Table 1.1).

non-regulatory, and incentive-based measures. Best Management Practices (BMP) are specific cultural practices aimed at reducing the load of a specific compound, while maintaining or increasing economical yields. They are tools available to vegetable growers to achieve the TMDL. BMP are intended to be educational, economically sound, environmentally effective, and based on science. It is important to recognize that BMP do not aim at becoming an obstacle to vegetable production. Instead, they should be viewed as a means to balance economical vegetable production with environmental responsibility.

The BMP that will apply to vegetable production in Florida are described in the 'Agronomic and Vegetable Crop Water Quality/Water Quantity BMP Manual for Florida'. This manual was developed between 2000 and 2005 through a cooperative effort between state agencies, water management districts and commodity groups, and under the scientific leadership of the University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS). The manual has undergone a thorough scientific review in 2003 and was presented to stakeholders and state commodity groups for feedback in 2004. The manual was adopted by reference in 2006 and by rule in Florida Statutes (5M-8 Florida Administrative Code) and may be consulted on-line at <http://www.floridaagwaterpolicy.com/PDFs/BMPs/vegetable&agronomicCrops.pdf>. BMP are 1-to-3 page long chapters that include a picture, a working definition of the topic, list specific things to do (BMP) as well as things to avoid (pitfalls), and present existing applicable technical criteria together with additional references.

Vegetable growers may get one-on-one information on 1) the benefits for joining the BMP program, 2) how to join it, 3) how to select the BMP that apply to their operation and 4) record keeping requirements by getting in contact with their county extension agent or their local implementation team.

The vegetable BMP have adopted all current UF/IFAS recommendations; including those for fertilizer and irrigation management (see BMP no. 33 "Optimum Fertilizer Management" on pg. 93 of BMP manual). Through the implementation of a series of targeted cultural practices (the BMP), growers should be able to reconcile economical profitability and responsible use of water and fertilizer. At the field level, adequate fertilizer rates should be used together with irrigation scheduling techniques and crop nutritional status monitoring tools (leaf analysis, petiole sap testing). In the BMP manual, adequate fertilizer rates may be achieved by combinations of UF/IFAS recommended base rates and supplemental fertilizer applications.

More detailed information on soil types and testing, as well as the use of lime, manures, specific fertilizer sources, and application procedures are available in the EDIS publication "Soil and Fertilizer Management for Vegetable Production in Florida" by Guodong Liu, Eric H. Simonne, and George J. Hochmuth at <http://edis.ifas.ufl.edu/pdffiles/CV/CV10100.pdf>. The specific soil and tissue testing, and fertilization recommendations for vegetable crops are presented in the following tables.

Table 1.1. Vegetable production acreage and value in Florida.

Crop	Planted acres	Value (million US\$)	U.S. rank
Tomato	32,000	564.7	1
Strawberry	9,900	366.3	2
Bell pepper	18,700	247.7	2
Sweet corn	50,500	174.2	1
Potato	36,400	144.8	n/a
Snap bean	46,000	131.3	1
Watermelon	25,900	111.9	1
Squash	12,500	94.9	1
Cabbage	8,800	65.0	3
Cucumber	10,000	52.0	1

Source: Vegetables-2011 summary, NASS, USDA.

The objective of this publication is to provide updated information on crop cultivars, pesticide labels, and certain practices for vegetable production in Florida. Suggested practices are guidelines for growers to plan farm activities and are always subjected to review using the latest scientific data available.

Crop Management

1. BEST MANAGEMENT PRACTICES

With the passage of the Federal Clean Water Act (FCWA) in 1972, states were required to assess the impacts of non-point sources of pollution on surface and ground waters, and establish programs to minimize them. Section 303(d) of the FCWA also requires states to identify impaired water bodies and establish total maximum daily loads (TMDL) for pollutants entering these water bodies. Water quality parameters targeted by the TMDL and involving vegetable production are concentrations of nitrate, phosphate, and total dissolved solids in these waters. A TMDL establishes the maximum amount of pollutant a water body can receive and still keep its water quality parameters consistent with its intended use (swimming, fishing, or potable uses). The establishment of the TMDL is currently underway and they will be implemented through a combination of regulatory,

2. SOIL AND TISSUE TESTING AND FERTILIZATION RECOMMENDATIONS FOR VEGETABLE CROPS

Table 1.2. Nitrogen (N) fertilization recommendations for selected vegetable crops in mineral soils of Florida.

Target pH	N (lb/acre)	Target pH	N (lb/acre)
Tomato, pepper, potato, celery, sweet corn, crisphead lettuce, endive, escarole, romaine lettuce and eggplant		Snapbean, lima bean and pole bean	
6.0 (potato) and 6.5	200	6.5	100
Broccoli, cauliflower, Brussels sprouts, cabbage, collards, Chinese cabbage and carrots		Radish and spinach	
6.5	175	6.5	90
Cucumber, squash, pumpkin, muskmelon, leaf lettuce, sweet bulb onion, watermelon and strawberry		Southernpea, snowpea, English pea and sweet potato	
6.0 (watermelon) and 6.5	150	6.5	60
Kale, turnip, mustard, parsley, okra, bunching onion, leek and beet			
6.5	120		

Table 1.3. Phosphorus (P; expressed as P_2O_5) and potassium (K; expressed as K_2O) fertilization recommendations for selected vegetable crops in mineral soils of Florida. VL, L, M, H, and VH = very low, low, medium, high, and very high, respectively.

VL	L	M	H	VH	VL	L	M	H	VH
P ₂ O ₅				(lb/acre/crop season)		K ₂ O			
Celery									
200	150	100	0	0	250	150	100	0	0
Eggplant									
160	130	100	0	0	160	130	100	0	0
Broccoli, cauliflower, Brussels sprouts, cabbage, collards, Chinese cabbage, carrots, kale, turnip, mustard, parsley, okra, muskmelon, leaf lettuce, sweet bulb onion, watermelon, pepper, sweet corn, crisphead lettuce, endive, escarole, strawberry and romaine lettuce									
150	120	100	0	0	150	120	100	0	0
Tomato									
150	120	100	0	0	225	150	100	0	0
Cucumber, squash, pumpkin, snapbean, lima bean, pole bean, beet, radish, spinach and sweet potato									
120	100	80	0	0	120	100	80	0	0
Bunching onion and leek									
120	100	100	0	0	120	100	100	0	0
Potato									
120	120	60	0	0	150	--	--	--	--
Southern pea, snowpea and English pea									
80	80	60	0	0	80	80	60	0	0

3. IRRIGATION, NEMATODE AND WEED MANAGEMENT

Details on these subjects are available in the EDIS publications:

a) "Principles and Practices of Irrigation Management for Vegetables" by Michael D. Dukes, Lincoln Zotarelli, Guodong Liu, and Eric H. Simonne at <<http://edis.ifas.ufl.edu/pdffiles/CV/CV10700.pdf>>.

b) "Nematodes and Their Management" by Joseph W. Noling at <<http://edis.ifas.ufl.edu/pdffiles/CV/CV11200.pdf>>.

c) "Weed Management" by Peter J. Dittmar and Andrew W. MacRae at <<http://edis.ifas.ufl.edu/pdffiles/CV/CV11300.pdf>>.

4. SOIL FUMIGATION

Since 1993, many different alternative soil fumigants have been evaluated in field trials to characterize pest control efficacy and crop yield response (Table 1.4). The results of these research trials have provided basis for overall generalization of pesticidal activity for each of the alternative fumigant chemicals. As a standard for comparison, this research has repeatedly demonstrated methyl bromide to be very effective against a wide range of soilborne pests including nematodes, diseases, and weeds.

Given the general lack of herbicidal activity associated with the alternative fumigants, weed control is usually assigned the highest pest management priority for most methyl bromide alternative chemical systems. Regardless of crop, separate application of one or more herbicides is a requirement for effective weed control with any methyl bromide chemical alternative system (Table 1.5).

More information of the subject is available in the EDIS publication "Alternatives to Methyl Bromide Soil Fumigation for Florida Vegetable Production" by Joseph W. Noling, Daniel A. Botts, and Andrew W. MacRae at <<http://edis.ifas.ufl.edu/pdffiles/CV/CV29000.pdf>>.

Table 1.4. Summary of maximum use rate and relative efficacy of soil fumigants on nematode, soilborne diseases, and weeds in Florida.

Active ingredients	Trade names	Maximum rate/acre	Relative pesticidal activity		
			Nematodes	Diseases	Weeds
1,3-dichloropropene	Telone II	18 gal	Good to excellent	None to poor	Poor
1,3-dichloropropene (40%) + chloropicrin (60%)	Pic-Clor 60	300 lb	Good to excellent	Good to excellent	Poor to fair
1,3-dichloropropene (65%) + chloropicrin (35%)	Telone C-35	35 gal	Good to excellent	Good to excellent	Poor to fair
1,3-dichloropropene (83%) + chloropicrin (17%)	Telone C-17	26 gal	Good to excellent	Good	Poor
Chloropicrin		300 lb	None to poor	Excellent	Poor
Dimethyl disulfide (79%) + chloropicrin (21%)	Paladin	60 gal	Good to excellent	Good to excellent	Poor to excellent
Metam potassium	KPam, Setacon K54	60 gal	Erratic	Erratic	Erratic
Metam sodium	Vapam, Setacon 42	75 gal	Erratic	Erratic	Erratic
Methyl bromide (50%) + chloropicrin (50%)		350 lb	Good to excellent	Excellent	Fair to excellent

Table 1.5. Fumigant and herbicide for tomato, pepper, and strawberry. Rates are expressed per treated acre.

Crops	Treatments and rates	Application procedures ²	Herbicide rates (lb a.i./acre)
Tomato	Telone C-35; 35 gal/acre	In-row or pre-bed ² , under LDPE, high barrier or VIF mulch film ³ ; applied 3-5 weeks before transplanting	Napropamide (2 lb) S-metolachlor (0.95 lb) Postemergent: Halosulfuron (0.036 lb)
	Telone II; 12 gal/acre Chloropicrin; 150 lb/acre	Telone pre-bed ² , chloropicrin in-bed under high barrier or VIF mulch film ³ ; applied 3-5 weeks before transplanting	
	Pic-Clor 60; 250-300 lb/acre	Pic-Clor 60 in-row or pre-bed ² under high barrier or VIF mulch film ³ ; applied 3-5 weeks before transplanting	
	Dimethyl disulfide (79%) + chloropicrin (21%) ⁴ ; 60 gal/acre	In-row or pre-bed ² , under high barrier or VIF mulch film ³ ; applied 3-5 weeks before transplanting	
Pepper	Telone C-35; 35 gal/acre	In-row or pre-bed ² , under LDPE, high barrier or VIF mulch film ³ ; applied 3-5 weeks before transplanting	Napropamide (2 lb) S-metolachlor (0.71 lb, 3rd party label obtained through FFVA)
	Telone II; 12 gal/acre Chloropicrin; 150 lb/acre	Telone pre-bed ² , chloropicrin in-bed under high barrier or VIF mulch film ³ ; applied 3-5 weeks before transplanting	
	Pic-Clor 60; 250-300 lb/acre	Pic-Clor 60 in-row or pre-bed ² under high barrier or VIF mulch film ³ ; applied 3-5 weeks before transplanting	
	Dimethyl disulfide (79%) + chloropicrin (21%) ⁴ ; 60 gal/acre	In-row or pre-bed ² , under high barrier or VIF mulch film ³ ; applied 3-5 weeks before transplanting	
Strawberry	Telone C-35; 35 gal/acre	In-row or pre-bed ² , under LDPE, high barrier or VIF mulch film ³ ; applied 3-5 weeks before transplanting	Napropamide (4 lb) Oxyfluorfen (0.5 lb)

¹ Crop recommendations for Pic-Clor 60, Telone II or Telone C-35 do not apply to the Homestead, Dade County production region of south Florida where soil types and water tables currently prohibit product use.

² Inject Telone II, Telone C-35, or Pic-Clor 60 to flat soil prior to any soil mounding or bed operation (PreBed) to a depth of at least 12 inches below the final bed top.

³ In combination with fumigant, use of an EPA approved high barrier or virtually impermeable (VIF) or totally impermeable (TIF) mulch film. With use of the mulch, fumigant rates can be reduced 25 to 40% from maximum pesticide labeled application rate.

⁴ DMDS (dimethyl disulfide) (79%) co-formulated with 21% chloropicrin. Its use has not been broadly tested in Florida but has proved very effective against nematode and disease, and for many weeds. Provides excellent control of nutsedge but only poor to fair control of annual grasses and requires the use of a separately applied herbicide for adequate control.

⁵ To achieve maximum weed control an application of metam sodium at 75 gal/acre or metam potassium at 60 gal/acre should be included to all recommended products using a minicoulter applicator or through a drip application using double drip tapes.

Economics of Vegetable Production

Table 1.6. Breakeven production costs selected vegetable crops in production areas of Florida.

Cabbage	Hastings	Yield (50-lb units/acre)				
2008-09	Cost per acre	660	680	700	720	740
Variable costs	\$1,794.37	\$2.72	\$2.64	\$2.56	\$2.49	\$2.42
Fixed costs	\$690.52	\$1.05	\$1.02	\$0.99	\$0.96	\$0.93
Harvest cost/unit		\$3.70	\$3.70	\$3.70	\$3.70	\$3.70
Total cost/unit		\$7.46	\$7.35	\$7.25	\$7.15	\$7.06
Cucurbit	SW Florida	Yield (55-lb bu/acre)				
2008-09	Cost per acre	427	448	468	489	509
Variable costs	\$2,216.60	\$5.19	\$4.95	\$4.74	\$4.54	\$4.35
Fixed costs	\$1,031.81	\$2.42	\$2.31	\$2.20	\$2.11	\$2.03
Harvest cost/unit		\$4.66	\$4.66	\$4.66	\$4.66	\$4.66
Total cost/unit		\$12.27	\$11.92	\$11.60	\$11.31	\$11.04

Table 1.6. Continued.

Summer squash	Miami-Dade Co.		Yield (bushels/acre)			
2005-06	Cost per acre	300	338	375	413	450
Variable costs	\$1,535.30	\$5.12	\$4.54	\$4.09	\$3.72	\$3.41
Fixed costs	\$1,197.38	\$3.99	\$3.54	\$3.19	\$2.90	\$2.66
Harvest cost/unit		\$5.40	\$5.40	\$5.40	\$5.40	\$5.40
Total cost/unit		\$14.51	\$13.48	\$12.69	\$12.02	\$11.47
Watermelon	Manatee Co.		Yield (cwt/acre)			
2008-09	Cost per acre	315	319	323	326	330
Variable costs	\$2,133.96	\$6.77	\$6.69	\$6.62	\$6.54	\$6.47
Fixed costs	\$1,011.84	\$3.21	\$3.17	\$3.14	\$3.10	\$3.07
Harvest cost/unit		\$2.60	\$2.60	\$2.60	\$2.60	\$2.60
Total cost/unit		\$12.59	\$12.47	\$12.35	\$12.24	\$12.13
Watermelon	SW Florida		Yield (cwt/acre)			
2008-09	Cost per acre	315	319	323	326	330
Variable costs	\$2,655.99	\$8.43	\$8.33	\$8.24	\$8.14	\$8.05
Fixed costs	\$1,320.22	\$4.19	\$4.14	\$4.09	\$4.05	\$4.00
Harvest cost/unit		\$6.50	\$6.50	\$6.50	\$6.50	\$6.50
Total cost/unit		\$19.12	\$18.97	\$18.83	\$18.69	\$18.55
Eggplant	Palm Beach Co.		Yield (ctn/acre)			
2005-06	Cost per acre	800	1000	1200	1400	1600
Variable costs	\$5,086.90	\$6.36	\$5.09	\$4.24	\$3.63	\$3.18
Fixed costs	\$2,996.96	\$3.75	\$3.00	\$2.50	\$2.14	\$1.87
Harvest cost/unit		\$2.85	\$2.85	\$2.85	\$2.85	\$2.85
Total cost/unit		\$12.95	\$10.93	\$9.59	\$8.62	\$7.90
Legumes	Miami-Dade Co.		Yield (bushels/acre)			
2005-06	Cost per acre	185	210	235	260	285
Variable costs	\$1,673.70	\$9.05	\$7.97	\$7.12	\$6.44	\$5.87
Fixed costs	\$1,141.65	\$6.17	\$5.44	\$4.86	\$4.39	\$4.01
Harvest cost/unit		\$6.65	\$6.65	\$6.65	\$6.65	\$6.65
Total cost/unit		\$21.87	\$20.06	\$18.63	\$17.48	\$16.53
Pepper	Palm Beach Co.		Yield (28-lb bushels/acre)			
2008-09	Cost per acre	803	879	955	1,031	1,107
Variable costs	\$7,724.55	\$9.62	\$8.79	\$8.09	\$7.49	\$6.98
Fixed costs	\$4,116.83	\$5.13	\$4.68	\$4.31	\$3.99	\$3.72
Harvest cost/unit		\$4.45	\$4.45	\$4.45	\$4.45	\$4.45
Total cost/unit		\$19.20	\$17.92	\$16.85	\$15.94	\$15.15
Pepper	SW Florida		Yield (28-lb bushels/acre)			
2008-09	Cost per acre	803	879	955	1,031	1,107
Variable costs	\$9,121.07	\$11.36	\$10.38	\$9.55	\$8.85	\$8.24
Fixed costs	\$4,955.91	\$6.17	\$5.64	\$5.19	\$4.81	\$4.48
Harvest cost/unit		\$4.45	\$4.45	\$4.45	\$4.45	\$4.45
Total cost/unit		\$21.98	\$20.46	\$19.19	\$18.10	\$17.17
Chip potato	Hastings		Yield (cwt/acre)			
2008-09	Cost per acre	240	260	280	300	320
Variable costs	\$2,135.74	\$8.90	\$8.21	\$7.63	\$7.12	\$6.67
Fixed costs	\$695.81	\$2.90	\$2.68	\$2.49	\$2.32	\$2.17
Harvest cost/unit		\$1.00	\$1.00	\$1.00	\$1.00	\$1.00
Total cost/unit		\$12.80	\$11.89	\$11.11	\$10.44	\$9.85
Table potato	Hastings		Yield (cwt/acre)			
2008-09	Cost per acre	240	260	280	300	320
Variable costs	\$2,621.18	\$10.92	\$10.08	\$9.36	\$8.74	\$8.19
Fixed costs	\$785.04	\$3.27	\$3.02	\$2.80	\$2.62	\$2.45
Harvest cost/unit		\$3.71	\$3.71	\$3.71	\$3.71	\$3.71
Total cost/unit		\$17.90	\$16.81	\$15.88	\$15.06	\$14.35
Strawberry	Plant City		Yield (12-lb flats/acre)			
2008-09	Cost per acre	1,917	2,105	2,292	2,480	2,667
Variable costs	\$9,791.02	\$5.11	\$4.65	\$4.27	\$3.95	\$3.67
Fixed costs	\$4,620.21	\$2.41	\$2.20	\$2.02	\$1.86	\$1.73
Harvest cost/unit		\$5.60	\$5.60	\$5.60	\$5.60	\$5.60
Total cost/unit		\$13.12	\$12.45	\$11.89	\$11.41	\$11.00

Table 1.6. Continued.

Sweet corn	Miami-Dade Co.	Yield (crates/acre)				
2005-06	Cost per acre	250	275	300	325	350
Variable costs	\$2,007.93	\$8.03	\$7.30	\$6.69	\$6.18	\$5.74
Fixed costs	\$1,579.61	\$6.32	\$5.74	\$5.27	\$4.86	\$4.51
Harvest cost/unit		\$3.28	\$3.28	\$3.28	\$3.28	\$3.28
Total cost/unit		\$17.63	\$16.33	\$15.24	\$14.32	\$13.53
Sweet corn	Palm Beach Co.	Yield (crates/acre)				
2008-09	Cost per acre	369	387	405	423	441
Variable costs	\$2,620.23	\$7.10	\$6.77	\$6.47	\$6.19	\$5.94
Fixed costs	\$1,885.73	\$5.11	\$4.87	\$4.66	\$4.46	\$4.28
Harvest cost/unit		\$3.28	\$3.28	\$3.28	\$3.28	\$3.28
Total cost/unit		\$15.49	\$14.92	\$14.41	\$13.93	\$13.50
Tomato (fall)	Manatee	Yield (boxes/acre)				
2008-09	Cost per acre	1,328	1,381	1,434	1,487	1,540
Variable costs	\$7,098.30	\$5.35	\$5.14	\$4.95	\$4.77	\$4.61
Fixed costs	\$3,880.33	\$2.92	\$2.81	\$2.71	\$2.61	\$2.52
Harvest cost/unit		\$3.44	\$3.44	\$3.44	\$3.44	\$3.44
Total cost/unit		\$11.71	\$11.39	\$11.10	\$10.82	\$10.57
Tomato (spring)	Manatee	Yield (boxes/acre)				
2008-09	Cost per acre	1,328	1,381	1,434	1,487	1,540
Variable costs	\$6,588.59	\$4.96	\$4.77	\$4.59	\$4.43	\$4.28
Fixed costs	\$3,608.68	\$2.72	\$2.61	\$2.52	\$2.43	\$2.34
Harvest cost/unit		\$3.39	\$3.39	\$3.39	\$3.39	\$3.39
Total cost/unit		\$11.07	\$10.77	\$10.50	\$10.25	\$10.01
Tomato (spring)	SW Florida	Yield (boxes/acre)				
2008-09	Cost per acre	1,328	1,381	1,434	1,487	1,540
Variable costs	\$7,763.49	\$5.85	\$5.62	\$5.41	\$5.22	\$5.04
Fixed costs	\$4,341.01	\$3.27	\$3.14	\$3.03	\$2.92	\$2.82
Harvest cost/unit		\$3.59	\$3.59	\$3.59	\$3.59	\$3.59
Total cost/unit		\$12.70	\$12.36	\$12.03	\$11.73	\$11.45

Chapter 2. Cole Crop Production

Lincoln Zotarelli, Peter J. Dittmar, Gary E. Vallad, Susan E. Webb, Stephen M. Olson and Nicholas S. Dufault

Botany and Planting

Broccoli - *Brassica oleraceae* Italica group, Brassicaceae (Cruciferae).

Cabbage - *Brassica oleraceae* Capitata group.

Cauliflower - *Brassica oleraceae* Botrytis group.

Collards - *Brassica oleraceae* Acephala group.

Kale - *Brassica oleraceae* Acephala group.

Mustard - *Brassica juncea*.

Turnip - *Brassica rapa* Rapifera group.

Table 2.1. Planting information for cole crops.

Planting dates	Broccoli	Brussels sprouts	Cabbage ¹	Cauliflower ¹
North Florida	Aug - Feb	Aug - Feb	Aug - Feb	Aug - Feb
Central Florida	Sept - Feb	Sept - Feb	Sept - Feb	Sept - Feb
South Florida	Oct - Jan	Oct - Jan	Sept - Jan	Sept - Jan
Planting information				
Distance between rows (in)	24 - 40	24 - 40	24 - 40	24 - 40
Distance between plants (in)	10 - 15	18 - 24	9 - 16	12 - 18
Seeding depth (in)	0.25 - 0.5	0.25 - 0.5	0.25 - 0.5	0.25 - 0.5
Seeding per acre for field (lb)	1 - 2	1 - 2	1 - 2	1 - 2
Seeding per acre for transplant (lb)	1.25 - 1.5	1.25 - 1.5	1	1.25 - 1.5
Days to maturity from seed	75 - 90	90 - 120	85 - 110	75 - 90
Days to maturity from transplant	50 - 70	70 - 90	70 - 90	50 - 70
Plant populations (acre)	10,400-26,000	Up to 15,500	Up to 29,400	Up to 29,000
Planting dates	Collards	Kale	Mustard	Turnip
North Florida	Aug - Feb	Aug - Feb	Aug - Feb	Aug - Feb
Central Florida	Sept - Feb	Sept - Feb	Sept - Feb	Sept - Feb
South Florida	Sept - Jan	Sept - Jan	Sept - Jan	Sept - Jan
Planting information				
Distance between rows (in)	24 - 36	18 - 24	12 - 36	12 - 36
Distance between plants (in)	12 - 24	8 - 12	5 - 10	2 - 6
Seeding depth (in)	0.25 - 0.5	0.25 - 0.5	0.25 - 0.5	0.25 - 0.5
Seeding per acre for field (lb)	2 - 4	2 - 4	3 - 5	2 - 3
Seeding per acre for transplant (lb)	1.25 - 1.5	N/A ²	N/A ²	N/A ²
Days to maturity from seed	70 - 90	50 - 70	40 - 50	40 - 60
Days to maturity from transplant	50 - 70	—	—	—
Plant populations (acre)	Up to 21,800	Up to 43,500	Up to 116,200	Up to 261,400

¹ It could be planted in double rows (15-24 in between rows; 10-12 in within rows; 40-60 in bed centers).

² Direct seeded.

Cultivars

Table 2.2. Cabbage cultivars.

Green		
Atlantis (H)	Emblem (H)	Rio Verde (H)
Blue Dynasty (H)	Gideon (H)	Royal Vantage (H)
Bravo (H)	Gloria (H)	Solid Blue 790 (H)
Cheers (H)	Green Cup (H)	Tropicana (H)
Ducati (H)	Ramada (H)	
Red		
Cardinal (H)	Red Rookie (H)	Red Success (H)
Red Dynasty (H)		
Savoy		
Savoy Ace (H)		H = hybrid

Table 2.3. Broccoli, cauliflower, collard, kale, mustard, and turnip cultivars.

Broccoli		
Arcadia (H)	Major (H)	Patriot (H)
Marathon (H)	Packman (H)	Pirate (H)
Cauliflower		
Majestic (H)	White Passion (H)	Snow Crown (H)
Collards		
Blue Max (H)	Georgia	Top Pick (H)
Bull Dog (H)	Top Bunch (H)	Vates
Flash (H)		
Kale		
Blue Ridge (H)	Vates	
Mustard		
Florida Broad Leaf	Red Giant	Tendergreen
Green Wave	Southern Giant Curled	
Turnip		
Just Right (H)	Purple Top	White Knight (H)
Southern Green	Royal Crown (H)	
Turnip Greens		
Seven Top		H = hybrid

Pesticides for Weed, Arthropod and Disease Management for Cole Crops.

Table 2.4. Selected herbicides approved for managing weeds in cole crops.

Active ingredient lb. a.i./acre	Trade name product/acre	Crops	Weeds controlled / remarks
*** PREEMERGENCE / POSTTRANSPLANT ***			
Bensulide 5.0 - 6.0	(Prefar) 4 E 5 - 6 qt.	Head & stem and leafy brassica	Annual broadleaf and grass weeds. Fair to poor control of lambsquarter, purslane, and some amaranth. Mechanically incorporate 1 to 2 in or irrigate 2 to 4 in deep within 36 h.
Carfentrazone up to 0.031	(Aim) 2 EC up to 2 fl.oz.	Head & stem and leafy brassica	Emerged broadleaf weeds. Use as a chemical fallow treatment and preplant burndown application. Include a nonionic surfactant or crop oil concentrate
DCPA 4.5 - 10.5	(Dacthal) 75 WP 6 - 14 lb.	Broccoli, brussel sprouts, cauliflower, cabbage, and Brassica leafy vegetables	Broadleaf and grass weeds. Can be preplant incorporated. If weeds have emerged they must be cultivated or weeded before application
Glyphosate	(various formulations) consult label	Head & stem and leafy brassica	Actively growing broadleaf and grass weeds. Use as a preplant burndown.
S-metolachlor mineral 0.64 - 1.91 muck 1.91	(Dual Magnum) 7.62 EC mineral 0.80 - 4.0 pt. muck 4.0 pt.	Head & stem brassica	Annual broadleaf and grass control. Apply immediately after planting. Label is a third party registration by TPR, Inc. and grower must sign an indemnification agreement. Use a higher rate on fine textured soils or high in organic matter. Do not apply more than 1.91 lb. a.i./acre of Dual Magnum per crop on sandy soils. Chinese varieties are more sensitive to Dual Magnum injury. PHI 60 days.
Oxyfluorfen 0.25 - 0.5	(Galigan, Goal 2XL) 2 EC 1 - 2 pt. (Galigan, GoalTender) 4 E 0.5 - 1.0 pt.	Broccoli, cabbage, cauliflower	Certain annual broadleaf weeds. Transplants less than 5 weeks old or in containers less than 1 in. square may result in more crop injury. Injury will occur as leaf cupping or crinkling. DO NOT apply in fields where acenitanilide herbicides (Dual Magnum, Lasso, or Ramrod) have been applied in the same growing season.
Paraquat 0.5 - 1.0	(Gramoxone) 2 SL 2.0 - 4.0 pt. (Firestorm) 3 SL 1.3 - 2.7 pt.	Broccoli, cabbage, cauliflower, cavalo broccoli, Chinese cabbage, turnip	Emerged broadleaf and grass weeds. Use as a preplant burndown. Crop plants that have emerged will be injured.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Broccoli, cabbage, cauliflower, collards, kale, mustard/turnip greens	Emerged broadleaf and grass weeds. Use as a preplant burndown
Trifluralin 0.5 - 0.75	(Treflan HFP, Trifluralin, Trilin) 4 EC 1.0 - 1.5 pt. (Treflan) 4 L 1.0 - 1.5 pt.	Broccoli, brussels sprouts, cabbage, cauliflower	Annual broadleaf and grass weeds. Incorporate or irrigate 4 in. within 8 h. Results in Florida are erratic on soils with low organic matter and clay contents.

Table 2.4. Continued.

Active ingredient lb. a.i./acre	Trade name product/acre	Crops	Weeds controlled / remarks
*** POSTEMERGENCE / POSTTRANSPLANT ***			
Carfentrazone up to 0.031	(Aim) 2 EC up to 2 fl. oz. (Aim) 1.9 EC up to 2 fl. oz.	Head & steam and leafy brassica	Emerged broadleaf weeds. Apply with a hooded sprayer to row middles. Do not exceed 4.1 fl. oz/acre in season as a row middle application. PHI 0 days.
Clethodim 0.09 - 0.13 0.07 - .25	(Select) 2 EC 6 - 8 fl. oz. (Select Max) 1 EC 9 - 16 fl. oz.	Head & stem and leafy brassica	Emerged grass weeds. Include crop oil concentrate at 1% v/v in finished spray volume. Head & stem brassica PHI 30 days. Leafy brassica PHI 14 days.
Clopyralid 0.09 - 0.19	(Stinger) 3 EC 0.25 - 0.5 pt.	Cabbage, Chinese cabbage (bok choy, napa), Chinese mustard cabbage	Broadleaf weeds. Do not apply more than 0.5 pt./acre per year. Check plant back dates. PHI 30 days.
DCPA 4.5 - 10.5	(Dacthal) 75 WP 6 - 14 lb.	Broccoli, Brussels sprouts, cauliflower, cabbage, and Brassica leafy vegetables	Broadleaf and grass weeds. Spray over transplants without injury. If weeds have emerged they must be cultivated or weeded before application. Can be preplant incorporated.
Glyphosate	(various formulations) consult label	Head & steam and leafy brassica	Broadleaf and grass weeds. Use a hooded sprayer and direct to row middles only.
Napropamide 2	(Devrinol DF XT) 50 DF 4 lb.	Broccoli, Brussels sprouts, cabbage, cauliflower	Apply to transplanted crops only. Within 24 h. of application, 2 to 4 in. of irrigation or rainfall. Do not exceed 4 lb./acre per crop cycle.
Paraquat 0.3 - 0.5	(Gramoxone) 2 SL 1.2 - 1.9 pt.	Cabbage	Emerged broadleaf and grass weeds. Direct spray solution to row middles only. Do not allow spray to contact crop as injury or excessive residues may result. Outer leaves should be stripped at the time of harvest. Do not apply where paraquat products have been used as preplant application.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Broccoli, cabbage, cauliflower, collards, kale, mustard/turnip greens	Emerged broadleaf and grass weeds. Apply as hooded spray to row middles only. Include a residual herbicide to broaden spectrum of weed control.
Sethoxydim 0.28	(Poast) 1.5 EC 1.5 pt.	Broccoli (including Chinese and raab), Brussels sprouts, cabbage (bok choy, Chinese mustard, napa), cauliflower, collards, kale, kohlrabi, mustard/rape greens	Annual and perennial weeds. Include a crop oil concentrate or methylated seed oil in spray solution. Maximum rate of 3.0 pt./acre per season. PHI 30 days.

Table 2.5. Selected insecticides approved for managing insect pests of cole crops.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Actara (thiamethoxam)	1.5-5.5 oz	12	0 - head & stem 7 - leafy	aphids, flea beetles, thrips, whiteflies	4A	Do not use if other 4A insecticide has been applied.
Admire Pro (imidacloprid) (see appropriate labels for other brands)	4.4-10.5 fl oz	12	21	aphids, leafhoppers, foliage-feeding thrips, whiteflies	4A	Do not apply more than 10.5 fl oz per acre per year.
Agree WG (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11	Apply when larvae are small for best control. Can be used in greenhouse. OMRI-listed ² .
*Ambush 25W³ (permethrin)	3.2-6.4 oz 3.2-12.8 oz – cabbage and Chinese cabbage only	12	1	cabbage aphid (suppression), cabbage looper, diamondback moth ³ , imported cabbageworm	3A	Do not apply more than 51.2 oz/acre per season. Head and stem Brassica crops only.
*Asana XL (0.66 EC)³ (esfenvalerate)	2.9-9.6 fl oz – head and stem Brassicas, 5.8-9.6 oz – collards, 9.6 – mustard greens	12	3-head & stem 7-collards, mustard greens	beet armyworm (aids in control), cabbage looper, cutworms, flea beetles, grasshoppers, imported cabbageworm	3A	Do not apply more than 0.4 lb ai/acre per season for head and stem Brassicas or 0.2 lb ai/acre per season for collards and mustard greens.
Assail 30SG (acetamiprid)	2.0-4.0 oz	12	7	aphids, thrips, whiteflies, suppression of diamondback moth	4A	Begin applications for whiteflies when first adults are noticed. Do not apply more than 5 times per season or apply more often than every 7 days.
Avaunt (indoxacarb)	2.5-3.5 oz	12	3	beet armyworm, cabbage looper, cabbage webworm, cross-striped cabbageworm, diamondback moth, imported cabbageworm	22	Do not apply more than 14 oz per acre per crop. Add a wetting agent to improve coverage. Do not use in greenhouse or in crops grown for transplant.
Aza-Direct (azadirachtin)	1-2 pts, up to 3.5 pts, if needed	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, weevils, whiteflies	un	Antifeedant, repellent, insect growth regulator. OMRI-listed ² .
Azatin XL (azadirachtin)	5-21 fl oz	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, whiteflies	un	Antifeedant, repellent, insect growth regulator.

Table 2.5. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
*Baythroid XL (beta-cyfluthrin)	0.8-3.2 fl oz	12	0	beet armyworm (1 st & 2 nd instar), cabbage looper, cabbage webworm, cutworms, diamondback moth larvae ³ , flea beetle, grasshoppers, imported cabbageworm, potato leafhopper, southern armyworm (1 st & 2 nd instar), stink bugs, thrips, yellowstriped armyworm	3A	Maximum per crop season: 12.8 fl oz/acre.
Belay 50 WDG (clothianidin)	1.6-3.2 oz (foliar)	12	7	aphids, flea beetles, harlequin bug, leafhoppers, stink bugs, whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Toxic to bees. High rate on supplemental label expiring on Dec. 30, 2013.
Belay 50 WDG (clothianidin)	4.8 -6.4 oz (soil application)	12	Apply at planting	aphids, flea beetles, harlequin bug, leafhoppers, leafminers (suppression), thrips, whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. See label for application instructions.
Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	0	aphids, plant bugs	9C	Do not apply more than 8.4 oz/acre per season. Begin applications before pests reach damaging levels.
Belt SC (flubendiamide)	2.0-2.4 fl oz	12	1	armyworms, cabbage webworm, corn earworm, cross-striped cabbageworm, diamondback moth, garden webworm, imported cabbageworm, loopers, saltmarsh caterpillar	28	Do not apply more than 7.2 fl oz/acre per season.
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11	Treat when larvae are young. Good coverage is essential. Can be used in the greenhouse. OMRI-listed.
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.
*Brigade 2 EC³ (bifenthrin)	2.1-6.4 fl oz	12	7	aphids, armyworms, corn earworm, crickets, cucumber beetles, cutworms, diamondback moth, flea beetles, ground beetles, imported cabbageworm, leafhoppers, loopers, mites, saltmarsh caterpillar, stink bugs, thrips, tobacco budworm, whitefly	3A	Do not apply more than 0.4 lb ai/acre for leafy or 0.5 lb ai/acre for head and stem.
*Brigadier Insecticide³ (bifenthrin)	3.8-6.1 fl oz	12	7	aphids, armyworms, corn earworm, crickets, cucumber beetles, cutworms, diamondback moth, flea beetles, ground beetles, imported cabbageworm, leafhoppers, loopers, mites, saltmarsh caterpillar, stink bugs, adult thrips, tobacco budworm, whitefly	3A, 4A	Do not apply more than 30.72 fl oz product per acre per season. Will not control beet armyworm.
*Capture LFR (bifenthrin)	3.4-8.5 fl oz	12	at planting	wireworms, grubs, maggots, root aphids, cutworms	3A	For mixing directly with liquid fertilizer to control soil insect pests. For Head and Stem Brassicas only .
Checkmate DBM-F (pheromone)	3.1-6.2 fl oz	0	0	diamondback moth	--	For mating disruption. Does not affect larvae and eggs already on plants. Do not exceed 23 fl oz per acre per year.
Coragen (rynaxypyr)	3.5-5.0 fl oz	4	3	beet armyworm, cabbage looper, corn earworm, cross-striped cabbageworm, diamondback moth, Hawaiian beet webworm, imported cabbageworm	28	For best results, use an adjuvant when using as a foliar spray. Can be applied to soil at planting or by drip chemigation. See label for diamondback moth resistance management.
Courier 40SC (buprofezin)	9.0-13.6 fl oz	12	1	leafhoppers, planthoppers, whiteflies	16	Do not make more than 2 applications per crop cycle or 4 applications per year. Head and stem brassicas only .
Crymax WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Use high rate for armyworms. Treat when larvae are young.
*Danitol³ (fenpropathrin)	10.67-16 fl oz	24	7	cabbage looper, imported cabbageworm, yellowstriped armyworm	3	Do not apply more than 42.67 fl oz per acre per season. Head and stem brassicas only .
Deliver (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11	Use higher rates for armyworms. OMRI-listed ² .
*Diazinon AG-500, *50 W (diazinon)	AG500 preplant: 1-4 qt 50W: 2-8 lb	96	preplant	cutworms, mole crickets, wireworms	1B	Broccoli, cabbage, cauliflower, collard, kale, mustard greens. See label for depth to incorporate.

Table 2.5. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
*Dibrom 8 EC (naled)	1 pt	48	1	aphids, diamondback moth, imported cabbageworm	1B	Apply no more than 1 pt per acre in Florida. Do not apply more than 10 pt per acre per season. Broccoli, cabbage, cauliflower, Brussels sprouts, kale and collards.
Dimethoate 4 EC (dimethoate)	0.5-1 pt – broccoli, cauliflower; 0.5 pt – kale, mustard greens, turnip	48	7 – broccoli, cauliflower, 14 – kale, mustard greens, turnip	aphids	1B	Highly toxic to bees. For broccoli, cauliflower, kale, turnip greens and roots, and mustard greens only.
*Dimilin 2L (diflubenzuron)	2-4 fl oz	12	7	grasshoppers	15	All Brassica crops. No more than 4 applications per season. May be applied only to turnip varieties that do not produce a harvestable root.
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. See label for rates for specific pests. Good coverage is essential. OMRI-listed ² .
Durivo (thiamethoxam, chlorantraniliprole)	10-13 fl oz	12	30	aphids, caterpillars, flea beetles, thrips, whiteflies	4A, 28	May be applied via one of several different soil applications methods.
Entrust SC (spinosad)	1.5-10 fl oz	4	1	armyworms, cabbage looper, diamondback moth, imported cabbageworm, leafminers, thrips, suppression of flea beetles	5	See label for resistance management. Do not apply more than 29 oz per acre per crop. OMRI-listed ² .
Esteem Ant Bait (pyriproxyfen)	1.5-2.0 lb	12	1	red imported fire ant	7C	Apply when ants are actively foraging. Do not exceed 0.134 lb ai per acre per season
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.
Fulfill (pymetrozine)	2.75 oz	12	7	cabbage aphid, green peach aphid, turnip aphid, suppression of whiteflies	9B	Apply when aphids and whiteflies first appear. Provides suppression of whiteflies. Maximum of 2 applications per crop.
Grandevo (<i>Chromobacterium</i> <i>subtsugae</i> strain PRAA4-1)	1.0-3.0 lb	4	0	armyworms, cabbage looper, cabbage webworm, cross-striped cabbageworm, cutworms, diamondback moth, imported cabbageworm, aphids, billbugs leafhop- pers, mites, plant bugs, thrips, whiteflies, yellowmargined leaf beetle larvae (newly hatched to second instar)	–	Can be used in organic production. OMRI-listed ²
Intrepid 2F (methoxyfenozide)	4-10 fl oz, depending on pest	4	1	beet armyworm, cabbage looper, cab- bageworm, cross-striped cabbageworm, fall armyworm garden webworm, imported cabbageworm, southern armyworm, true armyworm, yellowstriped armyworm	18	Do not apply more than 64 oz per acre per season.
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.50 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms)	11	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² . See label for crops (most cole crops).
Knack (pyriproxyfen)	8-10 fl oz	12	7	whiteflies (immatures)	7C	Limited to 2 applications per season.
*Lannate LV; *SP (methomyl)	LV: 0.75-3.0 pt SP: 0.25-1 lb	48	Cabbage – 1, broccoli and cauliflower – 3, others –10	Beet armyworm, diamondback moth, fall armyworm, imported cabbageworm, loopers, variegated cutworm (pests vary by specific crop)	1A	Do not make more than 10 applications per crop (8 for collards, kale, mustard and turnip greens). For use on broccoli, cabbage, cauliflower, Chinese cabbage, fresh market collards, kale, mustard and turnip greens.
*Larvin 3.2 (thiodicarb)	16-40 fl oz	48	7	beet armyworm, cabbage looper, diamondback moth, flea beetles, imported cabbageworm	1A	Do not exceed more than 4.0 lb active ingredient per acre per season. (160 fl oz) For broccoli, cabbage, and cauliflower only.
Lorsban 75WG, (chlorpyrifos)	Foliar: 0.67-1.33 lb	24, 72 for cauliflower	21	Armyworms (including beet armyworm), cabbage aphid, cutworms, striped flea beetle, imported cabbageworm	1B	For use on broccoli, cabbage, cauliflower, collards, kale, kohlrabi. See label for specific crop directions.
Lorsban 15G, 75WG, *Advanced	See labels for rates for soil application	24, 72 for cauliflower	30	root maggots. If preplant (Lorsban Ad- vanced), also billbugs, cutworms, grubs, symphylans, wireworms	1B	Only one application per season. See label for restrictions and specific crop directions.

Table 2.5. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Malathion 8F (malathion)	1.25 pt, 1 for collards, kale, mustard greens	48, 12 for collards, kale, and mustard greens	2 for head and stem Brassica except cabbage, 7 for greens and cabbage	aphids, cabbage looper, flea beetles, imported cabbageworm	1B	see label for limitations on number of applications per season--varies by crop.
Movento (spirotetramat)	4-5 fl oz	24	1	aphids, whiteflies	23	Limited to 10 oz/acre per season.
M-Pede 49% EC (soap, insecticidal)	1-2 % V/V	12	0	aphids, leafhoppers, mites, thrips, white- flies	--	OMRI-listed ² .
*MSR Spray Concentrate (oxydemeton-methyl)	1.5-2 pt	7 days	7	aphids, thrips	1B	Broccoli, broccoflower, broccolini, cabbage, cauliflower - See label for restrictions.
*Mustang (zeta-cypermethrin)	2.4-4.3 oz	12	1	aphids (some), armyworms, cabbage looper, cabbage webworm, corn earworm, crickets, cucumber beetles, cutworm, flea beetles, grasshoppers, imported cabbage- worm, leafhoppers, saltmarsh caterpillar, southern cabbageworm, stink bugs, aids in control of whiteflies	3A	Do not make applications less than 7 days apart. Diamondback moth popula- tions in Florida have been found to be resistant to pyrethroids.
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, cabbage looper, caterpillars, cutworms, diamondback moth, dipterous leafminers, leafminers, imported cabbageworm, whiteflies	un	IGR and feeding repellent. Greenhouse and field. OMRI-listed ² .
Oberon 2 SC (spiromesifen)	7.0-8.5 fl oz	12	7	whiteflies	23	Maximum amount per crop: 25.5 fl oz/ acre. No more than 3 applications. Not for turnip greens.
Platinum Platinum 75SG (thiamethoxam)	5.0-11 fl oz 1.66-3.67 oz	12	30	aphids, flea beetles, thrips, whiteflies	4A	Soil application.
*Pounce 25 WP³ (permethrin)	See label for crop- specific rates.	12	1	armyworms, cabbage looper, diamondback moth, imported cabbageworm, plant bugs, thrips	3A	Broccoli, cabbage, cauliflower, Chinese broccoli, collards, turnips.
*Proaxis Insecticide³ (gamma-cyhalothrin)	1.92-3.84 fl oz	24	1	aphids ⁽²⁾ , armyworm, beet armyworm ⁽¹⁾ , cabbage looper, cabbage webworm, corn earworm, cutworms, diamondback moth, fall armyworm ⁽¹⁾ , flea beetles, grasshop- pers, imported cabbageworm, leafhop- pers, southern cabbageworm, spider mites ⁽²⁾ , stink bugs, thrips ⁽²⁾ , vegetable weevil (adult), whiteflies ⁽²⁾ , yellowstriped armyworm	3A	⁽¹⁾ First and second instars only. ⁽²⁾ Suppression only. Do not apply more than 1.92 pints per acre per season. Head and stem brassicas only.
*Proclaim (emamectin benzoate)	2.4-4.8 oz	12	7 - head & stem 14 - leafy	beet armyworm, cabbage webworm, corn earworm, cross-striped cabbageworm, dia- mondback moth, fall armyworm, imported cabbageworm, loopers, suppression of <i>Liriomyza</i> leafminers	6	Do not make more than 2 sequential applications without rotating to another product with a different mode of action. Do not apply by aircraft. Not for turnips grown for roots.
Prokil Cryolite (cryolite)	8-16 lb	12	7	cabbage looper, cutworms, diamondback moth, flea beetles, imported cabbage- worm, yellowstriped armyworm	un	For broccoli, Brussels sprouts, and cauliflower only. Do not apply more than 96 lb per season or more often than every 7 days.
Provado 1.6F (imidacloprid)	3.8 oz	12	7	aphids, whiteflies	4A	Do not apply more than 0.5 lb ai per year.
Pyganic 5.0 (pyrethrins)	4.5-18 oz	12	0	insects	3A	Harmful to bees. Can be used in green- houses. OMRI-listed. ²
Radiant SC (spinetoram)	5-10 fl oz	4	1	armyworms, cabbage looper, diamondback moth, imported cabbageworm, <i>Liriomyza</i> leafminers, thrips	5	Do not apply to seedlings grown for transplant. Do not make more than two consecutive applications of Group 5 insecticides.
Requiem 25EC (extract of <i>Chenopodium ambrosioides</i>)	2-4 qt (no more than 2% v/v)	4	0	green peach aphid, turnip aphid, whiteflies	un	
Rimon 0.83 EC (novaluron)	6-12 fl oz	12	7	armyworms, cabbage looper, cabbage webworm, corn earworm, cucumber beetles, diamondback moth, imported cabbageworm, lepidopteran and dipteran leafminers, stink bugs, vegetable weevil, thrips, whiteflies	15	No more than 3 applications or 24 fl oz per acre per season. No more than 2 ap- plications for thrips or whiteflies. Head and stem Brassica only.
Saf-T-Side, others (Oil, insecticidal)	1-2 gal/100 gal	4	up to day of harvest	aphids, leafhoppers, mites, plant bugs, thrips, whiteflies	--	OMRI-listed ² .

Table 2.5. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Scorpion 35SL Insecticide (dinotefuran)	foliar: 2-7 fl oz, soil: 9-10.5 fl oz	12	foliar, 1; soil, 21	brown stink bug, cabbage aphid (suppression), cucumber beetles, flea beetles, grasshoppers, green peach aphid (suppression), harlequin bug, leafminers, southern green stink bug, thrips, whiteflies	4A	Head and stem brassicas only.
Sevin 80S; XLR, 4F (carbaryl)	XLR, 4F: 0.5-2 qts	12	3 or 14, depending on specific crop	armyworms, corn earworm, diamondback moth, flea beetles, harlequin bug, imported cabbage worm, leafhoppers	1A	Up to 4 applications, at least 7 days apart. See label for specific crops.
Trigard (cyromazine)	2.66 oz	12	7	leafminers	17	Limited to 6 applications. Includes turnip greens, not grown for roots.
Trilogy (extract of neem oil)	0.5-2% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .
Venom Insecticide (dinotefuran)	foliar: 1-4 oz soil: 5-6 oz	12	foliar - 1 soil - 21	Foliar: brown stink bug, suppression of cabbage aphid, flea beetle, grasshopper, suppression of green peach aphid, green sink bug, harlequin bug, southern green stink bug Soil: suppression of green peach aphid and cabbage aphid, leafminer, whiteflies	4A	Use one application method, not both (soil or foliar). Foliar: Do not apply more than 0.268 lb ai per acre per season. Soil: Do not apply more than 0.536 lb ai per acre per season.
Venom 20 SG	foliar: 0.44-0.895 lb soil: 1.13-1.34 lb					For head and stem Brassica only.
Vetica (buprofezin and flubendiamide)	10-20 fl oz	12	1	armyworms, cabbage looper, cabbage webworm, corn earworm, cross-striped cabbageworm, cutworms, diamondback moth, garden webworm, imported cabbageworm, saltmarsh caterpillar, leafhoppers, planthoppers, and whiteflies	16, 28	Do not make more than 2 applications per crop cycle.
Voliam Flexi (thiamethoxam and chlorantraniliprole)	4-7 oz	12	head and stem – 3, leafy Brassica greens - 7	aphids, beet armyworm, cabbage looper, cabbage webworm, corn earworm, diamondback moth, fall armyworm, flea beetles, imported cabbageworm, thrips, whitefly, yellowstriped armyworm	4A, 28	Highly toxic to bees exposed to direct treatment or residues on blooming crops.
*Voliam Xpress (lambda-cyhalothrin and chlorantraniliprole)	5-9 fl oz	24	3	aphids (suppression), beet armyworm, cabbage looper, cabbage webworm, corn earworm, diamondback moth, fall armyworm, flea beetles, grasshoppers, imported cabbageworm, leafhoppers, plant bugs, stink bugs, suppression of thrips and whiteflies, yellowstriped armyworm	3A, 28	Highly toxic to bees exposed to direct treatment or residues on blooming crops. Head and stem Brassica only.
*Warrior II³ (lambda-cyhalothrin)	0.96-1.92 fl oz	24	1	aphids ⁽¹⁾ , beet armyworm ⁽²⁾ , cabbage looper, cabbage webworm, corn earworm, cutworms, diamondback moth, fall armyworm ⁽²⁾ , flea beetles, grasshoppers, imported cabbageworm, leafhoppers, plant bugs, stink bugs, thrips ⁽¹⁾ , whiteflies ⁽¹⁾ , yellowstriped armyworm	3A	Do not apply more than 0.24 lb ai/acre per season. ⁽¹⁾ suppression only ⁽²⁾ 1 st and 2 nd instar only For head and stem Brassicas only.
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

* Restricted use insecticide.

Table 2.6. Cole crop fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²	
			Applic.	Season	Harvest	Reentry		
COLE CROPS								
Head and Stem Crops: Broccoli, Brussels Sprouts, Cauliflower, Chinese Broccoli and Chinese Cabbage; Leafy Crops: Collard, Kale, Mustard and Turnip; and Watercress								
Alternaria leaf spot (Alternaria spp.)	M1	(copper compounds) Many brands available.		SEE INDIVIDUAL LABELS	1	Varies by product from 4 h to 2 days	Mancozeb or maneb enhances bactericidal effect of fix copper compounds. Some reddening on older Broccoli leaves at higher rates and flecking on wrapper leaves of Cabbage may occur.	
	M5	(chlorothalonil) brands available:	Many	SEE INDIVIDUAL LABELS	7	1 - 2	Not labeled for collards, mustard, turnip or watercress.	
	2	Iprodione 4L AG Rovral 4F Enclosure 4 Nevado 4F (iprodione)	Rovral 4F	1pt	4 pt	10	-	Only labeled for Chinese mustard. Limit is 4 appl for mustard.
	3	Monsoon Orius 3.6F TebuStar 3.6L Tebuzol 3.6F Toledo 3.6F (tebuconazole)		4 fl oz	16 fl oz	7	1	Not labeled for watercress or head and stem cole crops. Apply prior to infection when environmental conditions are favorable.
	3	Procure (triflumizole)		8 fl oz	18 fl oz	1	0.5	Not labeled for watercress or head and stem cole crops. Apply prior to infection- and repeat sprays at a 14 day interval.
	4 & M5	Ridomil Gold Bravo Ridomil Gold Bravo SC (mefenoxam + chlorothalonil)		1.5 lb	See label	7	2	Not labeled for leafy cole crops or watercress. Limit is 4 applications per crop.
	7	Endura (boscalid)		9 oz	18 oz	0 (head and stem) 14 (leafy)	0.5	Not labeled for watercress; Limit is 2 appl/crop.
	7	Fontelis (penthiopyrad)		30 fl oz	72 fl oz	0	0.5	No more than 2 sequential applications.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)		20 fl oz	80 fl oz	7	0.5	Begin applications prior to disease development, and continue on a 7 – 10 day interval. Make no more than 2 sequential applications before rotating to another effective fungicide with a different mode of action.
	9 & 12	Switch 62.5WG (cyprodinil + fludioxonil)		14 oz	56 oz	7	0.5	No more than 2 sequential appl. before rotating to a different mode of action for at least 2 appl; 30 day plant back for off label crops.
Alternaria blight (Alternaria spp.)	11	Cabrio EG (pyraclostrobin)		16 oz	64 oz	0 (head and stem) 3 (leafy)	4 h	Not labeled for collards, kale, mustard or watercress; No more than 2 sequential appl/stem and head crop.
	11	Quadris (azoxystrobin)		15.5 fl oz	93 fl oz	0	4 h	Not labeled for watercress; No more than 1 sequential appl.
	7	Endura (boscalid)		9 oz	18 oz	0 (head and stem) 14 (leafy)	0.5	Not labeled for watercress; Limit is 2 appl/crop.
	9 &12	Switch 62.5WG fludioxonil)	(cyprodinil +	14 oz	56 oz	7	0.5	Can be applied as a preplant and surface application. Do not use in greenhouse crops or field-grown vegetable bedding plants.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)		14 fl oz	56 fl oz	1	0.5	No more than 1 sequential appl.
Anthraco (Colletotrichum spp.)	3	Procure 480 SC (triflumizole)		8 fl oz	18 fl oz	1 (head & stem) 0 (leafy)	0.5	Not labeled for watercress.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)		20 fl oz	80 fl oz	7	0.5	Begin applications prior to disease development, and continue on a 7 – 10 day interval. Make no more than 2 sequential applications before rotating to another effective fungicide with a different mode of action. Do not exceed 80 fl oz per season.

Table 2.6. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²	
			Applic.	Season	Harvest	Reentry		
COLE CROPS								
Head and Stem Crops: Broccoli, Brussels Sprouts, Cauliflower, Chinese Broccoli and Chinese Cabbage; Leafy Crops: Collard, Kale, Mustard and Turnip; and Watercress								
Anthracnose (<i>Colletotrichum</i> spp.)	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0 (head and stem)	4 h	Not labeled for collards, kale, mustard or watercress; No more than 2 sequential appl/stem and head crop.	
Continued					3 (leafy)			
	11	Quadris (azoxystrobin)	15.5 fl oz	93 fl oz	0	4 h	Not labeled for watercress; No more than 1 sequential appl.	
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	No more than 1 sequential appl.	
Black Leg (<i>Leptosphaeria maculans</i>)	2	Iprodione 4L AG Povral 4F Rovral Enclosure 4 Nevado 4F (iprodione)	2 pt (broc- coli)	4 pt	0	-	Only labeled for broccoli. Limit is 2 appl for broccoli.	
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0 (head and stem)	4 h	Not labeled for collards, kale, mustard or watercress; No more than 2 sequential appl/stem and head crop.	
	11	Quadris (azoxystrobin)	15.5 fl oz	93 fl oz	0	4 h	Not labeled for watercress; No more than 1 sequential appl.	
	11	Reason 500SC (fenamidone)	8.2 oz	24.6 oz	2	-	Not labeled for turnip or watercress. Limits are no more than 1 sequential appl.	
Black Rot (<i>Xanthomonas campestris</i>)	M1	(copper compounds) Many brands available:	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days	Mancozeb or maneb enhances bacteri- cidal effect of fix copper compounds.	
	P	Actigard 50 WG (acibenzolar-S-methyl)	1 oz	4 oz	7	0.5	Apply preventively; limit is 4 appl/crop on a 7-day schedule. Suppression only.	
Cercospora Leaf Spot (<i>Cercospora brassicola</i>)	3	Monsoon Orius 3.6F TebuStar 3.6L Tebuzol 3.6F Toledo 3.6F (tebuconazole)	4 fl oz	16 fl oz	7	0.5	Not labeled for watercress or head and stem cole crops. Apply prior to infection when environmental conditions are favorable.	
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl oz	7	0.5	Begin applications prior to disease development, and continue on a 7 – 10 day interval. Make no more than 2 sequential applications before rotating to another effective fungicide with a different mode of action.	
	9 & 12	Switch 62.5WG + fludioxonil	(cyprodinil	14 oz	56 oz	7	0.5	Can be applied as a preplant and surface application. Do not use in greenhouse crops or field-grown vegetable bedding plants. Suppression only.
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0 (head and stem)	4 h	Not labeled for collards, kale, mustard or watercress; No more than 2 sequential appl/stem and head crop.	
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	No more than 1 sequential appl.	
Club root (<i>Plasmodiophora brassicae</i>)	21	Ranman (cyazofamid)	SEE INDIVIDUAL LABELS		-	0.5	Applied as a transplant soil drench.	
	29	Omega 500F (fluazinam)	2.6 pt soil appl.	3.85 pt	20 (leafy)	2	Not labeled for watercress. Treated turnip roots are not fit for human or livestock consumption.	
			6.45 fl oz/ 100 gal transplant drench		50 (head and stem)			
Downy Mildew (<i>Perenospora parasitica</i>)	M1	(copper compounds) Many brands available:	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days	Mancozeb or maneb enhances bacteri- cidal effect of fix copper compounds.	
	M3	(mancozeb) Many brands available:	SEE INDIVIDUAL LABELS		10	1	Not labeled for collards, mustard, turnip or watercress. See labels for restrictions and details.	

Table 2.6. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²	
			Applic.	Season	Harvest	Reentry		
COLE CROPS								
Head and Stem Crops: Broccoli, Brussels Sprouts, Cauliflower, Chinese Broccoli and Chinese Cabbage; Leafy Crops: Collard, Kale, Mustard and Turnip; and Watercress								
Downy Mildew (<i>Perenospora parasitica</i>) Continued	M5	(chlorothalonil) brands available:	Many	SEE INDIVIDUAL LABELS	7	2	Not labeled for leafy cole crops or watercress.	
	4	Ridomil Gold SL (mefenoxam)	0.25 pt foliar	1 pt (foliar)	7	2	Not labeled for watercress; Use only in a tank mix with another effective fungicide (non FRAC code 4).	
	4 & M5	Ridomil Gold Bravo Ridomil Gold Bravo SC (mefenoxam + chlorothalonil)	1.5 lb	See label	7	2	Not labeled for leafy cole crops or watercress. Limit is 4 applications per crop.	
	9 & 3	Inspire Super + difenoconazole)	(cyprodinil	20 fl oz	80 fl oz	7	0.5	Begin applications prior to disease development, and continue on a 7 – 10 day interval. Make no more than 2 sequential applications before rotating to another effective fungicide with a different mode of action.
	11	Cabrio EG	(pyraclostrobin)	16 oz	64 oz	0 (head and stem) 3 (leafy)	4 h	Not labeled for collards, kale, mustard or watercress; No more than 2 sequential appl/stem and head crop.
	11	Quadris (azoxystrobin)		15.5 fl oz	93 fl oz	0	4 h	Not labeled for watercress; No more than 1 sequential appl.
	11	Reason 500SC (fenamidone)		8.2 oz	24.6 oz	2	-	Not labeled for turnip or watercress. Limits are no more than 1 sequential appl.
	21	Ranman (Cyazofamid)		2.75 fl oz	39.5 fl oz	0	0.5	This product can be applied as a transplant soil drench. Do not make more than six appl.
	40	Acrobat (dimethomorph)		6.4 oz	32 oz	0	0.5	Not labeled for head and stem cole crops. Only 5 appl. per season. See supplemental label for restrictions and details.
	40	Forum (dimethomorph)		6 oz	30 oz	0	0.5	Not labeled for turnip or watercress. Only 5 appl. per season.
	40	Revus (mandipropamid)		8 fl oz	32 fl oz	1	0.5	Not labeled for turnip or watercress. Limit is no more than 2 sequential appl. or 4 total appl.
	43	Presidio (fluopicolide)		4 fl oz	12 fl oz	2	0.5	Not labeled for watercress. Limit is no more than 2 sequential appl. or 4 total appl. per season; Use only in a tank mix with another effective fungicide; 18 month plant back for off label crops.
	P	Actigard 50 WG (acibenzolar-S-methyl)		1 oz	4 oz	7	0.5	Apply preventively; limit is 4 appl/crop on a 7-day schedule. Suppression only.
Fusarium soilborne diseases <i>Fusarium spp.</i>	12	Maxim 4FS (fludioxonil)		0.08 to 0.16 fl oz/ 100 lb. of seed	See label	-	0.5	Seed treatment only; Not labeled for turnip or watercress.
Gray mold (<i>Botrytis cinera</i>)	7	Endura (boscalid)		9 oz	18 oz	0 (head and stem) 14 (leafy)	0.5	Not labeled for watercress; Limit is 2 appl/crop.
	7	Fontelis (penthiopyrad)		30 fl oz	72 fl oz	0	0.5	No more than 2 sequential applications.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)		20 fl oz	80 fl oz	7	0.5	Begin applications prior to disease development, and continue on a 7 – 10 day interval. Make no more than 2 sequential applications before rotating to another effective fungicide with a different mode of action.
Powdery Mildew (<i>Erysiphe polygoni</i>)	M2	(sulfur) Many brands available:		SEE INDIVIDUAL LABELS	0	-		Products are available for most cole crops; See labels for restrictions and details.
	3	Monsoon Orius 3.6F TebuStar 3.6L Tebuzol 3.6F Toledo 3.6F (tebuconazole)		4 fl oz	16 fl oz	7	0.5	Not labeled for watercress or head and stem cole crops. Apply prior to infection when environmental conditions are favorable.

Table 2.6. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
COLE CROPS							
Head and Stem Crops: Broccoli, Brussels Sprouts, Cauliflower, Chinese Broccoli and Chinese Cabbage; Leafy Crops: Collard, Kale, Mustard and Turnip; and Watercress							
Powdery Mildew (<i>Erysiphe polygoni</i>)	3	Procure 480 SC (triflumizole)	8 fl oz	18 fl oz	0 (leafy)	0.5	Not labeled for watercress. See label for restrictions and details.
Continued	7	Endura (boscalid)	9 oz	18 oz	0 (head and stem) 14 (leafy)	0.5	Not labeled for watercress; Limit is 2 appl/crop.
	7	Fontelis (penthiopyrad)	30 fl oz	72 fl oz	0	0.5	No more than 2 sequential applications.
	9 & 12	Switch 62.5WG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	No more than 2 sequential appl. before rotating to a different mode of action for at least 2 appl; 30 day plant back for off label crops.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl oz	7	0.5	Begin applications prior to disease development, and continue on a 7 – 10 day interval. Make no more than 2 sequential applications before rotating to another effective fungicide with a different mode of action.
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0 (head and stem) 3 (leafy)	4 h	Not labeled for collards, kale, mustard or watercress; No more than 2 sequential appl/stem and head crop.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	No more than 1 sequential appl.
Pythium & Phytophthora diseases (soil)	4	Ridomil Gold SL (mefenoxam)	2 pt (soil)	2 pt (soil)	7	2	Not labeled for watercress; Use only in a tank mix with another effective fungicide (non FRAC code 4).
	4	Apron XL (mefenoxam)	SEE INDIVIDUAL LABELS		-	2	Seed treatment only; Not labeled for watercress. See label for details.
	4	Ultra Flourish (mefenoxam)	4 pt	4 pt	-	2	Soil applied as a preplant treatment or following transplanting.
Pythium Damping-off <i>Pythium spp.</i>	4	Allegiance-FL (Metalaxyl)	SEE INDIVIDUAL LABELS		-	2	Seed treatment only. Primarily for com- mercial seed treatment.
	4	MetaStar 2E AG (Metalaxyl)	SEE INDIVIDUAL LABELS		-	2	Can be applied as a preplant and surface application. Do not use in greenhouse crops or field-grown vegetable bedding plants.
Phytophthora spp.	4	MetaStar 2E AG (Metalaxyl)	SEE INDIVIDUAL LABELS		-	2	Can be applied as a preplant and surface application. Do not use in greenhouse crops or field-grown vegetable bedding plants.
	43	Presidio (fluopicolide)	4 fl oz	12 fl oz	2	-	Not labeled for watercress. Limit is no more than 2 sequential appl. or 4 total appl. per season; Use only in a tank mix with another effective fungicide; 18 month plant back for off label crops.
Rhizoctonia rot and blight (<i>Rhizoctonia solani</i>)	7	Endura (boscalid)	9 oz	18 oz	0 (head and stem) 14 (leafy)	0.5	Not labeled for watercress; Limit is 2 appl/crop.
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	4 h	Not labeled for collards, kale, mustard or watercress; No more than 2 sequential appl/stem and head crop.
	11	Quadris (azoxystrobin)		46 fl oz	0	4 h	Labeled only for the soilborne control on leaf green brassicas. See label for details on soilborne applications.
	12	Maxim 4FS (fludioxonil)	0.08 to 0.16 fl oz/ 100 lb. of seed		-	0.5	Seed treatment only; Not labeled for turnip or watercress.
	14	Blocker 4F Terraclor 400 Terraclor 75WP Terraclor FL (PCNB)	See label	30 lb a.i.	-	0.5	Not labeled for leafy cole crops or watercress.
Ring Spot (<i>Mycosphaerella brassicicola</i>)	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	4 h	Not labeled for collards, kale, mustard or watercress; No more than 2 sequential appl/stem and head crop.

Table 2.6. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
COLE CROPS							
Head and Stem Crops: Broccoli, Brussels Sprouts, Cauliflower, Chinese Broccoli and Chinese Cabbage; Leafy Crops: Collard, Kale, Mustard and Turnip; and Watercress							
Sclerotinia rot (<i>Sclerotinia spp.</i>)	7	Endura (boscalid)	9 oz	18 oz	0 (head and stem) 14 (leafy)	0.5	Not labeled for watercress; Limit is 2 appl/crop.
Sclerotinia rot (<i>Sclerotinia spp.</i>)	7	Fontelis (penthiopyrad)	30 fl oz	72 fl oz	0	0.5	No more than 2 sequential applications.
	NC	Contans WG <i>Coniothyrium minitans</i>	SEE INDIVIDUAL LABELS		-	4 h	OMRI listed.
White rust (<i>Albugo candida</i>)	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	4 h	Not labeled for collards, kale, mustard or watercress; No more than 2 sequential appl/stem and head crop.
	11	Quadris (azoxystrobin)	15.5 fl oz	93 fl oz	0	4 h	Not labeled for watercress; No more than 1 sequential appl.
	11	Reason 500SC (fenamidone)	8.2 oz	24.6 oz	2	-	Not labeled for turnip or watercress. Limits are no more than 1 sequential appl.
White leaf spot (<i>Pseudocercospora capsellae</i>)	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	4 h	Not labeled for collards, kale, mustard or watercress; No more than 2 sequential appl/stem and head crop.

¹ FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <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.

Chapter 3. Cucurbit Production

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Botany and Planting

Cucumber - *Cucumis sativus*, Cucurbitaceae.

Cantaloupe- *Cucumis melo*.

Summer squash - *Cucurbita pepo*.

Butternut squash - *Cucurbita moschata*.

Winter squash - *Cucurbita maxima*

Pumpkin (jack-o-lantern is *C. pepo*; some processing pumpkins are *C. maxima* and *C. moschata*).

Tropical pumpkin (calabaza) - *Cucurbita moschata*.

Watermelon - *Citrullus lanatus*.

Table 3.1. Planting information for cucurbits.

Planting dates	Cucumber	Cantaloupe	Pumpkin	Squash	Watermelon
North Florida	Feb - Apr; July - Aug	Feb 15 - Apr 15	Early July	Feb - Apr; Aug - Sept 15	Feb 15 - Apr 15
Central Florida	Jan - Mar; Sept	Jan 15 - Mar 15	Mid July	Jan - Apr; Aug - Sept	Jan 15 - Mar 15
South Florida	Sept - Feb	Dec 15 - Mar 1	Early August	Aug - Mar	Dec 15 - Mar 1
Planting information	Bush		Vining		
Distance between rows (in)	48 - 60	60 - 72	60 - 108	36 - 48	60 - 108
Distance between plants (in)	6 - 12	24 - 36	36 - 60	12 - 24	36 - 60
Seeding depth (in)	0.5 - 0.75	0.5 - 1.0	1.5 - 2.0	1.0 - 1.5	1.5 - 2.0
Seed per acre (lb)	2 - 4	1 - 2	4 - 5	2 - 3	1 - 1.5
Days to maturity from seed	40 - 65	85 - 110	80 - 100	40 - 50	85 - 120
Days to maturity from transplant	Not recommended	70 - 90	70 - 90	Not recommended	60 - 90
Plant populations (acre)	21,780	4,356	2,904	14,520	2,904

Cultivars

Cucumber

Pickling

Calypso (H) (GY)	Maxi Pik (H)
Eureka (H) (MO)	Napoleon Classic (H) (MO)
Excel (H) (GY)	Powerpak (H) (GY)
Fancipak (H) (GY)	Royal (H) (GY)
FMX 5020 (H)	Transamerica (H)
Jackson Classic (H) (GY)	

Slicing

Cobra (H) (GY)	Laser (H) (GY)
Darlington (H) (GY)	Mongoose (H) (GY)
Dasher II (H) (GY)	Rockingham (H) (GY)
Daytona (H) (GY)	Slice More (H) (GY)
Diomedea (H) (GY)	Speedway (H) (GY)
Dominator (H) (GY)	Stonewall (H) (GY)
Impact (H) (GY)	SV3462CS* (H) (GY)
Indy (H) (GY)	SV4719CS* (H) (GY)
Intimidator (H) (GY)	Tallegada (H) (GY)
Lightning (H) (GY)	Thunder(H) (GY)
Lancer (H) (GY)	

H=hybrid; flower habit: GY=gynocercous, MO=monoecious.

*Improved Downy Mildew resistance.

Cantaloupe

Aphrodite (H)	Athena (H)
Ariel (H)	Atlantis (H)
Avatar (H)	H=hybrid

Halloween pumpkin (North Florida only)

Miniature:< 1 lb

Bumpkin (H)	Little Guy
Gold Dust (H)	Munchkin
Jack-Be-Little	Wee-Be-Little (PVP)
Jack-Be-Quick	

Small: 1-5 lb

Baby Pam	Pick-A-Pie (H)
Hybrid Pam	Small Sugar
Little Lantern	Trickster (H)

Medium: 5-10 lb

Autumn Gold (H)	October (H)
Goose Bumps II	Superior (H)
Jack of All Trades (H)	Wizard (H)
Knuckle Head	

Halloween pumpkin (North Florida only) Continued

Large: 10-20 lb

Apogee (H)	Gold Medal (H)
Big Autumn (H)	Gold Medallian (H)
Checkmate (H)	Jumpin' Jack
Conestoga Giant	Phatso II (H)
Conestoga Special	ProGold 510 (H)
Connecticut Field	Summit (H)

Giant: 25-80 lb

Dill's Atlantic Giant	
PVP=Plant Variety Protection; H=hybrid	

Squash

Summer (yellow)

Conqueror III (H) (SN)*	Medalion (H) (CN)
Dixie (H)1 (CN)	Ocelot (H) (CN)
Enterprise (H) (SN)	Prelude (H) (CN)
Gentry (H) (CN)	Prelude II (H) (CN)
Destiny III (H) (CN)*	XPT 1832 III (H) (SN)*
Goldbar (H) (SN)	Sunbrite (H) (CN)
Goldprize (H) (SN)	Sunglo (H) (CN)
Gold Star (H) (SN)	Suwannee (H) (CN)
Lioness (H) (SN)	

Summer (zucchini)

Ambassador (H)	Progreen (H)
Cash Flow (H)	Quirinal (H)
Endeavor (H)	Senator (H)
Envy (H)	Seneca Zucchini (H)
Green Eclipse (H)	Southern Star (H)
Judgement III (H)*	Spineless Beauty (H)
Justice III (H)*	Spineless King (H)
Northern Star (H)	Spineless Perfection (H)
Pascola (H)	Springtime 843 (H)
Payroll (H)	SV6009YG (H)*
President (H)	Symphony (H)

Summer (yellow zuchinni)

Summer (grey zuchinni)

Goldrush (H) (SN)	Lolita (H)
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Acorn

Mesa Queen (H)	TayBelle PM (H)
Table Ace (H)	

Butternut

Alba (H)	Polaris (H)
Atlas (H)	Quantam (H)
Canesi (H)	Ultra (H)
Early Butternut	Waltham
Zenith (H)	

H=hybrid; type: CN=crookneck, SN=straightneck.

* Biotech: Specific requirements and restrictions apply to these products.

Tropical pumpkin (calabaza)

Agriset 9001 (vining type)	La Estrella (compact plant)
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Watermelon

Diploid

Duration (H)	Sentinel (H)
Estrella (H)	Starbrite (H)
Gold Strike (H) (orange flesh)	Stargazer (H)
Jamboree (H)	Stars N' Stripes (H)
Mardi Gras (H)	Summer Flavor 790 (H)
Regency (H)	Summer Flavor 800 (H)
Royal Star (H)	Summer Flavor 840 (H)
Royal Sweet (H)	Summer Velvet 2800
Sangria (H)	

Triploid (seedless, large)

Admiration (H)	Liberator (H)
Affirmed (H)	Liberty (H)
Bold Ruler (H)	Majestic
Citation (H)	Melody (H)
Cooperstown (H)	Premont (H)
Crisp N' Sweet (H)	PS 04911714
Cronos (H)	Sugarheart (H)
Crunchy Red (H)	Sweet Delight (H)
Cut Above (H)	Sweet Gem (H)
Distinction (H)	Sweet Polly (H)
Exclamation (H)	Sweet Slice Plus (H)
Fascination (H)	Tri X 313 (H)
Freedom (H)	Wrigley (H)
Gypsy (H)	4502 (H)
Harmony (H)	

Non-Harvestable Pollinizer

Accomplice	Pollen Pro
Ace	Pollen Pro
Patron	SP-5
Polimax	

H=hybrid

Pesticides for Weed, Arthropod and Disease Management for Cucurbit Crops.

Table 3.2. Selected herbicides approved for managing weeds in cucurbit crops.

Active ingredient lb. a.i./acre	Trade name product/acre	Crops	Weeds controlled / remarks
*** PREEMERGENCE ***			
Bensulide 5.0 - 6.0	(Prefar) 4 E 5 - 6 qt.	All cucurbits	Annual broadleaf and grass control. Incorporate or irrigate 1 to 2 in. within 6 h. of application. Nonlabeled crops should not be planted within 120 days of application.
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	All cucurbits	Emerged broadleaf control. Post-direct hooded application to row middles for burndown of emerged broadleaf weeds. Use of crop oil concentrate or nonionic surfactant at recommended rates
Clomazone 0.15 - 0.38	(Command) 4 ME 0.4 - 1 pt.	Cucumber	Annual broadleaf and grass weeds. Use lower rates on coarse soils.
Clomazone 0.15-0.25	(Command) 4 ME 0.4 - 0.67 pt.	Melons (muskmelon, watermelon)	Annual broadleaf and grass control. Use lower rates in coarse soils.
Ethalfuralin + Clomazone 0.4 - 0.6 + 0.13 - 0.19	(Strategy) 2 - 3 pt.	Cucumbers, melons, summer & winter squash, pumpkin, watermelon	Annual broadleaf and grass control. Must be applied no later than 2 days after seeding. Overhead irrigation or rainfall of 0.5 in. within 5 days. Do not apply under row mulch or over top of plants.
*** PREEMERGENCE ***			
Flumioxazin up to 0.125	(Chateau) 51 WDG up to 4 oz.	Cucumber, muskmelon, watermelon, pumpkins, summer & winter squash	Broadleaf control. Row middles only. Do not apply after crops are transplanted/ seeded. Label is a Third-Party registration (TPR, Inc.). Use without a signed authorization and waiver of liability is a misuse of the product.
Glyphosate	(various formulations) consult labels	All cucurbits	Controls emerged broadleaf and grass weeds. Consult individual labels for restrictions.
Halosulfuron 0.024	(Profine, Sandea) 75 DG 0.5 oz.	Cantaloupe, cucumber, crenshaw, honeydew	Yellow and purple nutsedge and broadleaf control. Apply uniformly with ground equipment in a minimum of 15 gal. of water/acre.
Halosulfuron 0.024 - 0.036	(Profine, Sandea) 75 DG 0.5 - 0.75 oz.	Watermelon	Yellow and purple nutsedge and broadleaf control. May be applied preemergence to seeded watermelon on bareground or pre-seeding to mulch-cultured watermelon. Transplanting should be no sooner than 7 days after application. Use lighter rates on sandy soils with low organic matter.
Halosulfuron 0.024 - 0.036	(Profine, Sandea) 75 DG 0.5 - 0.75 oz.	Pumpkin, winter squash	Yellow and purple nutsedge and broadleaf control. Apply before soil cracking or pre-transplant. Transplanting should not be made sooner than 7 days after application. May be applied POST over-the-top when plants reach the 4 - 5 true leaf stage, but before first female flower appear.
Paraquat 0.63 - 0.94	(Gramoxone) 2 SL 2 - 4 pt. (Firestorm) 3 SL 1.3 - 2.7 pt.	Cucumber, muskmelon, cantaloupe, pumpkin, squash, watermelon	Controls emerged weeds. Apply prior, during, or after planting, but before crop emergence. Use a non-ionic surfactant.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	All cucurbits	Controls emerged weeds. Apply before emergence of crop. Product is a contact, nonselective, foliar applied herbicide. There is no residual activity. May be tank mixed with soil residual herbicides.
S-metolachlor 0.95 - 1.26	(Brawl, Dual Magnum) 1.0 - 1.33 pt.	Pumpkin	Annual broadleaf and grass weeds and nutsedge control. Apply as inter-row or inter-hill application. Leave a 1 ft. untreated area over the seeded row (6 in. on either side of the row). Use lower rates on lighter soils. Apply before weeds emerge.
*** POSTEMERGENCE ***			
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	All cucurbits	Emerged broadleaf control. Post-direct hooded application to row middles for burndown of emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. PHI 0 days.
Clethodim 0.94 - 0.13 0.07 - 0.13	(Arrow, Intensity, Select) 2 EC 6 - 8 oz. (Select Max) 1 EC 9 - 16 fl. oz.	Cucumber, squash, melons, and all commodities in crop group	Annual and perennial grass control. Use a crop oil concentrate at 1% v/v spray volume. Use nonionic surfactant in Select Max. PHI 14 days.
DCPA 4.5 - 10.5	(Dacthal) W 75 6 - 14 lb. (Dacthal) 6 F 6 - 14 pt.	Muskmelon, cantaloupe, honeydew, watermelon	Annual grasses and certain broadleaf control. Apply only when plants have 4 - 5 true leaves, are well-established, and growing conditions are favorable for good plant growth. Cultivate prior to application to control emerged weeds.
Ethalfuralin + Clomazone	(Strategy) 2 - 3 pt.	Cucumber, melon, summer & winter squash, pumpkin, watermelon	Annual broadleaf and grass control. After transplanting apply to row middles only. Does not control emerged weeds.

Table 3.2. Continued.

Active ingredient lb. a.i./acre	Trade name product/acre	Crops	Weeds controlled / remarks
*** POSTEMERGENCE ***			
Glyphosate	(various formulations) consult labels	All cucurbits	Control emerged broadleaf and grass weeds. Apply to row middles only. Consult individual labels for restrictions.
Halosulfuron 0.04 -0.05	(Sandeia) 75 DF 0.5 - 1 oz.	Cucumber, cantaloupe, honeydew, crenshaw melon	Apply after the 3-5 true leaf stage (no sooner than 14 days after transplanting) but before the first female flower. Spot spray a POST application if a PRE application was made. Cucumber PHI 30 days. Cantaloupe, honeydew, crenshaw 57 days.
S-metolachlor 0.95 - 1.26	(Brawl, Dual Magnum) 7.62 EC 1.0 - 1.33 pt.	Pumpkin	Annual broadleaf and grass weeds and nutsedge. Apply as inter-row or inter-hill application. Leave a 1 ft. untreated area over the plant (6 in. on either side of the row). Use lower rates on lighter soils. Apply before weeds emerge. PHI 30 days.
Paraquat 0.47 - 0.93	(Gramoxone) 2 SL 1.88 - 3.72 (Firestorm) 3 SL 1.25 - 2.48	Cucumber, muskmelon, cantaloupe, pumpkin, squash, watermelon	Controls emerged weeds. Row middles only. Limit of 3 applications per year.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Cucumber, gourd, muskmelon, cantaloupe, pumpkin, squash, watermelon	Controls emerged weeds. Row middles only. Use a shielded sprayer directed to the row middles to reduce drift to the crop.
Sethoxydim 0.19 - 0.28	(Poast) 1.5 EC 1.0 - 1.5 pt.	All cucurbits	Growing grass weeds. Include a crop oil concentrate. Efficacy is decreased if weeds are under stress. Use 1 pt. for seedling grasses and 1.5 pt. on perennial grasses. PHI 14 days.
Terbacil 0.1 - 0.2	(Sinbar) 80 WP 2 - 4 oz.	Watermelon	Annual broadleaf weeds. Apply to row middles only. Do not allow contact with plant foliage. Do not exceed 4 oz. per year. PHI 70 days.
*** POSTHARVEST ***			
Diquat 0.25	(Reglone Dessicant) 1.0 pt	Cantaloupe	Minimum of 35 gal./acre. Include a NIS. Thorough coverage is required.
Diquat 0.38	(Reglone Dessicant) 1.5 pt	Cucumber, watermelon, squash (except acorn)	Minimum of 35 gal./acre. Include a NIS. Thorough coverage is required.
Diquat 0.5	(Reglone Dessicant) 2.0 pt	Squash (acorn)	Minimum of 35 gal./acre. Include a NIS. Thorough coverage is required.

Table 3.3. Selected insecticides approved for managing insect pests of cucurbit crops.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Acramite-50WS (bifenazate)	0.75-1.0 lb	12	3	twospotted spider mite	un	One application per season.
Actara (thiamethoxam)	1.5-5.5 oz	12	0	aphids, flea beetles, whiteflies, suppression of cucumber beetles and leafminers at higher rates	4A	Apply before pests reach damaging levels.
Admire Pro (imidacloprid) (see appropriate labels for other brands)	7-10.5 oz	12	21 (soil)	aphids, cucumber beetles, leafhoppers, foliage-feeding thrips, whiteflies	4A	Will not control thrips in flowers. Do not use with other Group 4A insecticides
Admire Pro (imidacloprid)	0.44 fl oz/10,000 plants	12	21	aphids, whiteflies	4A	Planthouse: One application to transplants. See label for use on mature greenhouse cucumbers.
Agree WG (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11	Apply when larvae are small for best control. OMRI-listed ² .
*Agri-Mek SC (abamectin)	1.75-3.50 fl oz	12	7	leafminers, spider mites	6	Minimum of 7 days between applications. No more than 2 sequential applications. Must be mixed with an adjuvant-see label for types.
*Ambush 25W (permethrin)	6.4-12.8 oz	12	0	cabbage looper, cucumber beetle adults, cutworms, leafminers, Lygus bug, melonworm, pickleworm, plant bugs, rindworms, squash bugs, squash vine borer, stink bugs	3A	Do not apply more than 1.6 lb ai/acre per season.
*Asana XL (0.66 EC) (esfenvalerate)	5.8-9.6 fl oz	12	3	cabbage looper, corn earworm, cucumber beetles (adults), cutworms (seedling spray), grasshoppers, leafhoppers, Lygus bug, pickleworm, rindworms, squash bug, squash vine borer, stink bugs	3A	Do not apply more than 0.25 lb ai/acre per season, (or 5 applications at high rate).
Assail 30SG (acetamiprid)	2.5-5.3 oz	12	0	aphids, cucumber beetles, leafhoppers, melonworm, pickleworm, squash bug, squash vine borer, whiteflies	4A	No more than 5 applications per season. Do not use if another group 4A insecticide has been used.

Table 3.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Avaunt (indoxacarb)	2.5-6.0 oz	12	3	beet armyworm, cabbage looper, melonworm, pickleworm	22	Do not apply more than 24 oz/acre per crop.
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	un	Antifeedant, repellent, insect growth regulator. OMRI-listed ² .
Azatin XL (azadirachtin)	5-21 fl oz	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, whiteflies	un	Antifeedant, repellent, insect growth regulator. Rate depends on pest-see label.
*Baythroid XL (beta-cyfluthrin)	0.8-2.8 fl oz	12	0	armyworms (1 st and 2 nd instars), cabbage looper, corn earworm, cucumber beetles, cutworms, grasshoppers, melonworm, pickleworm, rindworms, stink bugs, tobacco budworm	3A	Maximum amount per season: 11.2 fl oz/acre.
Belay 50 WDG (clothianidin)	1.6-3.2 oz	12	7	aphids, cucumber beetles, flea beetles, leafhoppers, leafminers (suppression), squash bug, stink bugs, whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Do not apply during bloom. Rates higher than 2.1 oz are for Florida only (supplemental label).
Belay 50 WDG (clothianidin)	4.8 -6.4 oz (soil application)	12	Apply at planting	aphids, cucumber beetles, flea beetles, leafhoppers, leafminers (suppression), squash bug, stink bugs, whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. See label for application instructions.
Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	0	aphids, plant bugs	9C	Do not apply more than 8.4 oz/acre per season. Begin applications before pests reach damaging levels.
Belt SC (flubendiamide)	1.5 fl oz	12	1	armyworms, cabbage looper, corn earworm, cutworms, melonworm, pickleworm, rindworms, squash vine borer	28	Do not apply more than 4.5 fl oz per acre per season.
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11	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 qt/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.
*Brigade 2 EC (bifenthrin)	2.6-6.4 fl oz	12	3	aphids, armyworms, cabbage looper, corn earworm, cucumber beetles, cutworms, grasshoppers, leafhoppers, melonworm, mites, pickleworm, plant bugs, rindworms, squash bug, squash vine borer, stink bugs, tobacco budworm	3A	Do not apply more than 19.2 ounces of product per acre per season. Do not make more than 2 applications after bloom.
*Capture LFR (bifenthrin)	3.4-8.5 fl oz, at planting	12	21	cucumber beetle larvae, cutworms, flea beetle larvae, grubs, wireworms	3A	At planting, banded over open furrow or in-furrow with seed or transplant
Coragen (rynaxypyr)	2.0-7.5 fl oz – drip, 3.5-7.5 – soil at planting, 2.0-7.0 – foliar	4	1	beet armyworm, cabbage looper, leafminer larvae, melonworm, pickleworm, suppression of whitefly nymphs	28	May be applied through drip (chemigation), as well as to soil at planting or as a foliar spray. Do not apply more than 15.4 fl oz per acre per season
Courier 40SC (buprofezin)	9.0-13.6 fl oz	12	7	leafhoppers, planthoppers, whiteflies	16	Insect growth regulator. Do not make more than 2 applications per season per crop or 4 per year. See label for crop rotational restrictions.
Crymax WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Use high rate for armyworms. Treat when larvae are young. Not for organic production.
*Danitol 2.4 EC (fenpropathrin)	10.67-16 fl oz	24	7	banded cucumber beetle, cabbage looper, fall armyworm, southern green stink bug, plant bug, striped cucumber beetle, spider mite, yellowstriped armyworm	3A	Do not exceed 42.67 fl oz per acre per season.
Deliver (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11	Use higher rates for armyworms. OMRI-listed ² .
*Diazinon 50 W, *AG500 (diazinon)	AG500: 2-4 qt 50W: 4-8 lb	72	preplant	cutworms, wireworms	1B	Melons and watermelons only. Not for squash or cucumbers. One application per year.
*Dibrom 8E (naled)	1 pt	48	1	aphids, armyworms, cucumber beetles, loopers, thrips	1B	Summer squash and netted varieties of cantaloupe only. Do not use if temperature is >90 degrees F.
Dimethoate 4 EC (dimethoate)	melons: 1 pt watermelons: 0.5 – 1 pt	48	3	aphids, leafhoppers, leafminers, thrips	1B	Highly toxic to bees. Not for squash or cucumber.

Table 3.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	small armyworms, looper, melonworm, rindworm complex	11	Treat when larvae are young. Good coverage is essential. For organic produc- tion.
Durivo (thiamethoxam, chlorantraniliprole)	10-13 fl oz	12	30	aphids, flea beetles, leafhoppers, mel- onworm, pickleworm, thrips, whiteflies, suppression of leafminers and cucumber beetles	4A, 28	May be applied via one of several soil ap- plication methods—see label for details.
Entrust SC (spinosad)	4-8 fl oz	4	3	armyworms, cabbage looper, leafminers, loopers, melonworm, pickleworm, rind- worms, thrips	5	Do not apply more than 29 fl oz per acre per crop. OMRI-listed ² .
Esteem Ant Bait (pyriproxyfen)	1.5-2.0 lb	12	1	red imported fire ant	7C	Apply when ants are actively foraging.
Extinguish ((S)-methoprene)	1.0-1.5 lb	4	0	fire ants	7A	Slow-acting IGR (insect growth regula- tor). 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.
Fulfill (pymetrozine)	2.75 oz	12	0	green peach aphid, melon aphid, suppres- sion of whiteflies	9B	Minimum of 7 days between applica- tions. Maximum 5.5 oz/acre/season.
Grandevo (<i>Chromobacterium</i> <i>subtsugae</i> strain PRAA4-1)	1.0-3.0 lb	4	0	aphids, armyworms, cabbage looper, corn earworm, cutworms, melonworm, mites, pickleworm, rindworm complex, thrips, whiteflies	11	OMRI-listed ² .
Intrepid 2F (methoxyfenozide)	4-10 oz	4	3	beet armyworm, cabbage looper, melon- worm, pickleworm, rindworms, southern armyworm, true armyworm, yellowstriped armyworm	18	Do not make more than 4 applications per season.
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.50 lb	4	0	most caterpillars, but not <i>Spodoptera</i> spe- cies (armyworms)	11	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
Kanemite 15 SC (acequinocyl)	31 fl oz	12	1	twospotted spider mite, broad mite	20B	Do not apply more than twice per season. Do not apply by air. Melons and cucumbers only.
Knack IGR (pyriproxyfen)	8-10 fl oz	12	7	whiteflies (immatures)	7C	Do not apply more than twice per grow- ing season.
*Lannate LV (methomyl)	LV: 1.5-3.0 pt	48	1=1.5 pts 3=1.5+ pts	beet armyworm, cucumber beetles, fall armyworm, flea beetles, granulate cut- worms, loopers, melon aphid, melonworm, pickleworm, tobacco budworm, variegated cutworm, yellowstriped armyworm	1A	Not for use on winter squashes such as butternut or acorn - only for summer squash, cucumbers, and melons.
*Lannate SP (methomyl)	SP: 0.5-1.0 lb	48	1=1/2 lb 3=1/2+ lb	See above	1A	See above
Malathion 8 (malathion)	1.75 pt, 1.00 pt for winter squash	24	1	aphids, cucumber beetles, leafminers, spider mites, pickleworm, squash vine borer, thrips	1B	Squash and cucumbers only.
M-Pede 49% EC (Soap, Insecticidal)	1-2%V/V	12	0	aphids, leafhoppers, mites, plant bugs, thrips, whiteflies. For green peach aphids and leafminers, mix with another insecti- cide.	—	OMRI-listed ² . Do not apply to stressed plants (high heat or drought conditions).
*MSR Spray Concentrate (oxydemeton-methyl)	1.5-2.0 pt	14 days	14	aphids, cucumber beetles, mites	1B	Do not apply more than 1 time per season.
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, leafminers, loopers, melonworm, pickleworm, rindworms, squash vine borer, whitefly	un	IGR and feeding repellent. Greenhouse and field use. OMRI-listed ² . Do not apply to wilted or stressed plants or trans- plants before root establishment.
Oberon 2SC (spiromesifen)	7.0-8.5 fl oz	12	7	twospotted spider mite, whiteflies	23	Maximum amount per crop: 25.5 fl oz/ acre. No more than 3 applications. See label for plant-back intervals.
Oil, Insecticidal SunSpray 98.8% Ultra-Fine JMS Stylet Oil, Saf-T-Side, Others	1-2 gal/100 gal 3-6 qt/100 gal (JMS)	4	0	aphids, leafhoppers, leafminers, mites, thrips, whiteflies, aphid-transmitted viruses (JMS)	--	Organic Stylet-Oil and Saf-T-Side are OMRI-listed ² .
Platinum (thiamethoxam)	5-11 fl oz	12	30	aphids, flea beetles, leafhoppers, thrips, whiteflies, suppression of cucumber beetles and leafminers	4A	For most crops that are not on the label, a 120-day plant-back interval must be observed.
Platinum 75SG	1.66-3.67 oz					

Table 3.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Portal (fenpyroximate)	2.0 pt	12	3, 1 for cucum- ber	Mites (including broad mite), whiteflies	21A	Melons and watermelons. Cucumbers (supplemental label). Two applications per season.
*Pounce 25 WP (permethrin)	6.4-12.8 oz	12	0	aphids, cabbage looper, cucumber beetles, cutworms, leafhoppers, leafminers, melonworm, pickleworm, plant bugs, rindworms, squash bug, squash vine borer	3A	Use high rate for aphids and squash bug. Do not apply more than 1.2 lb ai/acre per season (0.8 lb ai for cantaloupes).
Prokil Cryolite 96 (cryolite)	8-16 lb	12	14 7 for summer squash	cabbage looper, <i>Diabrotica</i> beetles (cucumber beetles), flea beetles, melonworm, pickleworm	un	Do not apply more than 80 lb/acre per season. Not for cucumbers.
Pyganic 5.0 (pyrethrins)	4.5-18 oz	12	0	many insects	3A	Treat when insects first appear. Harmful to bees. OMRI-listed. ²
Pyronyl Crop Spray (pyrethrin + piperonyl butoxide)	1-12 fl oz	12	12 hours	ants, aphids, armyworms, cabbage looper, corn earworm, cucumber beetles, flea beetles, leafhoppers, thrips, whiteflies	3A	Can be used on greenhouse vegetables.
Radiant SC (spinetoram)	5-10 fl oz	4	3 1 for cucum- bers	armyworms (not yellowstriped), cabbage looper, leafminers, melonworm, pickleworm, rindworms, thrips	5	No more than 6 applications or 34 fl oz per acre per crop.
Requiem (extract of <i>Chenopodium ambrosioides</i>)	2-3 qt	4	0	green peach aphid, thrips, whiteflies	un	Apply before pests reach damaging levels.
Rimon 0.83EC (novaluron)	9-12 fl oz	12	1	armyworms, cucumber beetles, leafminers, loopers, melonworm, pickleworm, sap beetles, squash bugs, thrips, whiteflies	15	Do not apply more than 36 oz per acre per season or apply more often than every 14 days. Do not use adjuvants.
Scorpion 35SL Insecticide (dinotefuran)	foliar: 2-7 fl oz soil: 9-10.5 fl oz	12	foliar: 1 soil: 21	Foliar: brown stink bug, cucumber beetles, flea beetles, grasshoppers, suppression of green peach aphid and melon aphid, green and southern green stink bugs, squash bug Soil: leafhoppers, leafminers, southern green stink bug, squash bug thrips, whiteflies, suppression of green peach aphid and melon aphid	4A	Do not apply more than 10.5 oz per acre per season (foliar) or 21 oz (soil) per acre per season. Use only one application method (soil or foliar).
Sevin 80S, 4F, XLR (carbaryl)	80S: 0.63-1.25 lb 4F, XLR: 0.5-1.0 qt	12	3	cucumber beetles, flea beetles, leafhoppers, melonworm, pickleworm, squash bug	1A	Do not apply more than 7.5 lb (80S) or 6 qt (4F, XLR) per acre per year. Do not apply when plants are wet.
Sulfur	See labels	24	1	mites	--	
*Thionex 50W (endosulfan)	1-2 lb	12 days	16	aphids, cabbage looper, cucumber beetles, melonworm, pickleworm, rindworms, squash beetle, squash bug, squash vine borer, striped flea beetle, whitefly	2	Do not make more than 4 applications per year or exceed 2.0 lb active ingredient per acre per year. This product cannot be used on any cucurbit except pumpkins and winter squash (use expires on Dec. 31, 2014)
Trigard (cyromazine)	2.66 oz	12	0	leafminers	17	Do not make more than six applications.
Trilogy (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .
Venom Insecticide (dinotefuran)	foliar: 1-4 oz soil: 5-6 oz	12	foliar: 1 soil: 21	Foliar: brown stink bug, cucumber beetles, flea beetles, grasshoppers, suppression of green peach aphid and melon aphid, green and southern green stink bugs, squash bug, thrips, whiteflies Soil: flea beetles, leafhoppers, leafminers, thrips, whiteflies, suppression of green peach aphid and melon aphid	4A	Do not apply more than 6 oz per acre per season (foliar) or 12 oz (soil) per acre per season. Use only one application method (soil or foliar). Note that pests controlled differ depending on application method. Supplemental label needed.
Vetica (flubendiamide and buprofezin)	12.0-17.0 fl oz	12	7, 1 with supplemental label	armyworms, cabbage looper, corn earworm, cutworms, melonworm, suppression of leafhoppers, pickleworm, squash vine borer, tobacco budworm, leafhoppers, whiteflies	28, 16	Do not apply more than 3 times per crop season or apply more than 38 fl oz per acre per season. Same MOAs as Belt, Coragen, and Courier. Use higher rates for leafhoppers and whiteflies.
Voliam Flexi (thiamethoxam and chlorantraniliprole)	4-7 oz	12	1	aphids, cabbage looper, corn earworm, flea beetles, melonworm, pickleworm, rindworms, tobacco budworm, whiteflies, suppression of cucumber beetles and leafminers	4A, 28	Highly toxic to bees exposed to direct treatment or residues on blooming crops.
*Vydate L (oxamyl)	2-4 pt	48	1	aphids, leafminers, thrips	1A	Do not apply more than 24 pt per acre per season.

Table 3.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
*Warrior II (lambda-cyhalothrin)	1.28-1.92 fl oz	24	1	armyworm spp., aphids, cabbage looper, corn earworm, crickets, cucumber beetle adults, cutworms, grasshoppers, leaffooted bug, leafhoppers, melonworm, pickleworm, plant bugs, squash bug, squash vine borer, stink bugs, thrips, tobacco budworm, webworms, suppression of leafminers, spider mites, whitefly	3	Do not apply more than 0.18 lb ai/acre per season. Does not control western flower thrips.
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.
Zeal (etoxazole)	2.0-3.0 oz	12	7	twospotted spider mite	10B	Apply when populations are low. One application per season, except two for cucumbers (supplemental label).

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

* **Restricted use insecticide.**

Table 3.4. Cucurbit fungicides ordered by disease and then FRAC group according to their mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Alternaria leaf spot	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, Champ DP Dry Prill, Champ Formula 2 FL, Champ WG, Champion WP, COC WDG, Copper-Count-N, Cueva, Cuprofix Ultra 40 Disperss, Cuprofix MZ Disperss, Kentan DF, Kocide 2000, Kocide 3000, Kocide DF, Nordox 75WG, Nu-Cop 3L, Nu-Cop 50WP, Nu-Cop 50DF	SEE INDIVIDUAL LABELS		1	Varies from 4 h to 2 days	
	M1 & M3	ManKocide 61.1DF (copper hydroxide + mancozeb)	2.5 lb	128 lb	5	2	Labeled on cucumber, melons, and summer squash. Not all diseases labeled for every crop.
	M3	(mancozeb) Many brands available: Dithane DF Rainshield, Dithane F45 Rainshield, Dithane M45, Manzate Pro-Stick, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		5	1	Labeled for all cucurbits.
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Chloronil 720, Chlorothalonil 720SC, Echo 720, Echo 90DF, Echo ZN, Eqyys 500 ZN, Equus DF, Equus 720 SST, Initiate 720, Initiate ZN	SEE INDIVIDUAL LABELS		0	1	Labeled for all cucurbits. Recommended maximum rate is less for certain diseases including downy mildew. Follow label recommendations on watermelon after fruit set. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	7	Fontelis (penthiopyrad)	16 fl oz	67 fl oz/year	1	0.5	Maximum rate is for year. Do not make more than 2 app sequentially
	7 & 3	Luna Experince (fluopyryram + tebuconazole)	17 fl oz	34	7	0.5	Only labeled for watermelon. No more than 2 sequential apps before rotating to a non-FRAC 7 fungicide.
	7 & 11	Pristine 38WG (boscalid + pyraclostrobin)	18.5 oz	74 oz	0	0.5	Labeled for all cucurbits. Limit is 4 appl/ crop & alternate chemistry.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl/acre	7	0.5	Labeled for all cucurbits. Do not make more than two consecutive applications.

Table 3.3. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Alternaria leaf spot Continued	9 & 12	Switch 62.5WG (cyprodinol + fludioxonil)	14 fl oz	See label	1	0.5	Labeled for all cucurbits. Do not apply more than 56 oz/acre per plot of land per year. Do not make more than two consecutive applications before switching to fungicide with a different mode of action.
	11	Cabrio 20EG (pyraclostrobin)	16 fl oz	64 fl oz	0	0.5	4 appl maximum. Maximum rate is less for downy mildew. Labeled for all cucurbits.
	11	Reason 500SC (fenamidone)	5.5 fl oz	22 oz	14	0.5	Limit is 4 appl/crop & alternate chemistry. Labeled for all cucurbits.
	11	Quadris 2.08FL (azoxystrobin)	15.4 fl oz	92.3 fl oz	1	4 h	Limit is 4 appl/crop & alternate chemistry. Labeled for all cucurbits. See label for tankmixing restrictions.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.2 pt	See label	1	0.5	Limit is 4 appl/crop for all QoI fungicides. Do not make more than two consecutive applications. Labeled for all cucurbits. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	Must be rotated with a non-FRAC 7 (QoI) containing fungicide. Labeled for all cucurbits.
	22 & M3	Gavel 75DF (zoxamide + mancozeb)	2 lb	16 lb	5	2	Limit is 8 appl/crop. Some cantaloupe varieties are sensitive, check label. Labeled for all cucurbits.
	27 & 11	Tanos 50DF (cymoxanil + famoxadone)	8 oz	See label	3	0.5	Limit is 4 appl/crop. Must tankmix with a contact fungicide. Limit is 72 oz/acre maximum/year. Labeled for all cucurbits.
Angular leaf spot	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, Champ DP Dry Prill, Champ Formula 2 FL, Champ WG, Champion WP, COC WDG, Copper-Count-N, Cueva, Cuprofix Ultra 40 Disperss, Cuprofix MZ Disperss, Kentan DF, Kocide 2000, Kocide 3000, Kocide DF, Nordox 75WG, Nu-Cop 3L, Nu-Cop 50WP, Nu-Cop 50DF	SEE INDIVIDUAL LABELS		1	Varies from 4 h to 2 days	
	P	Actigard 50WG (acibenzolar-S-methyl)	1 oz/acre	8 oz	0	0.5	Apply preventively prior disease development. Suppression of disease. Labeled for all cucurbits.
Anthracnose	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, Champ DP Dry Prill, Champ Formula 2 FL, Champ WG, Champion WP, COC WDG, Copper-Count-N, Cueva, Cuprofix Ultra 40 Disperss, Cuprofix MZ Disperss, Kentan DF, Kocide 2000, Kocide 3000, Kocide DF, Nordox 75WG, Nu-Cop 3L, Nu-Cop 50WP, Nu-Cop 50DF	SEE INDIVIDUAL LABELS		1	Varies from 4 h to 2 days	
	M1 & M3	ManKocide 61.1DF (copper hydroxide + mancozeb)	2.5 lb	128 lb	5	2	Labeled on cucumber, melons, and summer squash. Not all diseases labeled for every crop.
	M3	(mancozeb) Many brands available: Dithane DF Rainshield, Dithane F45 Rainshield, Dithane M45, Manzate Pro-Stick, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		5	1	Labeled for all cucurbits.
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Choloronil 720, Chlorothalonil 720SC, Echo 720, Echo 90DF, Echo ZN, Eqyys 500 ZN, Equus DF, Equus 720 SST, Initiate 720, Initiate ZN	SEE INDIVIDUAL LABELS		0	1	Labeled for all cucurbits. Recommended maximum rate is less for certain diseases including downy mildew. Follow label recommendations on watermelon after fruit set. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	1	(thiophanate-methyl) Many brands available: Topsin M 70WSP, Topsin 4.5FL, Topsin M WSB, Thiophanate methyl 85WDG, T-methyl E-Ag 70WSB	SEE INDIVIDUAL LABELS		1	1	Follow resistance management guidelines on label. Labeled for all cucurbits.

Table 3.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Anthracnose	7	Fontelis	16 fl oz	67 fl oz/year	1	12	Maximum rate is for year. Do not make more than 2 app sequentially
Continued		(penthiopyrad)					
	7 & 3	Luna Experince (fluopyryram + tebuconazole)	17 fl oz	34	7		Only labeled for watermelon. No more than 2 sequential apps before rotating to a non-FRAC 7 fungicide.
	7 & 11	Pristine 38WG (boscalid + pyraclostrobin)	18.5 oz	74 oz	0	0.5	Labeled for all cucurbits. Limit is 4 appl/crop & alternate chemistry.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl/acre	7		Labeled for all cucurbits. Do not make more than two consecutive applications.
	11	Cabrio 20EG (pyraclostrobin)	16 fl oz	64 fl oz	0	0.5	4 appl maximum. Maximum rate is less for downy mildew. Labeled for all cucurbits.
	11	Heritage (azoxystrobin)	8 oz	3 lb	1	4 h	Do not make more than two consecutive applications. Do not make more than 6 appl/crop. See label for tank mixing restrictions. Labeled for all cucurbits.
	11	Quadris 2.08FL (azoxystrobin)	15.4 fl oz	92.3 fl oz	1	4 h	Limit is 4 appl/crop & alternate chemistry. Labeled for all cucurbits. See label for tankmixing restrictions.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.2 pt	See label	1	0.5	Limit is 4 appl/crop for all QoI fungicides. Do not make more than two consecutive applications. Labeled for all cucurbits. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	Must be rotated with a non-FRAC 7 (QoI) containing fungicide. Labeled for all cucurbits.
	27 & 11	Tanos 50DF (cymoxanil + famoxadone)	8 oz	See label	3	0.5	Limit is 4 appl/crop. Must tankmix with a contact fungicide. Limit is 72 oz/acre maximum/year. Labeled for all cucurbits.
Bacterial diseases	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, Champ DP Dry Prill, Champ Formula 2 FL, Champ WG, Champion WP, COC WDG, Copper-Count-N, Cueva, Cuprofix Ultra 40 Disperss, Cuprofix MZ Disperss, Kentan DF, Kocide 2000, Kocide 3000, Kocide DF, Nordox 75WG, Nu-Cop 3L, Nu-Cop 50WP, Nu-Cop 50DF	SEE INDIVIDUAL LABELS		1	Varies from 4 h to 2 days	
	P	Actigard 50WG (acibenzolar-S-methyl)	1 oz/acre	8 oz	0	0.5	Apply preventively prior disease development. Suppression of disease. Labeled for all cucurbits.
Bacterial fruit blotch	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, Champ DP Dry Prill, Champ Formula 2 FL, Champ WG, Champion WP, COC WDG, Copper-Count-N, Cueva, Cuprofix Ultra 40 Disperss, Cuprofix MZ Disperss, Kentan DF, Kocide 2000, Kocide 3000, Kocide DF, Nordox 75WG, Nu-Cop 3L, Nu-Cop 50WP, Nu-Cop 50DF	SEE INDIVIDUAL LABELS		1	Varies from 4 h to 2 days	Suppression only
	M1 & M3	ManKocide 61.1DF (copper hydroxide + mancozeb)	2.5 lb	128 lb	5	2	Labeled on cucumber, melons, and summer squash. Not all diseases labeled for every crop. See label.
	27 & 11	Tanos 50DF (cymoxanil + famoxadone)	8 oz	See label	3	0.5	Limit is 4 appl/crop. Must tankmix with a contact fungicide. Limit is 72 oz/acre maximum/year. Labeled for all cucurbits.
	P	Actigard 50WG (acibenzolar-S-methyl)	1 oz/acre	8 oz	0	0.5	Apply preventively prior disease development. Suppression of disease. Labeled for all cucurbits.
Belly rot	7 & 3	Luna Experince (fluopyryram + tebuconazole)	17 fl oz	34	7		Only labeled for watermelon. No more than 2 sequential apps before rotating to a non-FRAC 7 fungicide.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl/acre	7		Labeled for all cucurbits. Do not make more than two consecutive applications.
	11	Cabrio 20EG (pyraclostrobin)	16 fl oz	64 fl oz	0	0.5	4 appl maximum. Maximum rate is less for downy mildew. Labeled for all cucurbits.

Table 3.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Belly rot Continued	11	Heritage (azoxystrobin)	8 oz	3 lb	1	4 h	Do not make more than two consecutive applications. Do not make more than 6 appl/crop. See label for tank mixing restrictions. Labeled for all cucurbits.
	11	Quadris 2.08FL (azoxystrobin)	15.4 fl oz	92.3 fl oz	1	4 h	Limit is 4 appl/crop & alternate chemistry. Labeled for all cucurbits. See label for tankmixing restrictions.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.2 pt	See label	1	0.5	Limit is 4 appl/crop for all QoI fungicides. Do not make more than two consecutive applications. Labeled for all cucurbits. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	Must be rotated with a non-FRAC 7 (QoI) containing fungicide. First appl. should be made at the 1- to 3-leaf stage with 2nd appl. prior to fine tip or 10-14 days later. Labeled for all cucurbits.
Cercospora leaf spot	M1 & M3	ManKocide 61.1DF (copper hydroxide + mancozeb)	2.5 lb	128 lb	5	2	Labeled on cucumber, melons, and summer squash. Not all diseases labeled for every crop. See label.
	M3	(mancozeb) Many brands available: Dithane DF Rainshield, Dithane F45 Rainshield, Dithane M45, Manzate Pro-Stick, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		5	1	Labeled for all cucurbits.
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Choloronil 720, Chlorothalonil 720SC, Echo 720, Echo 90DF, Echo ZN, Eqyys 500 ZN, Equus DF, Equus 720 SST, Initiate 720, Initiate ZN	SEE INDIVIDUAL LABELS		0	1	Labeled for all cucurbits. Recommended maximum rate is less for certain diseases including downy mildew. Follow label recommendations on watermelon after fruit set. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	7 & 11	Pristine 38WG (boscalid + pyraclostrobin)	18.5 oz	74 oz	0	0.5	Labeled for all cucurbits. Limit is 4 appl/crop & alternate chemistry.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl/acre	7		Labeled for all cucurbits. Do not make more than two consecutive applications.
	22 & M3	Gavel 75DF (zoxamide + mancozeb)	2 lb	16 lb	5	2	Limit is 8 appl/crop. Some cantaloupe varieties are sensitive, check label. Labeled for all cucurbits.
Downy Mildew	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, Champ DP Dry Prill, Champ Formula 2 FL, Champ WG, Champion WP, COC WDG, Copper-Count-N, Cueva, Cuproxif Ultra 40 Disperss, Cuproxif MZ Disperss, Kentan DF, Kocide 2000, Kocide 3000, Kocide DF, Nordox 75WG, Nu-Cop 3L, Nu-Cop 50WP, Nu-Cop 50DF	SEE INDIVIDUAL LABELS		1	Varies from 4 h to 2 days	
	M1 & M3	ManKocide 61.1DF (copper hydroxide + mancozeb)	2.5 lb	128 lb	5	2	Labeled on cucumber, melons, and summer squash. Not all diseases labeled for every crop. See label.
	M3	(mancozeb) Many brands available: Dithane DF Rainshield, Dithane F45 Rainshield, Dithane M45, Manzate Pro-Stick, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		5	1	Labeled for all cucurbits.
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Choloronil 720, Chlorothalonil 720SC, Echo 720, Echo 90DF, Echo ZN, Eqyys 500 ZN, Equus DF, Equus 720 SST, Initiate 720, Initiate ZN	SEE INDIVIDUAL LABELS		0	1	Labeled for all cucurbits. Recommended maximum rate is less for certain diseases including downy mildew. Follow label recommendations on watermelon after fruit set. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	4 & M1	Ridomil Gold/Copper 64.8 W (mefenoxam + copper hydroxide)	2 lb	8 lb	5	2	Limit is 4 appl/crop
	4 & M3	Ridomil Gold MZ WG (mancozeb + mefenoxam)	2.5 lb	10lb	5	2	Limit is 4 appl/crop. Rate for downy mildew is lower. Labeled for all cucurbits.

Table 3.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Downy Mildew Continued	4 & M5	Ridomil Gold Bravo SC (mefenoxam + chlorothalonil)	3.35 pt	See label	7	2	Limit is 4 appl/crop. Rate for downy mildew is lower. Labeled for all cucurbits.
	7 & 11	Pristine 38WG (boscalid + pyraclostrobin)	18.5 oz	74 oz	0	0.5	Labeled for all cucurbits. Limit is 4 appl/crop & alternate chemistry.
	11	Cabrio 20EG (pyraclostrobin)	16 fl oz	64 fl oz	0	0.5	4 appl maximum. Maximum rate is less for downy mildew. Labeled for all cucurbits.
	11	Flint 50WP (trifloxystrobin)	4 oz	8 oz	0	0.5	Limit is 4 appl/crop & alternate chemistry. Maximum rate is higher for downy mildew suppression. Labeled for all cucurbits.
	11	Heritage (azoxystrobin)	8 oz	3 lb	1	4 h	Do not make more than two consecutive applications. Do not make more than 6 appl/crop. See label for tank mixing restrictions. Labeled for all cucurbits.
	11	Quadris 2.08FL (azoxystrobin)	15.4 fl oz	92.3 fl oz	1	4 h	Limit is 4 appl/crop & alternate chemistry. Labeled for all cucurbits. See label for tankmixing restrictions.
	11	Reason 500SC (fenamidone)	5.5 fl oz	22 oz	14	0.5	Limit is 4 appl/crop & alternate chemistry. Labeled for all cucurbits.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.2 pt	See label	1	0.5	Limit is 4 appl/crop for all QoI fungicides. Do not make more than two consecutive applications. Labeled for all cucurbits. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	Must be rotated with a non-FRAC 7 (QoI) containing fungicide. Labeled for all cucurbits.
	21	Ranman (cyazofamid)	2.75 fl oz	16.5 fl oz	0	0.5	Limit is 6 appl/crop. Follow resistance management guidelines on label. Labeled for all cucurbits.
	22 & M3	Gavel 75DF (zoxamide & mancozeb)	2 lb	16 lb	5	2	Limit is 8 appl/crop. Some cantaloupe varieties are sensitive, check label. Labeled for all cucurbits.
	27	Curzate 60DF (cymoxanil)	3.2 oz	See remarks	3	0.5	Use only with a labeled rate of protectant fungicide. No more than 9 appl/12 months. Labeled for all cucurbits.
	27 & 11	Tanos 50DF (cymoxanil + famoxadone)	8 oz	See label	3	0.5	Limit is 4 appl/crop. Must tankmix with a contact fungicide. Limit is 72 oz/acre maximum/year. Labeled for all cucurbits.
	28	Previcur Flex Promess (propamocarb hydrochloride)	1.2 pt	6 pt	2	0.5	Use a tank mix partner. See label for directions using a contact fungicide and Pythium suppression.
	33	Aliette 80WDG Legion 80WDG Linebacter WDG (fosetyl-Al)	5 lb	35 lb	12 h	0.5	Limit is 7 appl/crop. Do not tank mix with copper fungicides. Labeled for all cucurbits. See label for specific brand.
	40	Acrobat 50WP (dimethomorph)	6.4 oz	32 oz	0	0.5	Limit is 5 appl/crop. Tank mix with another fungicide. Harvest after spray is dry. Labeled for all cucurbits.
	40	Forum (dimethomorph)	6 oz	30 oz	When spray is dried	0.5	Limit is 5 appl/ crop. Apply with another fungicide that has a different mode of action and alternate . Minimum gallons per acre required. Labeled for all cucurbits.
	40	Revus (mandipropamid)	8 fl oz	32 fl oz	0	4 h	An adjuvant is recommended for best control. Limit is 4 appl./crop
	43	Presidio (fluopicolide)	4 fl oz	12 fl oz	2	0.5	Tankmix with another fungicide product with a different mode of action. Labeled for all cucurbits.
	45 & 40	Zampro (ametoctradin + dimethomorph)	14 fl oz	42 fl oz	0	0.5	Limit is 3 appl/season. No more than 2 sequential appl. Addition of a spreading/penetrating adjuvant is recommended. Labeled for all cucurbits.
	P	Actigard 50WG (Acibenzolar-S-methyl)	1 oz/acre	8 oz	0	0.5	Apply preventively prior disease development. Suppression of disease. Labeled for all cucurbits.

Table 3.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Gummy stem blight	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, Champ DP Dry Prill, Champ Formula 2 FL, Champ WG, Champion WP, COC WDG, Copper-Count-N, Cueva, Cuprofix Ultra 40 Disperss, Cuprofix MZ Disperss, Kentan DF, Kocide 2000, Kocide 3000, Kocide DF, Nordox 75WG, Nu-Cop 3L, Nu-Cop 50WP, Nu-Cop 50DF	SEE INDIVIDUAL LABELS		1	Varies from 4 h to 2 days	
	M1 & M3	ManKocide 61.1DF (Copper hydroxide & Mancozeb)	2.5 lb	128 lb	5	2	Labeled on cucumber, melons, and summer squash. Not all diseases labeled for every crop.
	M3	(mancozeb) Many brands available: Dithane DF Rainshield, Dithane F45 Rainshield, Dithane M45, Manzate Pro-Stick, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		5	1	Labeled for all cucurbits.
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Choloronil 720, Chlorothalonil 720SC, Echo 720, Echo 90DF, Echo ZN, Eqyys 500 ZN, Equus DF, Equus 720 SST, Initiate 720, Initiate ZN	SEE INDIVIDUAL LABELS		0	1	Labeled for all cucurbits. Recommended maximum rate is less for certain diseases including downy mildew. Follow label recommendations on watermelon after fruit set. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	1	(thiophanate-methyl) Many brands available: Topsin M 70WSP, Topsin 4.5FL, Topsin M WSB, Thiophanate methyl 85WDG, T-methyl E-Ag 70WSB	SEE INDIVIDUAL LABELS		1	1	Follow resistance management guidelines on label. Labeled for all cucurbits.
	3	(tebuconazole) Many brands available: Folicur 3.6G, Monsoon 3.6G, Orius 3.6F, Tebustar 3.6L, Teledo, Tebuzol 3.6F	8 fl oz	24 fl oz	7	0.5	Maximum rate is lower for powdery mildew. Gummy stem blight suppression is only for watermelon, squash, pumpkin, and melons. See label for individual brands.
	4 & M5	Ridomil Gold Bravo SC (mefenoxam + chlorothalonil)	3.35 pt	See label	7	2	Limit is 4 appl/crop. Rate for downy mildew is lower. Labeled for all cucurbits.
	7	Endura (boscalid)	6.5 oz	26 oz	0	0.5	Labeled for all cucurbits. Do not make more than one application of Endura before alternating to another labeled fungicide with a different mode of action for at least one application.
	7	Fontelis (penthiopyrad)	16 fl oz	67 fl oz/year	1	0.5	Maximum rate is for year. Do not make more than 2 app sequentially
	7 & 3	Luna Experince (fluopyryam + tebuconazole)	17 fl oz	34	7	0.5	Only labeled for watermelon. No more than 2 sequential apps before rotating to a non-FRAC 7 fungicide.
	7 & 11	Pristine 38WG (boscalid + pyraclostrobin)	18.5 oz	74 oz	0	0.5	Labeled for all cucurbits. Limit is 4 appl/crop & alternate chemistry.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl oz	7	0.5	Labeled for all cucurbits. Do not make more than two consecutive applications.
	9 & 12	Switch 62.5WG (cyprodinil + fludioxonil)	14 oz.	See label	1	0.5	Labeled for all cucurbits. Do not apply more than 56 oz/acre per plot of land per year. Do not make more than two consecutive applications before switching to fungicide with a different mode of action.
	11	Cabrio 20EG (pyraclostrobin)	16 fl oz	64 fl oz	0	0.5	4 appl maximum. Maximum rate is less for downy mildew. Labeled for all cucurbits.
	11	Heritage (azoxystrobin)	8 oz	3 lb	1	4 h	Do not make more than two consecutive applications. Do not make more than 6 appl/crop. See label for tank mixing restrictions. Labeled for all cucurbits.
	11	Sovran (kresoxim-methyl)	4.8 oz	19.2 oz	0	0.5	Follow resistance management guidelines on label. Labeled for all cucurbits.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	Must be rotated with a non-FRAC 7 (QoI) containing fungicide. Labeled for all cucurbits.

Table 3.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Gummy stem blight Continued	19	PH-D (polyoxin D zinc salt)	6.2 oz	31 oz	0	4 h	Use in alteration with fungicides that have different modes of action. Labeled for all cucurbits.
Leaf spots - various	11	Cabrio 20EG (pyraclostrobin)	16 fl oz	64 fl oz	0	0.5	4 appl maximum. Maximum rate is less for downy mildew. Labeled for all cucurbits.
	11	Heritage (azoxystrobin)	8 oz	3 lb	1	4 h	Do not make more than two consecutive applications. Do not make more than 6 appl/crop. See label for tank mixing restrictions. Labeled for all cucurbits.
	11	Quadris 2.08FL (azoxystrobin)	15.4 fl oz	92.3 fl oz	1	4 h	Limit is 4 appl/crop & alternate chemistry. Labeled for all cucurbits. See label for tankmixing restrictions.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.2 pt	See label	1	0.5	Limit is 4 appl/crop for all QoI fungicides. Do not make more than two consecutive applications. Labeled for all cucurbits. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	19	PH-D (polyoxin D zinc salt)	6.2 oz	31 oz	0	4 h	Use in alteration with fungicides that have different modes of action. Labeled for all cucurbits.
	7	Endura (boscalid)	6.5 oz	26 oz	0	0.5	Labeled for all cucurbits. Do not make more than one application of Endura before alternating to another labeled fungicide with a different mode of action for at least one application.
	7 & 11	Pristine 38WG (boscalid + pyraclostrobin)	18.5 oz	74 oz	0	0.5	Labeled for all cucurbits. Limit is 4 appl/crop & alternate chemistry.
Phytophthora blight	19	PH-D (polyoxin D zinc salt)	6.2 oz	31 oz	0	4 h	Use in alteration with fungicides that have different modes of action. Labeled for all cucurbits.
	21	Ranman (cyazofamid)	2.75 fl oz	16.5 fl oz	0	0.5	Limit is 6 appl/crop. Follow resistance management guidelines on label. Labeled for all cucurbits.
	27 & 11	Tanos 50DF (cymoxanil + famoxadone)	8 oz	See label	3	0.5	Limit is 4 appl/crop. Must tankmix with a contact fungicide. Limit is 72 oz/acre maximum/year. Labeled for all cucurbits. Phytophthora blight foliar and fruit phase only (disease suppression)
	33	Aliette 80WDG Legion 80WDG Linebacter WDG (fosetyl-Al)	5 lb	35 lb	12 h	0.5	Limit is 7 appl/crop. Do not tank mix with copper fungicides. Labeled for all cucurbits. See label for specific brand. Phytophthora root and fruit rot
	40	Acrobat 50WP (dimethomorph)	6.4 oz	32 oz	0	0.5	Limit is 5 appl/crop. Tank mix with another fungicide. Harvest after spray is dry. Labeled for all cucurbits.
	40	Forum (dimethomorph)	6 oz	30 oz	When spray is dried	0.5	Limit is 5 appl/ crop. Apply with another fungicide that has a different mode of action and alternate . Minimum gallons per acre required. Labeled for all cucurbits. Phytophthora blight and crown rot
	40	Revus (mandipropamid)	8 fl oz	32 fl oz	0	4 h	An adjuvant is recommended for best control. Limit is 4 appl./crop. Phytophthora blight (supression).
	43	Presidio (fluopicolide)	4 fl oz	12 fl oz	2	0.5	Tankmix with another fungicide product with a different mode of action. Labeled for all cucurbits.
	45 & 40	Zampro (ametoctradin + dimethomorph)	14 fl oz	42 fl oz	0	0.5	Limit is 3 appl/season. No more than 2 sequential appl. Addition of a spreading/ penetrating adjuvant is recommended. Labeled for all cucurbits.
Plectosporium Blight	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl oz	7		Labeled for all cucurbits. Do not make more than two consecutive applications.
	11	Flint (trifloxystrobin)	2 oz	16 oz	0	0.5	Limit is 4 appl/ season. Apply or alternate with another fungicide that has a different mode of action. Labeled for all cucurbits.
	11	Quadris 2.08FL (azoxystrobin)	15.4 fl oz	92.3 fl oz	1	4 h	Limit is 4 appl/crop & alternate chemistry. Labeled for all cucurbits. See label for tankmixing restrictions.

Table 3.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Plectosporium Blight Continued	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	Must be rotated with a non-FRAC 7 (QoI) containing fungicide. Labeled for all cucurbits.
Powdery Mildew	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, Champ DP Dry Prill, Champ Formula 2 FL, Champ WG, Champion WP, COC WDG, Copper-Count-N, Cueva, Cuprofix Ultra 40 Disperss, Cuprofix MZ Disperss, Kentan DF, Kocide 2000, Kocide 3000, Kocide DF, Nordox 75WG, Nu-Cop 3L, Nu-Cop 50WP, Nu-Cop 50DF	SEE INDIVIDUAL LABELS		1	Varies from 4 h to 2 days	
	M2	(sulfur) Many brands available: Cosavet DF, Kumulus DF, Micro Sulf, Microthiol Disperss, Sulfur 90W	SEE INDIVIDUAL LABELS			1	See individual label. Do not use when temperatures are greater than 90 F or on sulfur-sensitive varieties. Labeled for all cucurbits.
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Chloronil 720, Chlorothalonil 720SC, Echo 720, Echo 90DF, Echo ZN, Eqyys 500 ZN, Equus DF, Equus 720 SST, Initiate 720, Initiate ZN	SEE INDIVIDUAL LABELS		0	1	Labeled for all cucurbits. Recommended maximum rate is less for certain diseases including downy mildew. Follow label recommendations on watermelon after fruit set. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	1	(thiophanate-methyl) Many brands available: Topsin M 70WSP, Topsin 4.5FL, Topsin M WSB, Thiophanate methyl 85WDG, T-methyl E-Ag 70WSB	SEE INDIVIDUAL LABELS		1	1	Follow resistance management guidelines on label. Labeled for all cucurbits.
	3	Rally 40WSP Sonoma 40WSP (myclobutanil)	5 oz	1.5 lb	0	1	Note that a 30 day plant back restriction exists. Follow resistance management guidelines on label. Labeled for all cucurbits.
	3	(tebuconazole) Many brands available: Folicur 3.6G, Monsoon 3.6G, Monsoon 3.6G, Orius 3.6F, Tebustar 3.6L, Teledo, Tebuconazole 3.6F	8 fl oz	24 fl oz	7	0.5	Maximum rate is lower for powdery mildew. Gummy stem blight suppression is only for watermelon, squash, pumpkin, and melons. See label for individual brands.
	3	Procure 50WS and 480SC (triflumizole)	8 oz	40 oz	0	0.5	Follow resistance management guidelines on label. Labeled for all cucurbits.
	7	Fontelis (penthiopyrad)	16 fl oz	67 fl oz/year	1	0.5	Maximum rate is for year. Do not make more than 2 app sequentially
	7	Endura (boscalid)	6.5 oz	26 oz	0	0.5	Labeled for all cucurbits. Do not make more than one application of Endura before alternating to another labeled fungicide with a different mode of action for at least one application. (suppression)
	7 & 3	Luna Experince (fluopyram + tebuconazole)	17 fl oz	34	7	0.5	Only labeled for watermelon. No more than 2 sequential apps before rotating to a non-FRAC 7 fungicide.
	7 & 11	Pristine 38WG (boscalid & pyraclostrobin)	18.5 oz	74 oz	0	0.5	Labeled for all cucurbits. Limit is 4 appl/ crop & alternate chemistry.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl/acre	7	0.5	Labeled for all cucurbits. Do not make more than two consecutive applications.
	9 & 12	Switch 62.5WG (cyprodinal + fludioxonil)	14 oz.	See label	1	0.5	Labeled for all cucurbits. Do not apply more than 56 oz/acre per plot of land per year. Do not make more than two consecutive applications before switching to fungicide with a different mode of action.
	11	Flint (trifloxystrobin)	2 oz	16 oz	0	0.5	Limit is 4 appl/ season. Apply or alternate with another fungicide that has a different mode of action. Labeled for all cucurbits.
	11	Cabrio 20EG (pyraclostrobin)	16 fl oz	64 fl oz	0	0.5	4 appl maximum. Maximum rate is less for downy mildew. Labeled for all cucurbits.

Table 3.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Powdery Mildew Continued	11	Flint 50WP (trifloxystrobin)	2 oz	8 oz	0	0.5	Limit is 4 appl/crop & alternate chemistry. Maximum rate is higher for downy mildew suppression. Labeled for all cucurbits.
	11	Heritage (azoxystrobin)	8 oz	3 lb	1	4 h	Do not make more than two consecutive applications. Do not make more than 6 appl/crop. See label for tank mixing restrictions. Labeled for all cucurbits.
	11	Quadris 2.08FL (azoxystrobin)	15.4 fl oz	92.3 fl oz	1	4 h	Limit is 4 appl/crop & alternate chemistry. Labeled for all cucurbits. See label for tankmixing restrictions.
	11	Sovran (kresoxim-methyl)	4.8 oz	19.2 oz	0	0.5	Follow resistance management guidelines on label. Labeled for all cucurbits.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.2 pt	See label	1	0.5	Limit is 4 appl/crop for all QoI fungicides. Do not make more than two consecutive applications. Labeled for all cucurbits. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	11 + 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	Must be rotated with a non-FRAC 7 (QoI) containing fungicide. Labeled for all cucurbits.
	13	Quintec (quinoxifen)	6 fl oz	See label	3	0.5	Do not make more than 4 appl. Do not make more than two consecutive appls. Not labeled on all cucurbits; labeled on various melons, cantaloupe, winter squash, gourds, pumpkins, and watermelon.
	19	PH-D (polyoxin D zinc salt)	6.2 oz	31 oz	0	4 h	Use in alteration with fungicides that have different modes of action. Labeled for all cucurbits.
	P	Actigard 50WG (acibenzolar-S-methyl)	1 oz	8 oz	0	0.5	Apply preventively prior disease development. Suppression of disease. Labeled for all cucurbits.
Pythium	U6	Torino (cyflufenamid)	3.4 oz	6.8 oz	0	4 h	Limit is 2 appl. per year. Labeled for all cucurbits.
	4	Apron XL Ridomil Gold SL Ultra Flourish (mefenoxam) Allegiance FL Metastar 2E (metalaxyl)	SEE INDIVIDUAL LABELS		28	2	Apply at seeding in a 7-12" band on soil over seed furrow. Some must be applied with other fungicide. Labeled for all cucurbits. (Damping off caused by <i>Pythium</i> spp.)
	28	Previcur Flex Promess (propamocarb hydrochloride)	1.2 pt	6 pt	2	0.5	Use a tank mix partner. See label for directions using a contact fungicide and Pythium suppression. Labeled for all cucurbits.
Target spot	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Choloronil 720, Chlorothalonil 720SC, Echo 720, Echo 90DF, Echo ZN, Eqyys 500 ZN, Equus DF, Equus 720 SST, Initiate 720, Initiate ZN	SEE INDIVIDUAL LABELS		0	1	Labeled for all cucurbits. Recommended maximum rate is less for certain diseases including downy mildew. Follow label recommendations on watermelon after fruit set. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	19	PH-D (polyoxin D zinc salt)	6.2 oz	31 oz	0	4 h	Use in alteration with fungicides that have different modes of action. Labeled for all cucurbits.
	1	(thiophanate-methyl) Many brands available: Topsin M 70WSP, Topsin 4.5FL, Topsin M WSB, Thiophanate methyl 85WDG, T-methyl E-Ag 70WSB	SEE INDIVIDUAL LABELS		1	1	Follow resistance management guidelines on label. Labeled for all cucurbits.
	11	Cabrio 20EG (pyraclostrobin)	16 fl oz	64 fl oz	0	0.5	4 appl maximum. Maximum rate is less for downy mildew. Labeled for all cucurbits.
	P	Actigard 50WG (acibenzolar-S-methyl)	1 oz/acre	8 oz	0	0.5	Apply preventively prior disease development. Suppression of disease. Labeled for all cucurbits.

Table 3.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Scab	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, Champ DP Dry Prill, Champ Formula 2 FL, Champ WG, Champion WP, COC WDG, Copper-Count-N, Cueva, Cuprofix Ultra 40 Disperss, Cuprofix MZ Disperss, Kentan DF, Kocide 2000, Kocide 3000, Kocide DF, Nordox 75WG, Nu-Cop 3L, Nu-Cop 50WP, Nu-Cop 50DF	SEE INDIVIDUAL LABELS		1	Varies from 4 h to 2 days	
	M3	(mancozeb) Many brands available: Dithane DF Rainshield, Dithane F45 Rainshield, Dithane M45, Manzate Pro-Stick, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		5	1	Labeled for all cucurbits.
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Chloronil 720, Chlorothalonil 720SC, Echo 720, Echo 90DF, Echo ZN, Eqqys 500 ZN, Equus DF, Equus 720 SST, Initiate 720, Initiate ZN	SEE INDIVIDUAL LABELS		0	1	Labeled for all cucurbits. Recommended maximum rate is less for certain diseases including downy mildew. Follow label recommendations on watermelon after fruit set. Do not apply to mature watermelons under dry, hot and other environmental conditions listed on label.
	19	PH-D (polyoxin D zinc salt)	6.2 oz	31 oz	0	4 h	Use in alteration with fungicides that have different modes of action. Labeled for all cucurbits.
	P	Actigard 50WG (acibenzolar-S-methyl)	1 oz/acre	8 oz	0	0.5	Apply preventively prior disease development. Suppression of disease. Labeled for all cucurbits.

¹ FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <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.

Chapter 4. Eggplant Production

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Botany and Planting

Eggplant - *Solanum melongena*, Solanaceae.

Table 4.1. Planting information for eggplant.

Planting dates	
North Florida	Aug/Feb - Mar
Central Florida	Aug - Sept/Jan - Feb
South Florida	Aug - Feb
Planting information	
Distance between rows (in)	36 - 72
Distance between plants (in)	18 - 40
Seeding depth (in)	0.5-0.75
Seed per acre to field (lb)	1
Seed per acre to transplant (lb)	0.25 - 0.50
Days to maturity from seed	90 - 115
Days to maturity from transplant	70 - 90
Plant population (acre)	9,680

Cultivars

1. TRADITIONAL TYPES

Classic. Erect, vigorous plant glossy, glossy deep purple-black elongated oval, green calyxed fruit, medium tall upright plant, fancy fruit appearance. Heavy yields of high quality fruit. It does not perform well in cooler weather. R to ToM.

Epic. Oval shape, early maturing, green calyx, upright plant, high yield potential and deep purple-black color. Widely adapted. R to ToM.

Nadia. Oval long, vigorous plant with good fruit set under cool conditions. Very firm, attractive, purple-black fruit with long harvest period, and sets well under cool conditions.

Night Shadow. Elongate oval, widely adapted with high yield potential. Strong plants produce firm fruit which maintain rich, dark glossy black color right through harvest. R to ToM.

Santana. Tall, upright plant with few spines, firm, white flesh, glossy black-purple exterior with attractive bright green calyx. Continuous setting.

Triviata. Fruit are half-long in shape, very uniform in size and very attractive shiny purple in color. Strong growing, well balanced plant.

2. SPECIALTY TYPES

Zebra. Elongated oval, purple with white stripes, very attractive with good flavor.

Megal. Italian cylindrical fruit, purple black color, very uniform, excellent shelf life and flavor, few spines, early maturity. R to CM, ToM.

Victoria. Very long cylindrical, deep purple Imperial type, green calyx, mild flavor. R to ToM.

Millionaire. Slender, oriental type, dark purple fruit color, purple calyx, early maturing.

Rosita. Large size, very prolific, white flesh, deep rose color.

Italian pink. Open pollinated cultivar, oval fruit, cream/rose color, mature fruit color is rose pink, purple calyx.

Birgah. A Sicilian style eggplant with a round, heavy, firm fruit, deep purple color and sweet taste and white flesh.

Disease key: CM = cucumber mosaic, ToM = tomato mosaic, R = resistant, IR = intermediate resistance, T = tolerant.

Pesticides for Weed, Arthropod and Disease Management for Eggplant.

Table 4.2. Selected herbicides approved for managing weeds in eggplant.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREEMERGENCE ***		
Bensulide 5.0 - 6.0	(Prefar) 4 E 5 - 6 qt.	Annual broadleaf and grass weeds. Incorporate 2 - 4 in. with mechanical cultivation or irrigation.
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides.
Flumioxazin up to 0.128	(Chateau) 51 WDG up to 4 oz.	Annual broadleaf weeds. Apply to row middles of raised plastic mulched beds that are at least 4 in. higher than the treated row middles and 24 in. bed width. Label is a Third-Party Registration (TPR, Inc.). Use without a signed authorization and waiver of liability is a misuse of the product. Tank mix with a burndown herbicide to control emerged weeds.

Table 4.2. Continued.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREEMERGENCE ***		
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burndown. Consult label for individual product directions.
Halosulfuron 0.024 - 0.05	(Sanda, Profine) 75 DF 0.5 - 1.0 oz.	Broadleaf weeds and yellow/purple nutsedge. Apply to row middles only. Do not exceed 2 oz./acre per 12 month period
Lactofen 0.25 - 0.5	(Cobra) 2 EC 16 - 32 fl. oz.	Broadleaf weeds. Label is a Third-Party registration (TPR, Inc.). Use without a signed authorization and waiver of liability is a misuse of the product. Apply to row middles only with shielded or hooded sprayers. Cobra contacting green foliage or fruit can cause excessive injury. Drift of cobra treated soil particles onto plants can cause injury. Limit of 1 PRE and 1 POST application per growing season. PHI 30 days.
S-metolachlor 0.64 - 0.95	(Dual Magnum) 7.62 EC 0.67 - 1.0 pt.	Annual broadleaf and grass weeds and nutsedge. Label is a Third Party registration (TPR, Inc.). Use without a signed authorization and waiver of liability is a misuse of the product. Apply to the finished bed immediately before laying the plastic. Do not exceed 16.8 pt. of Dual Magnum/acre per crop cycle.
Napropamide 1.0 - 2.0	(Devrinol) 50 DF 2 - 4 lb.	Annual broadleaf and grass weeds. Transplanted eggplant only. Apply to a finished bed before laying plastic. Use the lower rate on light soils (coarse textured-sandy).
Paraquat 0.5 - 1.0	(Gramoxone) 2 SL 2.0 - 4.0 pt. (Firestorm) 3 SL 1.3 - 2.7 pt.	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment. Use a nonionic surfactant.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with soil residual compounds.
Pendimethalin 0.48 - 0.72	(Prowl H ₂ O) 3.8 1.0 - 1.5 pt.	May be applied pretransplant. May be applied at 1.0-1.5 pt./acre to row middles. Do not exceed 3.0 pt./acre per year. PHI 70 days.
Pyraflufen 0.001 - 0.003	(ET Herbicide) 0.208 EC 0.5 - 2.0 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burndown treatment.
Trifluralin 0.5	(Treflan, Triflurex) 4 EC 1 pt.	Annual broadleaf and grass weeds. Do not apply in Dade County. Incorporate 4 in. or less within 8 h. of application. Results in Florida are erratic on soils with low organic matter and clay contents. Do not apply after transplanting. Not all trifluralin herbicides are labeled in eggplant so consult labels before application.
*** POSTTRANSPLANT ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a hooded application to row middles only. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides. Do not exceed 6.1 fl. oz./acre. per cropping season. PHI 0 PHI.
Clethodim 0.09 - 0.13	(Select, Arrow) 2 EC 6 - 8 fl.oz. (Select Max) 1 EC 9 - 16 fl. oz.	Perennial and annual grass weeds. In fields with heavy grass pressure or larger grass weeds, use higher rates or repeat applications 14 days apart. Use a crop oil concentrate at 1 % v/v in the finished spray volume. Nonionic surfactant with Select Max. PHI 20 days.
DCPA 6.0 - 7.5	(Dacthal) W-75 8 - 10 lb. (Dacthal) 6 F 8 - 10 pt.	Apply to weed-free soil to 6 to 8 wk. after crop is established and growing rapidly or to moist soil in row middles after crop establishment. Note label precautions against replanting non-registered crops within 8 months.
Diquat 0.5	(Reglone Dessiccant) 1 qt.	Broadleaf and grass weeds. Apply to row middles only. Maximum of 2 applications per season. Include a NIS. Prevent drift to crop. PHI 30 days.
Halosulfuron 0.024 - 0.05	(Sanda, Profine) 75 DF 0.5 - 1.0 oz.	Small seeded broadleaf weeds and nutsedge. Apply to row middles only. Include a nonionic surfactant. Do not exceed 2 oz./acre per 12 month period. PHI 30 days.
Lactofen 0.25 - 0.5	(Cobra) 2 EC 16 - 32 fl. oz.	Broadleaf weeds. Apply to row middles only with shielded or hooded sprayers. Cobra contacting green foliage or fruit can cause excessive injury. Drift of Cobra treated soil particles onto plants can cause contact injury. Limit of 1 PRE and 1 POST application per growing season. PHI 30 days.
S-metolachlor 0.95	(Dual Magnum) 7.62 EC 1.0 pt.	Annual broadleaf and grass weeds and nutsedge. Label is a Third-Party registration (TPR, Inc.). Use without a signed authorization and waiver of liability is a misuse of the product. Direct spray solution to row middles only. Do not exceed 1.68 pt. of Dual Magnum/acre per crop. PHI 60 days.
Paraquat 0.5	(Gramoxone) 2 SL 2 pt. (Firestorm) 3 SL 1.3 pt.	Emerged broadleaf and grass weeds. Direct spray over emerged weeds 1 to 6 inches tall in row middles between mulched beds. Use a nonionic surfactant. Use low pressure and shields to control drift. Do not apply more than 3 times per season.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Direct spray to row middles. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with several soil residual compounds.
Sethoxydim 0.19 - 0.28	(Poast) 1.5 EC 1.0 - 1.5 pt.	Controls growing grass weeds. A total of 4.5 pt./acre applied in one season. Include a crop oil concentrate. Unsatisfactory results may occur if applied to grasses under stress. PHI 20 days.
*** POSTHARVEST ***		
Diquat 0.5	(Reglone Dessiccant) 2.0 pt.	Minimum of 35 gal./acre. Include a NIS. Thorough coverage is required.

Table 4.3. Selected insecticides approved for managing insect pests of eggplant.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Acramite-50WS (bifenazate)	0.75-1.0 lb	12	3	twospotted spider mite	un	One application per season.
Actara (thiamethoxam)	2.0-5.5 oz	12	0	aphids, Colorado potato beetle, flea beetles, leafhoppers, stink bugs, whiteflies	4A	Maximum of 11 oz/acre per season. Do not use if a soil application of a neonicotinoid has been used.
Admire Pro (imidacloprid) (for rates for other brands, see labels)	7-10.5 fl oz	12	21	aphids, Colorado potato beetle, flea beetles, foliar-feeding thrips, leafhoppers, whiteflies	4A	Most effective if applied to soil at transplanting.
Admire Pro (imidacloprid)	0.44 fl oz/10,000 plants	12	21	aphids, whiteflies	4A	Planthouse: 1 application. See label.
*Agri-Mek SC (abamectin)	1.7-3.5 fl oz	12	7	broad mite, Colorado potato beetle, <i>Liriomyza</i> leafminers, spider mites, <i>Thrips palmi</i> , tomato pinworm, tomato russet mite	6	Do not make more than 2 sequential applications. Must be used with a non-ionic activator type wetting, spreading, or penetrating adjuvant.
*Ambush 25W (permethrin)	6.4-12.8 oz	12	3	cabbage looper, Colorado potato beetle, flea beetles, leafminers	3A	Do not apply more than 2 lb ai per acre per season. (128 oz)
*Asana XL (0.66 EC) (esfenvalerate)	5.8-9.6 fl oz	12	7	Colorado potato beetle, corn earworm, flea beetle, loopers	3A	Do not apply more than 0.35 lb ai per acre per season.
Assail 30 SG (acetamiprid)	1.5-4.0 oz	12	7	aphids, Colorado potato beetle, thrips, whiteflies	4A	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.
Avaunt (indoxacarb)	2.5-3.5 oz	12	3	beet armyworm, loopers, southern armyworm, tomato fruitworm, tomato pinworm	22	Do not apply more than 14 oz of Avaunt 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	un	Antifeedant, repellent, insect growth regulator. OMRI-listed ² .
Azatin XL (azadirachtin)	5-21 oz	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, weevils, whiteflies	un	Antifeedant, repellent, insect growth regulator. See label for rates for specific pests.
*Baythroid XL (beta-cyfluthrin)	1.6-2.8 fl oz	12	7	cabbage looper, Colorado potato beetle, garden symphylan, garden webworm, potato aphid, potato leafhopper, stink bugs, tomato fruitworm, tomato hornworm, beet and southern armyworm (1 st and 2 nd instar), thrips (except <i>Thrips palmi</i>), tomato pinworm, flea beetles	3A	Do not apply at less than 7-day intervals, maximum amount per season: 16.8 fl oz per acre.
Belay 50 WDG (clothianidin)	1.6-3.2 oz	12	7	aphids, Colorado potato beetle, flea beetles, leafhoppers, leafminers (suppression), Lygus, stink bugs, whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Toxic to bees. Do not release irrigation water from the treated area. Supplemental label (expires 12-30-13) for rates above 2.1 oz per acre.
Belay 50 WDG (clothianidin)	4.8 -6.4 oz (soil application)	12	Apply at planting	aphids, Colorado potato beetle, flea beetles, leafhoppers, leafminers (suppression), Lygus, foliar feeding thrips, whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. See label for application instructions. Do not release irrigation water from the treated area.
Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	0	aphids, plant bugs	9C	Do not apply more than 8.4 oz/acre per season. Begin applications before pests reach damaging levels.
Belt SC (flubendiamide)	1.5 fl oz	12	1	armyworms, cutworms, garden webworm, hornworms, loopers, saltmarsh caterpillar, tomato fruitworm	28	Do not apply more than 4.5 fl oz per acre per season.
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11B	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: 0.5-2.0 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.
*Brigade 2EC (bifenthrin)	2.1-6.4 fl oz	12	7	armyworms, cabbage looper, Colorado potato beetle, corn earworm, cucumber beetles, flea beetles, <i>Lygus</i> spp., mites, plant bugs, stink bugs, thrips, tomato hornworm, tomato pinworm, vegetable leafminer, whiteflies	3	Do not make applications less than 7 days apart. Do not apply more than 0.2 lb active ingredient per acre per season.
Checkmate TPW-F (pheromone)	1.2-6.0 fl oz	0	0	tomato pinworm	--	For mating disruption. See label for details of use.

Table 4.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Confirm 2F (tebufenozide)	6-16 fl oz	4	7	beet armyworm, black cutworm, cabbage looper, fall armyworm, southern armyworm, tobacco hornworm, tomato hornworm, true armyworm, yellowstriped armyworm	18	Do not apply more than 16 ounces per application or more than 64 ounces product per season.
Coragen (rynaxypyr)	3.5-7.5 fl oz	4	1	beet armyworm, Colorado potato beetle, fall armyworm, hornworms, leafminer larvae, loopers, southern armyworm, tomato fruitworm, tomato pinworm	28	Can be applied by drip chemigation or as a soil application at planting as well as a foliar spray. See label. For hornworms, can use as little as 2.0 fl oz/acre when applied as a foliar spray. Make no more than 4 applications per crop.
Courier 40SC (buprofezin)	9.0-13.6 fl oz	12	1	leafhoppers, mealybugs, planthoppers, whiteflies	16	Immature insects only. No more than 2 applications per crop cycle.
Crymax WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Use high rate for armyworms. Treat when larvae are young. Not for organic production.
*Danitol 2.4 EC (fenpropathrin)	10.67 fl oz	24	3	stink bug, tobacco hornworm, tomato fruitworm, twospotted spider mite, yellowstriped armyworm	3A	Maximum of 4 applications (0.8 lb ai/acre) per season.
Deliver (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11A	Use higher rates for armyworms. OMRI-listed ² .
*Dibrom 8 EC (naled)	1 pt	48	1	aphids, blister beetles, flea beetles, leafminers, mites	1B	Apply no more than 1 pt/acre in Florida. Do not apply when temperature is over 90°F.
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. Good coverage is essential. Can be used in greenhouses. OMRI listed ² .
Durivo (thiamethoxam, chlorantraniliprole)	10-13 oz	12	30	aphids, beet armyworms, Colorado potato beetle, fall armyworm, flea beetles hornworms, leafhoppers, loopers, southern armyworm, thrips, tomato fruitworm, tomato pinworm, whiteflies, yellowstriped armyworm	4A, 28	May be applied to soil by one of several methods—see label.
Entrust SC (spinosad)	1.5-10 fl oz	4	1	armyworms, Colorado potato beetle, flower thrips, hornworms, leafminers, loopers, other caterpillars, <i>Thrips palmi</i> , tomato fruitworm, tomato pinworm, suppression of flea beetles	5	Do not use more than 29 oz per acre per crop. Do not apply to seedlings grown for transplant. OMRI-listed ² .
Esteem Ant Bait (pyriproxyfen)	1.5-2.0 lb	12	1	red imported fire ant	7C	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.
Fulfill (pymetrozine)	2.75 oz	12	0	green peach aphid, potato aphid, suppression of whiteflies	9B	Apply before populations build to damaging levels. Minimum of 7 days between applications. Do not make more than two applications.
Grandevo <i>Chromobacterium</i> subspecies <i>sugae</i> strain PRAA4-1	1-3 lb	4	0	armyworms, hornworms, loopers, saltmarsh caterpillar, tomato fruitworm, tomato pinworm, variegated cutworm	—	Can be used in organic production. OMRI-listed ² .
Intrepid 2F (methoxyfenozide)	4-16 fl oz	4	1	beet armyworm, cabbage looper, fall armyworm, hornworms, southern armyworm, suppression of tomato fruitworm and tomato pinworm, true armyworm, yellowstriped armyworm	18	Do not apply more than 16 oz per application or more than 64 oz product per season.
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.50 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms)	11A	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
Kanemite 15 SC (acequinocyl)	31 fl oz	12	1	twospotted spider mite	20B	Allow a minimum of 21 days between treatments. Do not make more than two applications per year. Do not use an adjuvant.
Knack IGR (pyriproxyfen)	8-10 fl oz	12	1	immature whiteflies	7C	Apply when nymphs first appear. Make no more than two applications.
*Lannate LV; *SP (methomyl)	LV: 0.75-3.0 pt SP: 0.25-1.0 lb	48	5	beet armyworm, corn earworm, green peach aphid, tomato pinworm (ground application only)	1A	No more than 10 applications per crop and no more than 15 pt LV/acre/crop or 5 lb SP.
Malathion 8F (malathion)	1.56 pt	12	3	aphids, lace bugs, spider mites	1B	Maximum number of applications is 4. greenhouse.

Table 4.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Movento (spirotetramat)	4.0-5.0 fl oz	24	1	aphids, psyllids, whiteflies	23	Maximum of 10 fl oz per acre per season.
M-Pede 49% EC Soap, insecticidal	1-2% V/V	12	0	aphids, leafhoppers, mites, plant bugs, thrips, whiteflies	--	OMRI-listed ² .
*Mustang (zeta-cypermethrin)	2.4-4.3 oz	12	1	brown stink bugs, cabbage looper, Colorado potato beetle, cutworms, fall armyworm, flea beetles, grasshoppers, green stink bugs, hornworms, leafhoppers, pepper weevil, plant bugs, southern armyworm, tomato fruitworm, tomato pinworm, true armyworm, yellow-striped armyworm	3A	Do not make applications less than 7 days apart. Do not apply more than 0.3 lb ai/acre per season.
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, cabbage looper, Colorado potato beetle, cutworms, hornworms, leafminers, saltmarsh caterpillar, tomato fruitworm (corn earworm), tomato pinworm, whiteflies	un	IGR and feeding repellent. OMRI-listed ² .
Oberon 25C (spiromesifen)	7.0-8.5 fl oz	12	7	broad mites, twospotted spider mite, whiteflies (eggs and nymphs)	23	Maximum amount per crop: 25.5 fl oz/acre. No more than 3 applications.
Platinum Platinum 75SG (thiamethoxam)	5.0-11.0 fl oz 1.66-367.0z	12	30	aphids, Colorado potato beetle, flea beetles, leafhoppers, thrips, tomato pinworm, whiteflies	4A	For most crops that are not on the label, a 120-day plant-back interval must be observed. To manage resistance, avoid using Provado or other related pesticides (Actara, Assail) in conjunction with Platinum.
Portal (fenpyroximate)	2.0 pt	12	1	mites, including broad mites, whiteflies	21A	Do not make more than 2 applications per season.
*Pounce 25 W (permethrin)	6.4-9.6 oz	12	3	cabbage looper, Colorado potato beetle, flea beetles, vegetable leafminer	3A	Do not apply more than 0.6 lbs ai/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⁾	3A	⁽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	12	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.
Provado 1.6F (imidacloprid)	3.8-6.2 oz	12	0	aphids, Colorado potato beetle, leafhoppers, whiteflies	4A	Do not apply if imidacloprid or thiamethoxam have been used at planting.
Pyganic Crop Protection EC 5.0 (pyrethrins)	4.5-18.0 fl oz	12	0	aphids, beetles, caterpillars, grasshoppers, leafhoppers, leafminers, mites, plant bugs, thrips, whiteflies	3A	Pyrethrins degrade rapidly in sunlight. Thorough coverage is important. OMRI-listed ² .
Radiant (spinetoram)	5-10 fl oz	4	1	armyworms (except yellowstriped armyworm), Colorado potato beetle, flower thrips, hornworms, <i>Liriomyza</i> leafminers, loopers, <i>Thrips palmi</i> , tomato fruitworm, tomato pinworm	5	Maximum of 34 fl oz per acre per season.
Requiem 25EC (extract of <i>Chenopodium ambrosioides</i>)	2-4 qt	4	0	chili thrips, Florida flower thrips, eastern flower thrips, green peach aphid, suppression of leafminers, melon thrips, potato aphid, western flower thrips, silverleaf whitefly	un	Begin applications before pests reach damaging levels.
Rimon 0.83EC (novaluron)	9-12 fl oz	12	1	armyworms, Colorado potato beetle, foliage feeding caterpillars, leafminers, stink bugs, thrips, tomato pinworm, whiteflies	15	Do not apply more than 36 fl oz per acre per season. Do not use with an adjuvant.
Scorpion 35SL Insecticide (dinotefuran)	Foliar: 2-7 fl oz Soil: 9-10.5 fl oz	12	foliar - 1, soil - 21	brown stink bug, Colorado potato beetle, cucumber beetles, flea beetles, grasshoppers, green stink bug, leafhoppers, leafminers, psyllids, southern green stink bug, thrips, whiteflies, suppression of green peach aphid and potato aphid	4A	Do not apply more than 10.5 fl oz per acre per season as foliar sprays or more than 21 fl oz to soil. Use only one application method
Sevin 80 S; XLR; 4F (carbaryl)	80S: 0.63-2.5 lb XLR, 4F: 0.5-2 qt	12	3	Colorado potato beetle, cutworms, fall armyworm, flea beetles, lace bugs, leafhoppers, stink bugs (suppression), tarnished plant bug, thrips (suppression), tomato fruitworm, tomato hornworm, tomato pinworm	1A	Do not apply more than seven times. Do not apply more than 8 qt or 10 lb per acre per crop. Applications must be at least 7 days apart. Do not apply to crops or weeds in bloom.
Trilogy (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .

Table 4.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Ultra-Fine Oil JMS Stylet-Oil Saf-T-Side Others (oil, insecticidal)	3-6 qts/100 gal (JMS) 1-2 gal/100 gal water	4	0	aphids, leafhoppers, leafminers, mites, thrips, whiteflies. Aphid transmitted viruses (JMS)	--	Do not exceed four applications per season. Stylet-oil will not control aphids or beetles. Organic Stylet-Oil and Saf-T-Side are OMRI-listed ³ .
*Vendex 50 WP (fenbutatin-oxide)	2-3 lb	48	3	twospotted spider mite	12B	Apply when mites first appear, no more than 9 lb per year.
Venom Insecticide (dinotefuran)	foliar: 1-4 oz soil: 5-6.0 oz	12	foliar - 1 soil - 21	Foliar: brown stink bug, cucumber beetles, grasshopper, green stink bug, southern green stink bug, suppression of green peach aphid and potato aphid Soil: Colorado potato beetle, flea beetle, grasshopper, thrips, whiteflies, suppression of aphids	4A	Do not use both application methods. Do not apply more than 6 oz, foliar; or 12 oz, soil, per season. No more than 3 applications per season.
Vetica (flubendiamide and buprofezin)	12.0-17.0 fl oz	12	1	armyworms, cabbage looper, cutworms, garden webworm, leafhoppers, saltmarsh caterpillar, tobacco budworm, tomato hornworm, tomato fruitworm, tomato pinworm, whiteflies	28, 16	Do not apply more than 3 times per season or apply more than 38 fl oz per acre per season. Use 14 to 17 fl oz per acre to control whiteflies, leafhoppers, and planthoppers.
Voliam Flexi (thiamethoxam, chlorantraniliprole)	4.0-7.0 oz	12	1	aphids, beet armyworm, Colorado potato beetle, fall armyworm, flea beetles, hornworms, leafhoppers, loopers, southern armyworm, stink bugs, tobacco budworm, tomato fruitworm, tomato pinworm, whiteflies, yellowstriped armyworm	4A/28	Limited to 14 oz/acre per growing season.
*Vydate L (oxamyl)	2-4 pt (foliar)	48	1	aphids, Colorado potato beetle, leafminers, mites	1A	Do not apply more than 24 pt per acre per season.
*Warrior II (lambda-cyhalothrin)	0.96-1.92 fl oz	24	5	armyworms (1 st & 2 nd instar), cutworms, grasshoppers, hornworms, leafhoppers, loopers, plant bugs, stink bugs, thrips ⁽¹⁾ , tomato fruitworm, vegetable weevil. Suppression of aphids, mites, whiteflies	3A	Do not apply more than 0.36 lb ai/acre per season. ⁽¹⁾ Does not control western flower thrips.
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11B	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.
Zeal Miticide (etoxazole)	2-3 oz	12	7	twospotted spider mite	10B	Do not make more than one application per season. Do not use with an adjuvant or surfactant.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

* Restricted use insecticide.

Table 4.4. Eggplant fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Alternaria blight/ Early blight	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, C-O-C DF, C-O-C WP, Copper Count N, Cueva, Cuprofix Ultra 40D, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Master Cop, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		Varies by product from 0 to 1 day	Varies by product from 4 h to 2 days	
	M1 & M2	Top Cop with Sulfur (basic copper sulfate + sulfur)	2 qt			1	
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	0	0.5	
	7	Endura (boscalid)	3.5 oz	21 oz	0	0.5	
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	
	11	Cabrio EG (pyraclostrobin)	16 oz	96 oz	0	0.5	
	11	Aftershock Evito 480 EC (fluoxastrobin)	5.7 fl oz	22.8 fl oz	3	0.5	Do not use in greenhouse production, see label for additional instructions.
	11	Flint (trifloxystrobin)	3.0 oz	16 oz	3	0.5	
	11	Reason 500 SC (fenamidone)	8.2 fl oz	24.6 fl oz	14	0.5	
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	24 fl oz	7	0.5	
Anthracnose	19	Ph-D WDG (polyoxin D zinc salt)	6.2 oz	See label	0	4 h	
	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Master Cop, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		Varies by product from 0 to 1 day	Varies by product from 4 h to 2 days	
	M1 & M2	Top Cop with Sulfur (copper sulfate + sulfur)	2 qt			1	
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Chloronil 720, Echo 720, Equus 720 SST	SEE INDIVIDUAL LABELS		See label	0.5	
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	0	See label	Disease suppression only
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	7	0.5	
	11	Cabrio EG (pyraclostrobin)	16 oz	96 oz	0	0.5	
	11	Flint (trifloxystrobin)	3.0 oz	16 oz	3	0.5	
	11	Quadris (azoxystrobin)	15.5 fl oz	61.5 fl oz	0	4 h	
	11 & 3	Quadris top (azoxystrobin + difenoconazole)	14 fl oz	55.3 fl. oz	0	0.5	
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	24 fl oz	7	0.5	
	19	Ph-D (polyoxin D zinc salt)	6.2 oz	See label	0	4 h	Disease suppression only

Table 4.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Phomopsis blight	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Master Cop, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		Varies by product from 0 to 1 day	Varies by product from 4 h to 2 days	
	M1 & M2	Top Cop with Sulfur (basic copper sulfate + sulfur)	2 qt			1	
Powdery mildew	M2	(sulfur) Many brands available: Cosavet DF, Kumulus DF Fungicide-Acaricide, Micro Sulf, Microfine Sulfur, Microthiol Disperss, Suffa, Sulfur 90 W/ Yellow Jacket Wettable Sulfur	SEE INDIVIDUAL LABELS		1	1	
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Chloronil 720, Echo 720, Equus 720 SST	SEE INDIVIDUAL LABELS			0.5	
	3	Rally 40 WSP Sonoma 40 WSP (myclobutanil)	SEE INDIVIDUAL LABELS		0	1	
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	0	0.5	
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	
	11	Cabrio EG Heritage Quadris (azoxystrobin)	16 oz 8 oz 15.5 fl oz	96 oz 32 oz 61.5 fl oz	0 0 0	0.5 4 h 4 h	
	11 & 3	Quadris top (azoxystrobin + difenoconazole)	14 fl oz	55.3 fl. oz	0	0.5	
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	24 fl oz	7	0.5	
	19	Ph-D WDG (polyoxin D zinc salt)	6.2 oz	See label	0	4 h	
Damping off (Pythium, Rhizoctonia and other seed-borne and soil-borne fungi)	M3	Signet 480 FS (thiram)	6.5 fl oz/100 lb seed			1	
	4	(mefenoxam) Many brands available: Apron XL, Ridomil Gold SL, Ridomil Gold EC, Ultra Flourish	SEE INDIVIDUAL LABELS			2	
	4	(metalaxyl) Many brands available: Acquire, Allegiance FL, Metastar 2E, Sebring 2.65 ST, Sebring 318 FS, Sebring 480 FS	SEE INDIVIDUAL LABELS				
	11	Dynasty (azoxystrobin)	0.38 fl oz/100 lb seed			4 h	
	11	Quadris (azoxystrobin)	See label		0	4 h	For Rhizoctonia seedling rot
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	24 fl oz	7	0.5	
	12	Maxim 4 FS Spirato 480 FS (fludioxonil)	0.16 fl oz/100 lb seed			0.5	
	4	Metastar 2E AG (metalaxyl)	8 pt	12 pt	7	2	See label for specific instructions
Crown rot (Phytophthora capsici)	4	Ridomil Gold SL Ridomil Gold EC Ultra Flourish (mefenoxam)	SEE INDIVIDUAL LABELS				

Table 4.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Late blight/ Phytophthora blight	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Cueva, C-O-C WDG	SEE INDIVIDUAL LABELS		Varies by product from 0 to 1 day	Varies by product from 4 h to 2 days	
	11	Aftershock Evito 480 EC (fluoxastrobin)	5.7 fl oz	22.8 fl oz	3	0.5	For disease suppression only; Do not use in greenhouse production
	11	Cabrio EG (pyraclostrobin)	16 oz	96 oz	0	0.5	
	11	Flint (trifloxystrobin)	3.0 oz	16 oz	3	0.5	
	11	Reason 500 SC (fenamidone)	8.2 fl oz	24.6 fl oz	14	0.5	Disease suppression only
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	24 fl oz	7	0.5	Disease suppression only
	21	Ranman (cyazofamid)	2.75 fl oz	16.5 fl oz	0	0.5	
	40	Forum (dimethomorph)	6 oz	30 oz	0	0.5	
	43	Presidio (fluopicolide)	4 fl oz	12 fl oz	2	0.5	
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	
Gray leaf spot	11	Flint Fungicide (trifloxystrobin)	3.0 oz	16 oz	3	0.5	
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	55.3 fl. oz	0	0.5	
	M1	Cueva (copper octanoate)	SEE LABEL				
Septoria leaf spot	7	Fontelis (penthioopyrad)	24 fl oz	72 fl oz	0	0.5	
	11	Cabrio EG (pyraclostrobin)	16 oz	96 oz	0	0.5	
	11	Flint Fungicide (trifloxystrobin)	3.0 oz	16 oz	3	0.5	Disease suppression only
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	
	11	Reason 500 SC (fenamidone)	8.2 fl oz	24.6 fl oz	14	0.5	Disease suppression only
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	24 fl oz	7	0.5	

¹ FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <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.

Chapter 5. Leafy Vegetable Production

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I. Lettuce, Endive, and Escarole

Botany and Planting

Lettuce - *Lactuca sativa*, Asteraceae (Compositae)

Endive - *Cichorium endiva*

Escarole - *Cichorium endive*

Table 5.1. Planting information for lettuce, endive and escarole.

Planting dates	Crisphead	Butterhead	Romaine
North Florida	Sept - Oct; Jan - Feb	Sept - Oct; Jan - Feb	Aug - Oct; Jan - Feb
Central Florida	Sept - Feb	Sept - Feb	Aug - Feb
South Florida	Sept - Feb	Sept - Feb	Sept - Mar
Planting information			
Distance between rows (in)	18 - 30	18 - 30	18 - 30
Distance between plants (in)	8 - 12	9	12
Seeding depth (in)	0.25	0.25	0.25
Seed per acre (lb)	1 - 3	1 - 3	2 - 4
Days to maturity from seed	70 - 95	60 - 80	60 - 80
Plant populations (acre)	43,560	38,720	29,040

Planting dates	Endive	Escarole
North Florida	Aug - Oct; Jan - Feb	Aug - Oct; Jan - Feb
Central Florida	Aug - Feb	Aug - Feb
South Florida	Sept - Mar	Sept - Mar
Planting information		
Distance between rows (in)	18 - 30	18 - 30
Distance between plants (in)	14 - 16	14 - 16
Seeding depth (in)	0.25	0.25
Seed per acre (lb)	3 - 4	3 - 4
Days to maturity from seed	60 - 80	60 - 80
Plant populations (acre)	24,891	24,891

II. Spinach

Botany and Planting

Spinach - *Spinacia oleracea*

Table 5.3. Planting information for spinach.

Planting dates	
North and Central Florida	Sept - Mar
South Florida	Oct - Feb
Planting information	
Distance between rows (in)	12 - 36
Distance between plants (in)	2 - 6
Seeding depth (in)	0.5
Seed per acre (lb)	10 - 15
Days to maturity from seed	45 - 60
Plant population (acre)	261,136

Cultivars

Table 5.2. Lettuce, endive and escarole cultivars.

Lettuce		
Green Leaf	Romaine (green)	Red Leaf
Green Saladbowl	Concept	Galatic
Green Star	Kalura	New Red Fire
Tropicana	Medallion	Red Saladbowl
Two Star	Terrapin	Vulcan
	Snappy	
Boston	Crisphead	Romaine (red)
Florida Butter Crisp	Gator	Outredeous
Ermosa	Gulfstream	Rosalita
Margarita	Raleigh	
Oakleaf (green)	Oakleaf (red)	Summer Crisp (red)
Royal Oak	Ferrari	Cherokee
Bibb		
Floribibb		
Endive		
Frisan	Marcant	Salad King
Escarole		
Full Heart NR 65	Twinkle	

Cultivars

Table 5.4. Spinach cultivars.

Smooth leaf	
A&C #30 (H)	Space (H)
Semi-savoy leaf	
Chinook II (H)	Gladiator (H)
Melody (H)	Skookum (H)
Tyee (H)	
Savoy leaf	
Ambassador (H)	Hybrid 612 (H)
H = hybrid	

Pesticides for Weed, Arthropod and Disease Management for Leafy Vegetables

Table 5.5. Selected herbicides approved for managing weeds in non-brassica leafy vegetables.

Active ingredient lb. a.i./acre	Trade name product/acre	Crops	Weeds controlled / remarks
*** PREEMERGENCE ***			
Benefin 1.2	(Balan) 2 lb.	Lettuce	Annual broadleaf and grass weeds. Apply before seeding or transplanting. Incorporate with cultivation or irrigation into the top 2 to 3 in. of the final bed
Bensulide 5.0 - 6.0	(Prefar) 4 E 5 - 6 qt.	Leafy vegetables	Annual broadleaf and grass weeds. Incorporate with cultivation or irrigation. Do not use on spinach or Swiss chard.
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Leafy vegetables	Emerged broadleaf weeds. Apply as a burndown herbicide before planting.
Glyphosate	(various formulations) consult labels	Leafy vegetables	Emerged broadleaf and grass weeds. Apply as a preplant burn down. Consult label for individual product directions.
Imazethapyr 0.016 - 0.031	(Pursuit) 2 EC 1 - 2 fl. oz.	Lettuce, endive, escarole	Broadleaf weeds. Apply in fields with 40% organic matter or greater. Do not apply more than 2 applications per crop. A maximum of 4 oz. of product per crop season. Should be applied in 2 or more gallons of water per acre. Potential for rotational crop injury is highly variable. Label is a Third-Party registration (TPR, Inc.). Use without having a signed authorization and waiver for liability agreement is a misuse of the product. PHI 30 days.
Paraquat 0.5 - 1.0	(Gramoxone) 2 SL 2 - 4 pt. (Firestorm) 3 SL 1.3 - 2.7 pt.	Lettuce	Emerged broadleaf and grass weeds. Apply as a preplant burndown. Do not make more than 3 applications per year.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Leafy vegetables	Emerged broadleaf and grass weeds. Apply as a preplant burndown before planting.
Pronamide 1.0 - 2.0	(Kerb) 50 WP 2.0 - 4.0 lb.	Head lettuce, endive, escarole	Certain annual broadleaf and grass weeds. Overhead irrigate with 1 to 2 in. following applications. Observe rotational restrictions to other crops. Not recommended for soils with high organic matter. PHI 55 days.
Pyraflufen 0.001 - 0.003	(ET Herbicide) 0.5 - 2.0 fl. oz.	Leafy vegetables	Emerged broadleaf weeds. Apply as a preplant burndown 1 day prior to planting. Include an NIS at 0.25% or COC at 1.0% to the spray solution
Trifluralin 0.5	(Treflan, Trifluralin) 4 EC 1.0 pt. (Trifluralin) 10 G 5 lb.	Endive, escarole, radicchio	Annual broadleaf and grass weeds. Apply as preplant incorporate to mineral soils only.
*** POSTEMERGENCE ***			
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Leafy vegetables	Emerged broadleaf weeds. Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides.
Clethodim 0.09 - 0.13 0.07 - 0.13	(Select, Arrow) 2 EC 6 - 8 fl. oz. (Select Max) 1 EC 9 - 16 fl. oz.	Leafy vegetables	Emerged annual and perennial grass weeds. For repeat application, minimum of 14 days between applications. PHI 14 days
Imazethapyr 0.016 - 0.031	(Pursuit) 2 EC 1 - 2 fl. oz.	Lettuce, endive, escarole	Broadleaf weeds. Apply in fields with 40% organic matter or greater. Apply postemergence after 3 - 4 true leaf stage. Do not apply more than 2 applications per crop. A maximum of 4 oz. per crop season. Potential for rotational crop damage is highly variable. Label is a Third-Party registration (TPR, Inc.). Use without having a signed authorization and waiver for liability agreement is a misuse of the product. PHI 30 days.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Leafy vegetables	Emerged broadleaf and grass weeds. Apply as a directed or shielded spray to row middles.
Sethoxydim 0.19 - 0.28	(Poast) 1.5 EC 1.0 - 1.5 pt.	Head/leaf lettuce, endive, radicchio	Emerged grass weeds. Do not exceed 3.0 pt./acre. per season. Include a crop oil concentrate. Head lettuce and radicchio PHI 30 days. Leaf lettuce and endive PHI 15 day.

Table 5.6. Selected herbicides approved for managing weeds in spinach.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREPLANT / PREEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burn down treatment. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with soil residual compounds.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Apply as a preplant burn down treatment. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with soil residual compounds.
Pyraflufen 0.001 - 0.003	(ET Herbicide) 0.208 EC 0.5 - 2.0 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burndown treatment.
*** POSTEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as hooded application to row middles only. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides. PHI 0 days.
Clopyralid 0.06 - 0.12	(Clopyr Ag) 3 EC 0.17 - 0.33 pt.	Certain broadleaf weeds. Do not exceed a total of 0.5 pt./acre per growing season. Apply in the 2- to 5-leaf stage of crop growth. PHI 21 days.
Clethodim 0.09 - 0.13	(Arrow, Select) 2 EC 6 - 8 fl. oz. (Select Max) 1 EC	Perennial and annual grass weeds. Use higher rates under heavy grass pressure or larger grass weeds. Read the label for required surfactant. PHI 14 days.
0.07 - 0.25	9 - 16 fl. oz.	
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Direct spray to row middles. Product is a contact, nonselective, foliar applied herbicide with no residual control. may be tank mixed with several soil residual compounds.
Sethoxydim 0.19 - 0.28	(Poast) 1.5 EC 1.0 - 1.5 pt.	Controls emerged grass weeds. A total of 3.0 pt./acre. applied in one season. Include a crop oil concentrate. Unsatisfactory results may occur if applied to grasses under stress. PHI 15 days.

Table 5.7. Selected insecticides approved for managing insect pests of lettuce and other non-brassica leafy vegetables.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Actara (thiamethoxam)	1.5-5.5 oz	12	7	aphids, flea beetles, leafhoppers, whiteflies	4A	Do not use if other 4A insecticides have been or will be used.
Admire Pro (imidacloprid)	4.4-10.5 fl oz	12	21	aphids, leafhoppers, thrips (foliage feeders), whiteflies	4A	Do not apply more than 10.5 fl oz per acre per year.
Agree WG (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11	Apply when larvae are small for best control. Can be used in greenhouse. OMRI-listed ² .
*Agri-Mek SC (abamectin)	1.75-3.5 fl oz	12	7	carmine spider mite, <i>Liriomyza</i> leafminers, twospotted spider mite	6	No more than 2 sequential applications. Must be used with an adjuvant (but not binder sticker types). Not for use on leafy vegetables grown for transplant.
*Ambush 25W (permethrin)	6.4-12.8 oz	12	1	beet armyworm, cabbage looper, corn earworm, cutworms, fall armyworm, leafhoppers, leafminers	3A	Do not apply more than 2.0 lb ai/acre per season. (128 oz)
*Asana XL (0.66 EC) (esfenvalerate)	4.8-9.6 fl oz	12	7	beet armyworm (aids in control), cabbage looper, <i>Heliothis</i> spp.	3A	Head lettuce only. Do not apply more than 0.35 lb ai. per acre per season.
Assail 30SG (acetamiprid)	2.0-4.0 oz	12	7	aphids, whiteflies	4A	Begin applications for whiteflies when first adults are noticed. Do not apply more than 5 times per season or apply more often than every 7 days.
Avaunt (indoxacarb)	2.5-6.0 oz	12	3	beet armyworm, cabbage looper, corn earworm	22	Do not apply more than 24 ounces of product per acre per crop.
Aza-Direct (azadirachtin)	1-2 pts, up to 3.5, if needed	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, mites, stink bugs, thrips, weevils, whiteflies	un	Antifeedant, repellent, insect growth regulator. OMRI-listed.
Azatin XL (azadirachtin)	5-21 fl oz	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, weevils, whiteflies	un	Antifeedant, repellent, insect growth regulator.

Table 5.7. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
*Baythroid XL (beta-cyfluthrin)	0.8-3.2 fl oz	12	0	beet and southern armyworm (1 st and 2 nd instars), cabbage looper, corn earworm, cutworms, flea beetles, grasshoppers, potato leafhopper, saltmarsh caterpillar, thrips, vegetable weevil, yellowstriped armyworm	3A	Maximum amount per acre per season: 12.8 fl oz.
Belay 50 WDG (clothianidin)	1.6-3.2 oz	12	7	aphids, flea beetles, leafhoppers, leafminers (suppression), whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Toxic to bees. Rates above 2.1 oz are on supplemental label.
Belay 50 WDG (clothianidin)	4.8 -6.4 oz (soil application)	12	Apply at planting	aphids, flea beetles, leafhoppers, leafminers (suppression), whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. See label for application instructions.
Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	0	aphids, plant bugs	9C	Do not apply more than 8.4 oz/acre per season. Begin applications before pests reach damaging levels.
Belt SC (flubendiamide)	1.5 fl oz	12	1	armyworms, corn earworm, green cloverworm, loopers, saltmarsh caterpillar	28	Do not apply more than 4.5 fl oz/acre per season.
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11	Treat when larvae are young. Good coverage is essential. Can be used in the greenhouse. OMRI-listed.
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.
*Brigade 2EC (bifenthrin)	2.1-6.4 fl oz	12	7 – head lettuce, 3 – cilantro and coriander	aphids, armyworms, carmine mite, corn earworm, cucumber beetle, cutworms, flea beetles, leafhoppers, loopers, <i>Lygus</i> spp., saltmarsh caterpillar, stink bug spp., twospotted spider mite, whiteflies	3A	Head lettuce only.
Confirm 2F (tebufenozide)	6-8 fl oz	4	7	armyworms, cabbage looper, garden webworm	18	Do not exceed 56 ounces of product per acre per season.
Coragen (rynaxypyr)	3.5-7.5 fl oz	4	1	beet armyworm, cabbage looper, corn earworm, leafminers, suppression of whitefly nymphs	28	Can be applied by drip chemigation, to soil at planting or used as a foliar spray.
Courier 40SC (buprofezin)	9.0-13.6 fl oz	12	7	leafhoppers, planthoppers, whiteflies	16	Insect growth regulator. Do not make more than 2 applications per season per crop or 4 per year. Allow 7 days between applications. See label for crop rotational restrictions.
Crymax WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Use high rate for armyworms. Treat when larvae are young.
Deliver (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11	Use higher rates for armyworms. OMRI-listed ² .
*Diazinon AG500 *Diazinon 50W (diazinon)	0.5-1 pt 0.5-1 lb	72	14 (foliar)	aphids, leafminers	1B	Do not apply more than once. Head and leaf lettuce only.
*Diazinon AG500	1-2 qt, 1-4 qt for endive (escarole)	72 – head & leaf	preplant	cutworms, mole crickets, wireworms	1B	See label. Head and leaf lettuce, endive (escarole) only.
*Diazinon 50W (diazinon)	2-4 lb, 2-8 lb for endive (escarole)	96 – endive (escarole)				
Dimethoate 4 EC (dimethoate)	0.5 pt	48	14	aphids, leafhoppers, leafminers	1B	Leaf lettuce only, not for head lettuce. Also for endive (escarole).
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Good coverage is essential. Can be used in greenhouse. See label for rates for specific pests. For organic production.
Durivo (thiamethoxam, chlorantraniliprole)	10-13 oz	12	30	aphids, beet armyworm, cabbage looper, corn earworm, fall armyworm, flea beetles, imported cabbageworm, leafhoppers, whiteflies	4A, 28	May be applied using one of several soil application methods.
Entrust SC (spinosad)	1.5-10.0 fl oz	4	1, 3 for turnip greens	armyworms, cabbage looper, diamondback moth, leafminers, thrips	5	See label for resistance management recommendations. Do not apply more than 29 oz per acre per crop, or more than twice in succession. OMRI-listed ² .

Table 5.7. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Extinguish ((S)-methoprene)	1-1.5 lb	0	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.
Fulfill (pymetrozine)	2.75 oz	12	7	bean aphid, green peach aphid, lettuce aphid, potato aphid, red lettuce aphid, suppression of whiteflies.	9B	Do not exceed 5.5 oz product per acre per season.
Grandevo <i>Chromobacterium</i> <i>subtsugae</i> strain PRAA4-1	1-3 lb	4	0	aphids, armyworm, cabbage looper, cutworms, diamondback moth, green cloverworm, mites, tobacco budworm, thrips, whiteflies	—	Can be used in organic production. OMRI-listed ² .
Intrepid 2F (methoxyfenozide)	4-10 fl oz	4	1	armyworms, cabbage looper, webworms	18	Do not apply more than 64 fl oz/acre per season.
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.5 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms)	11	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
Kryocide (cryolite)	8-20 lb	12	14	armyworms, cabbage looper, corn earworm, tobacco budworm	un	Do not apply more than 160 lb/acre/season. For leaf and head varieties of lettuce.
*Lannate LV; *SP (methomyl)	LV: 1.5-3 pt SP: 0.5-1.0 lb	48	10, or 7 for lowest rates for lettuce only	Lettuce: aphids, aster leafhopper, beet armyworm, cabbage looper, corn earworm, thrips, variegated cutworm Endive (escarole): beet armyworm	1A	Head varieties: Do not apply more than 24 pt LV per acre per crop or 8 lb SP. Leaf varieties and endive (escarole): Do not apply more than 12 pt LV per acre/crop or 4 lb SP.
*Larvin 3.2 (thiodicarb)	16-30 fl oz	48	14	armyworms, beet armyworm, cabbage looper, corn earworm, fall armyworm, tomato fruitworm, southern armyworm	1A	Do not exceed 1.5 lb active ingredient per acre per season (60 fl oz).
Malathion 8F (malathion)	1-1.25 pt, 1.88 pt for leaf and head lettuce	24	7, 14 for head and leaf lettuce	aphids, leafhoppers, mites for head and leaf lettuce, aphids for all others	1B	Do not apply more than twice per year.
Movento (spirotetramat)	4.0-5.0 fl oz	24	3	aphids, whiteflies	23	Do not apply more than 10 fl oz/acre/crop.
M-Pede 49% Soap, insecticidal	1-2% V/V	12	0	aphids, leafhoppers, mites, plant bugs, thrips, whiteflies	--	OMRI-listed ² .
*MSR Spray Concentrate (oxydemeton-methyl)	2 pt	72	21	aphids, mites	1B	For head lettuce only.
*Mustang (zeta-cypermethrin)	2.4-4.3 oz	12	1	aphids, armyworms, corn earworm, crickets, cucumber beetles, cutworms, flea beetles, leafhoppers, loopers, saltmarsh caterpillar, stink bugs, whiteflies	3A	A maximum of 0.3 lb ai/acre per season may be applied.
Neemix 4.5 EC (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, cabbage looper, cutworms, leafminers, whiteflies	un	OMRI-listed ² .
Oberon 2 SC (spiromesifen)	7.0-8.5 fl oz	12	7	whiteflies	23	Maximum amount per crop: 25.5 fl oz. No more than 3 applications.
Orthene 97 (acephate)	0.5-1.0 lb	24	21	green peach aphid, armyworms (excluding beet armyworm), aster leafhopper, cabbage looper	1B	Winter-grown head lettuce only. Do not apply more than 2 and 1/8 lb per crop cycle.
Platinum Platinum 75 SG (thiamethoxam)	5.0-11 fl oz 1.66-3.67 oz	12	30	aphids, flea beetles, leafhoppers, leafminers (suppression), whiteflies	4A	Maximum = 11 oz/acre or 3.67 oz/acre (75 SG) per season. Do not use in conjunction with other 4A insecticides.
*Pounce 25 W (permethrin)	6.4-12.8 oz	12	1	aphids, beet armyworm, cabbage looper, corn earworm, cutworms, fall armyworm, leafhoppers, leafminers, southern armyworm, tobacco budworm	3A	Do not apply more than 1.0 lb ai/acre per season for leafy vegetables other than lettuce (maximum of 0.8 lb ai/acre)
*Proaxis Insecticide (gamma-cyhalothrin)	1.92-3.84 fl oz	24	1	Aphids ⁽¹⁾ , armyworm, beet armyworm ⁽²⁾ , cabbage looper, corn earworm, cutworm, fall armyworm ⁽²⁾ , flea beetles, grasshoppers, green cloverworm, leafhoppers, meadow spittlebug, southern armyworm, spider mites ⁽¹⁾ , stink bugs, tobacco budworm, vegetable weevil (adult), whiteflies ⁽¹⁾	3A	Head and leaf lettuce only. ⁽¹⁾ Suppression only. ⁽²⁾ First and second instars only. Do not apply more than 2.4 pints per acre per season.
*Proclaim (emamectin benzoate)	2.4-4.8 oz	12	7	beet armyworm, corn earworm, fall armyworm, <i>Liriomyza</i> leafminers (suppression), loopers, tobacco budworm	6	Do not make more than 2 sequential applications without rotation to another product with a different mode of action.
Provado 1.6 F (imidacloprid)	3.8 oz	12	7	aphids, flea beetles, leafhoppers, whiteflies	4A	Do not use in conjunction with other 4A insecticides.

Table 5.7. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
PyGanic Crop Protection EC 5.0 (pyrethrins)	4.5-18 fl oz	12	0	Aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, whiteflies, others	3A	Can be used in greenhouses. Thorough coverage is essential. Breaks down rapidly in sunlight. OMRI-listed ² .
Radiant SC (spinetoram)	5-10 fl oz	4	1, 3 for turnip greens and other leaves of root, tuber, legume veg- etables	armyworms (not yellowstriped), cabbage looper, corn earworm, <i>Liriomyza</i> leafminer, thrips	5	Includes turnip greens. Maximum of 6 applications, no more than 2 consecutive applications before rotating to another MOA.
Requiem 25EC (extract of <i>Chenopodium ambrosioides</i>)	2.0-4.0 qt	4	0	green peach aphid, suppression of <i>Liriomyza</i> leafminers, potato aphid, turnip aphid, whiteflies	un	
Sevin 80S, XLR, 4F (carbaryl)	80S: 0.63-2.5 lb XLR, 4F: 0.5-2.0 qt	12	14	armyworms, aster leafhopper, corn earworm, fall armyworm, flea beetles, leafhoppers, Lygus bugs, spittlebugs, stink bugs, tarnished plant bug	1A	Repeat as needed, up to 5 times, at least 7 days apart.
Scorpion 35 SL insecticide (dinotefuran)	Foliar: 2-5.25 fl oz Soil: 9-10.5 fl oz	12	foliar - 7, soil - 21	brown stink bug, cucumber beetle, flea beetles, grasshoppers, green stink bug, harlequin bug, leafhoppers, leafminers, southern green stink bug, thrips, whiteflies, suppression of green peach aphid	4A	No more than 2 applications at highest rate per acre per season.
Sun Spray 98.8%, JMS Stylet-Oil, Saf-T-Side, others Oil, insecticidal	3-6 qts/100 gal H ₂ O (JMS) 1-2 gal/100 gal	4	0	leafhoppers, leafminers, mites, thrips, whiteflies	--	Organic Stylet-Oil and Saf-T-Side are OMRI-listed ² .
Trigard (cyromazine)	2.66 oz	12	7	leafminers	17	Limited to six applications for head let- tuce and five applications for other leafy vegetables.
Trilogy (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed.
Venom Insecticide (dinotefuran)	foliar: 1.0-3.0 oz soil: 5.0-6.0 oz	12	foliar - 7 soil - 21	Foliar: brown stink bug, cucumber beetle, flea beetle, grasshopper, green stink bug, suppression of green peach aphid and potato aphid, southern green stink bug, whiteflies Soil: suppression of green peach aphid and potato aphid, leafhoppers, leafminers, whiteflies	4A	Do not apply more than 6 oz per acre per season (foliar) or 12 oz per acre per season (soil). Do not use both applica- tion methods.
Vetica (flubendiamide and buprofezin)	12.0-17.0 fl oz	12	7	armyworms, cabbage looper, corn earworm, cutworms, green cloverworm, imported cabbageworm, leafhoppers, saltmarsh caterpillar, tobacco budworm, whitefly	28, 16	Do not apply more than 3 times per sea- son or apply more than 38 fl oz per acre per season. Use high rate for leafhoppers and whiteflies.
Voliam Flexi (thiamethoxam and chlorantraniliprole)	4.0-7.0 oz	12	7	aphids, beet armyworm, cabbage looper, corn earworm, fall armyworm, flea beetles, leafhoppers, southern armyworm, tobacco budworm, whiteflies	4A, 28	Do not exceed a total of 14 oz of Voliam Flexi per acre per season.
*Warrior II (lambda-cyhalothrin)	0.96-1.92 fl oz	24	1	aphids ⁽¹⁾ , armyworms, beet armyworm ⁽²⁾ , cabbage looper, corn earworm, cutworms, fall armyworm ⁽²⁾ , flea beetles, grasshoppers, leafhoppers, mites, plant bugs, saltmarsh caterpillar, southern armyworm, spider mites ⁽³⁾ , spittlebugs, stink bugs, tobacco budworm, vegetable weevil, whiteflies ⁽¹⁾	3A	Head and leaf lettuce only. Do not apply more than 0.3 lb ai/acre per season. ⁽¹⁾ Suppression only. ⁽²⁾ 1 st and 2 nd instar larvae only.
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

* **Restricted use insecticide.**

Table 5.8. Selected insecticides approved for managing insect pests of spinach.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Actara (thiamethoxam)	1.5-5.5 oz	12	7	aphids, flea beetles, leafhoppers, whiteflies	4A	Do not use if other 4A insecticides have been or will be used.
Admire Pro (imidacloprid)	4.4-10.5 fl oz—soil 1.3 fl oz—foliar	12	21 – soil 7 – foliar	aphids, leafhoppers, flea beetles (foliar) foliage-feeding thrips (soil), whiteflies	4A	Limited to 10.5 fl oz per acre per season for soil application or 6.7 fl oz per acre per season for foliar applications.
Agree WG (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11	Apply when larvae are small for best control. OMRI-listed ² .
*Agri-Mek SC (abamectin)	1.75-3.5 fl oz	12	7	carmine spider mite, <i>Liriomyza</i> leafminers, spider mites	6	No more than 2 sequential applications. Maximum of 10.25 fl oz per acre per season. Must be mixed with a non-ionic activator type wetting, spreading, and/or penetrating adjuvant, but not a binder sticker type adjuvant.
*Ambush 25W (permethrin)	6.4-12.8 oz	12	1	aphids, beet armyworm, cabbage looper, corn earworm, cutworms, fall armyworm, leafhoppers, vegetable leafminer	3A	Do not apply more than 1.0 lb ai/acre per season (5 applications at high rate).
Assail 30SG (acetamiprid)	2.0-4.0 oz	12	7	aphids, whiteflies	4A	Begin applications for whiteflies when first adults are noticed. Do not apply more than 5 times per season or apply more often than every 7 days.
Avaunt (indoxacarb)	3.5 oz	12	3	beet armyworm, cabbage looper	22	Do not apply more than 14 oz Avaunt per acre per crop.
Aza-Direct (azadirachtin)	1.0-2.0 pt, to 3.5 pt if needed	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, mites, stink bugs, thrips, weevils, whiteflies	un	Antifeedant, repellent, insect growth regulator. OMRI-listed ² .
Azatin XL (azadirachtin)	5.0-21.0 fl oz	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, weevils, whiteflies	un	Antifeedant, repellent, insect growth regulator.
*Baythroid XL (beta-cyfluthrin)	0.8-3.2 fl oz	12	0	beet and southern armyworm (1 st and 2 nd instars), cabbage looper, corn earworm, cutworms, flea beetles, grasshoppers, potato leafhopper, saltmarsh caterpillar, thrips, vegetable weevil, yellowstriped armyworm	3A	Maximum of 12.8 fl oz per acre per season.
Belay 50 WDG (clothianidin)	1.6-3.2 oz	12	7	aphids, flea beetles, leafhoppers, leafminers (suppression), whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Toxic to bees. A supplemental label that expires Dec. 30, 2013 covers rates above 2.1 oz for foliar applications.
Belay 50 WDG (clothianidin)	4.8-6.4 oz (soil application)	12	Apply at planting	aphids, flea beetles, leafhoppers, leafminers (suppression), whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. See label for application instructions.
Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	0	aphids, plant bugs	9C	Do not apply more than 8.4 oz/acre per season. Begin applications before pests reach damaging levels.
Belt SC (flubendiamide)	1.5 fl oz	12	1	armyworms, corn earworm, green cloverworm, loopers, saltmarsh caterpillar	28	Do not apply more than 4.5 fl oz/acre per season.
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11	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: 0.5-2.0 lb/100 gal ES: 0.5-2.0 qt/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.
Confirm 2F (tebufenozide)	6.0-8.0 fl oz	4	7	armyworms, cabbage looper, garden webworm	18	Do not exceed 56 ounces of product per acre per season.
Coragen (chlorantraniliprole)	3.5-7.5 fl oz	4	1	beet armyworm, cabbage looper, corn earworm, leafminers, suppression of whitefly nymphs	28	Can be applied by drip chemigation, to soil at planting or used as a foliar spray.
Courier 40SC (buprofezin)	9.0-13.6 fl oz	12	7	leafhoppers, planthoppers, whiteflies	16	Insect growth regulator. Do not make more than 4 applications per year or 2 applications per crop. Allow 7 days between applications. See label for crop rotational restrictions.
Crymax WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Use high rate for armyworms. Treat when larvae are young.
Deliver (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11	Use higher rates for armyworms. OMRI-listed ² .

Table 5.8. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
*Diazinon AG500 *Diazinon 50W (diazinon)	2.0-4.0 qt 4.0-8.0 lb	72	preplant	cutworms, wireworms	1B	Do not make more than one soil application per year.
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Good coverage is essential. See label for rates for specific pests. For organic production.
Durivo (thiamethoxam, chlorantraniliprole)	10-13 oz	12	30	aphids, beet armyworm, cabbage looper, corn earworm, fall armyworm, flea beetles, imported cabbageworm, leafhoppers, whiteflies	4A, 28	May be applied using one of several soil application methods. One application per season.
Entrust SC (spinosad)	1.5-10 fl oz	4	1	armyworms, cabbage looper, leafminers, thrips	5	Use no more than 9 oz per acre per crop. OMRI-listed ² .
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.
Fulfill (pymetrozine)	2.75 oz	12	7	bean aphid, green peach aphid, lettuce aphid, potato aphid, red lettuce aphid, suppression of whiteflies	9B	Apply when aphids first appear, before populations build to damaging levels. Two applications may be needed to control persistent aphid populations.
Grandevo <i>Chromobacterium</i> <i>subtsugae</i> strain PRAA4-1	1-3 lb	4	0	aphids, armyworm, cabbage looper, cutworms, diamondback moth, green cloverworm, mites, tobacco budworm, thrips, whiteflies	—	Can be used in organic production. OMRI-listed ² .
Intrepid 2F (methoxyfenozide)	4.0-10.0 fl oz	4	1	armyworms, cabbage looper, webworms	18	Do not apply more than 64 fl oz per acre per season.
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.5 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms)	11	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
*Lannate LV; *SP (methomyl)	LV: 1.5-3.0 pt SP: 0.5-1.0 lb	48	7	beet armyworm, cabbage looper, fall armyworm, variegated cutworm	1A	Do not use more than 4 lb of SP, or 12 pt of LV per acre/season. Do not apply to seedlings less than 3" diameter.
*Larvin 3.2 (thiodicarb)	16-30 fl oz	48	14	armyworms, beet armyworm, cabbage looper, corn earworm, fall armyworm, southern armyworm	1A	Do not exceed 60 fl oz per acre per season.
Malathion 8 F (malathion)	1.0 pt	12	7	aphids	1B	Do not apply more than twice per year.
Movento (spirotetramat)	4.0-5.0 fl oz	24	3	aphids, whiteflies	23	Do not apply more than 10 fl oz/acre/crop.
M-Pede 49% EC Soap, insecticidal	1-2% V/V	12	0	aphids, leafhoppers, mites, plant bugs, whiteflies	--	OMRI-listed ² .
*Mustang (zeta-cypermethrin)	2.4-4.3 oz	12	1	aphids, armyworms, corn earworm, crickets, cucumber beetles, cutworms, flea beetles, ground beetles, leafhoppers, loopers, <i>Lygus</i> bugs, saltmarsh caterpillar, stink bugs, tobacco budworm, whiteflies, wireworm adults	3A	A maximum of 0.3 lb ai/acre per season may be applied. Do not make applications less than 7 days apart.
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, leafhoppers, leafminers, loopers, whiteflies	un	IGR and feeding repellent. OMRI-listed ² .
Oberon 2SC (spiromesifen)	7.0-8.5 fl oz	12	7	whiteflies	23	Maximum amount per crop: 25.5 fl oz/acre. No more than three applications.
Platinum Platinum 75 SG (thiamethoxam)	5.0-11 fl oz 1.66-3.67 oz	12	30	aphids, flea beetles, leafhoppers, leafminers (suppression), whiteflies	4A	Maximum = 11 oz/acre or 3.67 oz/acre (75 SG) per season. Do not use in conjunction with other 4A insecticides.
*Pounce 25 W (permethrin)	6.4-12.8 oz	12	1	aphids, armyworms, beet armyworm, cabbage looper, corn earworm, cutworms, fall armyworm, leafhoppers, loopers, southern armyworm, tobacco budworm, vegetable leafminer	3A	Do not apply more than 0.6 lb ai/acre per season (no more than 3 applications at highest rate).
*Proclaim (emamectin benzoate)	2.4-4.8 oz	12	7	beet armyworm, corn earworm, fall armyworm, loopers, tobacco budworm, suppression of leafminers	6	Do not apply more than 28.8 oz/acre per season.
Provado 1.6 F (imidacloprid)	3.8 oz	12	7	aphids, flea beetles, leafhoppers, whiteflies	4A	Maximum of 19.0 fl oz per acre per season. Do not use with other 4A insecticides.
Pyganic Crop Protection EC 5.0 (pyrethrins)	4.5-18 fl oz	12	0	aphids, beetles, caterpillars, crickets, grasshoppers, leafhoppers, leafminers, mites, stink bugs, thrips, whiteflies,	3A	Pyrethrins degrade rapidly in sunlight, but still may be harmful to bees. OMRI-listed ²

Table 5.8. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Radiant (spinetoram)	5-10 fl oz	4	1	armyworms (not yellowstriped), cabbage looper, corn earworm, <i>Liriomyza</i> leafminer, thrips	5	Maximum of 6 applications, no more than 2 consecutive applications before rotating to another MOA.
Scorpion 35 SL insecticide (dinotefuran)	Foliar: 2-5.25 fl oz Soil: 9-10.5 fl oz	12	foliar - 7, soil - 21	brown stink bug, cucumber beetle, flea beetles, grasshoppers, green stink bug, harle- quin bug, leafhoppers, leafminers, southern green stink bug, thrips, whiteflies, suppression of green peach aphid	4A	No more than 2 applications at highest rate per acre per season.
Sevin 80S; XLR; 4F (carbaryl)	80S: 0.63-2.5 lb XLR; 4F: 0.5-2.0 qt	12	14	armyworms, aster leafhopper, corn earworm, fall armyworm, flea beetles, leafhoppers, <i>Lygus</i> bug, spittlebugs, stink bug, tarnished plant bug	1A	Do not apply more than a total of 7.5 lb or 6 qt per acre per crop.
Trigard (cyromazine)	2.66 oz	12	7	leafminers	17	No more than 5 applications per crop.
Trilogy (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees ex- posed to direct treatment. OMRI-listed ² .
Venom Insecticide (dinotefuran)	foliar: 1.0-3.0 oz soil: 5.0-6.0 oz	12	foliar: 7 soil: 21	leafhoppers, leafminers, whiteflies	4A	Use only one application method (soil or foliar, not both). Do not apply more than 6 oz/acre (foliar) or 12 oz/acre (soil) per season.
Vetiva (flubendiamide and buprofezin)	12.0-17.0 fl oz	12	7	armyworms, cabbage looper, corn earworm, cutworms, green cloverworm, imported cab- bageworm, leafhoppers, saltmarsh caterpillar, tobacco budworm, whitefly	28, 16	Do not apply more than 3 times per season or more than 38 fl oz per acre per season. Use high rate for leafhoppers and whiteflies.
Voliam Flexi (thiamethoxam and chlorantraniliprole)	4.0-7.0 oz	12	7	aphids, beet armyworm, cabbage looper, corn earworm, fall armyworm, flea beetles, leafhoppers, southern armyworm, tobacco budworm, whiteflies	4A, 28	Do not exceed a total of 14 oz of Voliam Flexi per acre per season. Do not use an adjuvant.
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

* Restricted use insecticide.

Table 5.9. Lettuce fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Alternaria	7	Fontelis 1.67SC (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	
	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	0	0.5	Alternate with fungicide with dissimilar modes of action after 2 applications.
	11	Amistar 80DF (azoxystrobin)	5 oz	20 oz	0	4 h	Alternate with fungicides with dissimilar modes of action.
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	0.5	Alternate with fungicides with dissimilar modes of action.
	11	Quadris (azoxystrobin)	15.4 fl oz	2.88 qt	0	4 h	Alternate with fungicides with dissimilar modes of action.
Bacterial blight	M1	(copper compounds) Many brands available: Basic Copper 53, C-O-C-S WDG, Champ DP, Champ WG, Champ Formula 2, Champ WP, Cueva, Kocide 3000, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Stretch, Tenn Cop, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days	

Table 5.9. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Basal rot	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	0	0.5	Alternate with fungicide with dissimilar modes of action after 2 applications.
	12	Cannonball WP (fludioxonil)	7 oz	28 oz	0	0.5	
Botrytis rot	7	Endura 70WG (boscalid)	11 oz	22 oz	14	0.5	Alternate with fungicide with dissimilar modes of action after 2 applications.
	7	Fontelis 1.67 SC (penthioopyrad)	24 fl oz	72 fl oz	3	0.5	
	14	Botran 75W (dichloran)	5.33 lb	5.33 lb	14	0.5	
Cercospora leaf spot	7	Fontelis 1.67SC (penthioopyrad)	24 fl oz	72 fl oz	3	0.5	Alternate with fungicides with dissimilar modes of action.
	11	Amistar 80DF (azoxystrobin)	5 oz	20 oz	0	4 h	
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	0.5	
	11	Quadris (azoxystrobin)	15.4 fl oz	2.88 qt	0	4 h	
	12	Cannonball WP (fludioxonil)	0.5 oz	1.5 lb	14	0.5	
Damping off	M3	Defiant 75WP (thiram)	5.3 oz/ 100 lbs of seed			1	Seed treatment only.
Downy mildew	M1	(copper compounds) Many brands available: Basic Copper 53, C-O-C-S WDG, Champ DP, Champ WG, Champ Formula 2, Champ WP, Cueva, Kocide 3000, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Stretch, Tenn Cop, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
	M2	(sulfur) Many brands available: Kumulus DF, Micro Sulf, Microthiol Disperss, Sulfur 90W, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		1	1	
	M3	(mancozeb) Many brands available: Mankocide, Manzate Flowable, Manzate Pro-stick	SEE INDIVIDUAL LABELS		10	1	
	4	Ridomil Gold SL (mefenoxam)	0.25 pt	1.0 pt	7	2	
	11	Amistar 80DF (azoxystrobin)	5 oz	20 oz	0	4 h	
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	0.5	
	11	Quadris (azoxystrobin)	15.4 fl oz	2.88 qt	0	4 h	
	11	Reason (fenamidone)	8.2 fl oz	24.6 fl oz	2	0.5	
	15	Acrobat 50WP (dimethomorph)	6.4 oz	32 oz	0	0.5	
	15	Forum (dimethomorph)	6 fl oz	30 fl oz	0	0.5	
	21	Ranman SC (cyazofamid)	2.75 fl oz	16.5 fl oz	0	0.5	Alternate with fungicides with dissimilar modes of action.
	21	Actigard 50WG (acibenzolar)	1 oz	4 oz	7	0.5	Apply preventatively. See label for details.
	27	Curzate (cymoxanil)	5 oz	30 oz	3	0.5	Must be applied as a tank-mix with a fungicide of dissimilar mode of action.
	27 & 11	Tanos (cymoxanil + famoxadone)	8 oz	24 oz	3	0.5	
	28	Previcur Flex (propamocarb)	2 pt	8 pt	2	0.5	

Table 5.9. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Downy mildew	28	Promess	2 pt	8 pt	2	0.5	
Continued		(propamocarb)					
	33	Aliette 80WDG (fosetyl Al)	5 lb	35 lb	3	0.5	Caution should be used when applying in a management program including copper fungicides.
	33	Legion 80WDG (fosetyl-Al)	5 lb	20 lb	3	0.5	Caution should be used when applying in a management program including copper fungicides.
	33	Linebacker WDG (fosetyl-Al)	5 lb	20 lb	3	0.5	Caution should be used when applying in a management program including copper fungicides.
	40	Forum (dimethomorph)	6 fl oz	30 fl oz	0	0.5	Do not apply alone in sequential applications.
	40	Revus 250SC (mandipropamid)	8 fl oz	32 fl oz	1	0.5	Do not exceed 2 sequential applications. See label for soil applications.
	43	Presidio 4L (fluopicolide)	3-4 fl oz	12 fl oz	2	0.5	Must be tank-mixed with a fungicide of different mode of action. Do not exceed two sequential applications. See label for soil applications.
	45 & 40	Zampro SC (ametoctradin + dimethomorph)	14 fl oz	42 fl oz	0	0.5	
Gray mold	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	0	0.5	Alternate with fungicide with dissimilar modes of action after 2 applications.
Powdery mildew	M2	(sulfur) Many brands available: Kumulus DF, Micro Sulf, Microthiol Disperss, Sulfur 90W, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		1	1	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
	M3	(mancozeb) Many brands available: Mankocide, Manzate Flowable, Manzate Pro-stick	SEE INDIVIDUAL LABELS		10	1	
	3	Procure 480SC (fludioxinil)	8 fl oz	18 fl oz	0	0.5	
	3	Rally 40WSP (myclobutanil)	5 oz	20 oz	3	1	Supplemental label.
	3	Sonoma 40WSP (myclobutanil)	5 oz	20 oz	3	1	
	7	Fontelis 1.67 SC (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	Alternate with fungicide with dissimilar modes of action after 2 applications.
	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	0	0.5	Alternate with fungicide with dissimilar modes of action after 2 applications.
	11	Amistar 80DF (azoxystrobin)	5 oz	20 oz	0	4 h	Alternate with fungicides with dissimilar modes of action.
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	0.5	Alternate with fungicides with dissimilar modes of action.
	11	Quadris (azoxystrobin)	15.4 fl oz	2.88 qt	0	4 h	Alternate with fungicides with dissimilar modes of action.
	13	Quintec (quinoxifen)	6 fl oz	24 fl oz	1	0.5	Alternate with fungicides with dissimilar modes of action.
Pythium damping off	4	Sebring 2.65ST (metalaxyl)	0.75 fl oz/ 100 lb of seed			1	Seed treatment only.
Pythium seedling blight	4	Allegiance FL (metalaxyl)	0.75 fl oz/ 100 lb seed			1	Seed treatment only.
	4	Apron XL LS (mefenoxam)	0.64 fl. oz./ 100 lb seed				
	4	Metastar 2E AG (metalaxyl)	8 pt				Apply as a broadcast soil application and incorporate into top 2 inches.
Pythium seedling diseases	4	Ridomil Gold EC	2 pt			2	See label for specifics regarding preplant incorporated applications and surface applications at the time of planting.
		Ridomil Gold GR	40 lb			2	
		Ultra Flourish (mefenoxam)	4 pt			2	

Table 5.9. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Pythium seedling diseases Continued	4 & 11	Uniform SC (fludioxonil)	0.34 fl oz/1000 ft of row	1 appl.		0	Soil incorporated.
Rhizoctonia bottom rot	2	(iprodione) Many brands available: Enclosure 4F, Iprodione 4L AG, Meteor, Nevado 4F, Rovral 4F	2 pt	6 pt	14	1	
Rhizoctonia	7	Endura 70WG (boscalid)	11 oz	22 oz	14	0.5	
Sclerotinia drop	2	(iprodione) Many brands available: Enclosure 4F, Iprodione 4L AG, Meteor, Nevado 4F, Rovral 4F	2 pt	6 pt	14	1	
	7	Endura 70WG (boscalid)	11 oz	22 oz	14	0.5	
	7	Fontelis 1.67SC (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	
	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	0	0.5	Alternate with fungicide with dissimilar modes of action after 2 applications.
	14	Botran 75W (dichloran)	5.33 lb	5.33 lb	14	0.5	
Septoria	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	0	0.5	Alternate with fungicide with dissimilar modes of action after 2 applications.
	7	Fontelis 1.67SC	24 fl oz	72 fl oz	3	0.5	
	11	Amistar 80DF (azoxystrobin)	5 oz	20 oz	0	4 h	Alternate with fungicides with dissimilar modes of action.
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	0.5	Alternate with fungicides with dissimilar modes of action.
	11	Quadris (azoxystrobin)	15.4 fl oz	2.88 qt	0	4 h	Alternate with fungicides with dissimilar modes of action.
Various seedling diseases	12	Maxim 4FS (fludioxonil)	0.16 fl oz/ 100 lb of seed			0.5	Seed treatment only.
	4 & 11	Uniform SC	0.34 fl oz/ 1000 ft of row	1 appl.		0	Soil incorporated.

¹ FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <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.

Table 5.10. Escarole and Endive fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Alternaria leaf spot	3	Procure 480SC (triflumazole)	8 fl oz	18 fl oz	0	0.5	
	11	Amistar 80DF	5 oz	20 oz	0	4 h	Alternate with fungicides with dissimilar modes of action.
		Quadris (azoxystrobin)	15.4 fl oz	2.88 qt	0	4 h	
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	0.5	Alternate with fungicides with dissimilar modes of action.
	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	0	0.5	Alternate with fungicide with dissimilar modes of action after 2 applications.
Bacterial blight	M1	(copper compounds) Many brands available: Basic Copper 53, Champ DP, Champ Formula 2, Kentan DF, Kocide 3000, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF	SEE INDIVIDUAL LABEL		1	Varies by product from 4 h to 2 days	
Basal rot	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	0	0.5	Alternate with fungicide with dissimilar modes of action after 2 applications.
Septoria							
Gray mold							
Sclerotinia	12	Cannonball WP (fludioxonil)	7 oz	28 oz	0	0.5	
	14	Botran 75W (dichloran)	5.33 lb	5.33 lb	14	0.5	
Botrytis rot	14	Botran 75W (dichloran)	5.33 lb	5.33 lb	14	0.5	
Cercospora leaf spot	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	0.5	Alternate with fungicides with dissimilar modes of action.
Septoria leaf spot	11	Quadris (azoxystrobin)	15.4 fl oz	2.88 qt	0	4 h	Alternate with fungicides with dissimilar modes of action.
Damping off	M3	Defiant 75WP (thiram)	5.3 oz/ 100 lbs of seed			1	Seed treatment only.
Downy mildew	M1	(copper compounds) Many brands available: Basic Copper 53, Champ DP, Champ Formula 2, Kentan DF, Kocide 3000, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF	SEE INDIVIDUAL LABEL		1	Varies by product from 4 h to 2 days	
	M2	(sulfur) Many brands available: Micro Sulf, Microthiol Disperss, Sulfur 90W	SEE INDIVIDUAL LABEL		1	1	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
	11	Amistar 80DF	5 oz	20 oz	0	4 h	Alternate with fungicides with dissimilar modes of action.
		Quadris (azoxystrobin)	15.4 fl oz	2.88 qt	0	4 h	
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	0.5	Alternate with fungicides with dissimilar modes of action.
	11	Reason (fenamidone)	8.2 fl oz	24.6 fl oz	2	0.5	Alternate with fungicides with dissimilar modes of action.
	21	Ranman SC (cyazofamid)	2.75 fl oz	16.5 fl oz	0	0.5	Alternate with fungicides with dissimilar modes of action.
	27 & 11	Tanos (cymoxanil + famoxadone)	8 oz	24 oz	3	0.5	
	33	Aliette 80WDG	5 lb	35 lb	3	0.5	Caution should be used when applying in a management program including copper fungicides.
		Legion 80WDG	5 lb	20 lb	3	0.5	
		Linebacker WDG (fosetyl-Al)	5 lb	20 lb	3	0.5	
	40	Revus (mandipropamid)	8 fl oz	32 fl oz	1	4 h	Do not exceed 2 sequential applications. See label for soil applications.
	43	Presidio (fluopicolide)	4 fl oz	12 fl oz	2	0.5	Must be tank-mixed with a fungicide of different mode of action. Do not exceed two sequential applications.
	45/40	Zampro SC (ametoctradin + dimethomorph)	14 fl oz	42 fl oz	0	0.5	Do not exceed 2 sequential appl.

Table 5.10. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Powdery mildew	M2	(sulfur) Many brands available: Micro Sulf, Microthiol Disperss, Sulfur 90W	SEE INDIVIDUAL LABEL		1	1	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
	3	Procure 480SC (triflumazole)	8 fl oz	18 fl oz	0	0.5	
	7	Fontelis 1.67SC (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	
	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	0	0.5	Alternate with fungicide with dissimilar modes of action after 2 applications. See label for details.
	11	Amistar 80DF Quadris (azoxystrobin)	5 oz 15.4 fl oz	20 oz 2.88 qt	0 0	4 h 4 h	Alternate with fungicides with dissimilar modes of action.
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	0.5	Alternate with fungicides with dissimilar modes of action.
Pythium damping off	4	Sebring 2.65ST (metalaxyl)	0.7 fl oz/ 100 lbs of seed			2	Seed treatment only.
Pythium seedling blight	4	Acquire Allegiance FL (metalaxyl)	0.75 fl oz/ 100 lb seed			1	Seed treatment only.
	4	Metastar 2E AG (metalaxyl)	8 pt			2	Apply as a broadcast soil application and incorporate into top 2 inches.
	4	Apron XL LS (mefenoxam) (mefenoxam)	0.64 fl. oz./100 lb seed			2	
Pythium seedling diseases	4	Ridomil Gold EC Ridomil Gold GR Ultra Flourish (mefenoxam)	2 pt 40 lb 4 pt			2 2 2	See label for specifics regarding preplant incorporated applications and surface applications at the time of planting.
Sclerotinia diseases	11	Amistar 80DF (azoxystrobin)	5 oz	20 oz	0	4 h	Alternate with fungicides with dissimilar modes of action.
Various seedling diseases	4 & 11	Uniform SC (azoxystrobin + mefenoxam)	0.34 fl oz/1000 ft of row	1 appl.		0	Soil incorporated.
	12	Maxim 4FS (fludioxonil)	0.16 fl oz/ 100 lb of seed			0.5	Seed treatment only.

¹FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

²Information 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.

Table 5.11. Spinach fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Anthracnose	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ WG, Champ Formula 2, Champ WP, COC DF, COC WP, Copper Count N, Cueva, Cuprofix Ultra, Kentan DF, Kocide DF, Kocide 2000, Kocide 3000, Kocide 4.5 LF, Mastercop, Nordox, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS				Varies by product from 4 h to 2 days
Downy mildew	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ WG, Champ Formula 2, Champ WP, COC DF, COC WP, Copper Count N, Cuerva, Cuprofix Ultra, Kentan DF, Kocide DF, Kocide 2000, Kocide 3000, Kocide 4.5 LF, Nordox, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS				Varies by product from 4 h to 2 days
	M2	(sulfur) Many brands available: Micro Sulf, Microfine Sulfur, Microthiol Disperss, Suffa, Sulfur 90W, Yellow Jacket Wettable Sulfur	SEE INDIVIDUAL LABELS		1	1	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
	4	Ridomil Gold SL (mefenoxam)	0.25 pt	0.5 pt	21	2	Shank application. A total of two applications may be made.
	4 & M1	Ridomil Gold/Copper WP (mefenoxam + copper hydroxide)	2 lb	4 lb	21	2	Follow Ridomil Gold EC at planting. Apply no more than 2 foliar applications.
	11	Cabrio EG (pyraclostrobin)	16 oz	48 oz	0	0.5	Limit is 3 appl./crop & alternate chemistry.
	11	Quadris (azoxystrobin)	15.4 fl oz	3.75 qt	0	4 h	Alternate with a fungicide of dissimilar mode of action.
	11	Reason (fenamidone)	8.2 fl oz	24.6 fl oz	2	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	27	Curzate 60DF (cymoxanil)	5 oz	30 oz	1	0.5	Use only in combination with a broad spectrum protectant such as copper fungicides
	27 & 11	Tanos 50DF (cymoxanil + famoxadone)	8 oz	72 oz	3	0.5	Do not alternate or tank mix with another FRAC group 11 fungicide.
	33	Aliette80WDG Legion 80WDG Linebacker 80WDG (fosetyl-Al)	5 lbs	35 lb	3	0.5	Caution should be used when applying in a management program including copper fungicides or adjuvants.
	40	Revus 2.08F (mandipropamid)	8 fl oz	32 fl oz	1	4 h	Do not exceed 2 sequential applications. See label for soil applications.
	40 & 45	Zampro SC (dimethomorph + ametoctradin)	14 fl oz	42 fl oz	0	0.5	Do not exceed 2 sequential appl.
	43	Presidio 4L (fluopicolide)	4 oz	1 pt	2	0.5	Must be tank-mixed with a fungicide of a different mode of action. See label for rotational restrictions.
	21	Actigard 50WG (acibenzolar)	0.75 oz	2.25 oz	7	0.5	See label for specific conditions.
White rust	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ WG, Champ Formula 2, Champ WP, COC DF, COC WP, Copper Count N, Cuerva, Cuprofix Ultra, Kentan DF, Kocide DF, Kocide 2000, Kocide 3000, Kocide 4.5 LF, Nordox, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS				Varies by product from 4 h to 2 days
	4	Ridomil Gold SL (mefenoxam)	0.25 pt	0.5 pt	21	2	Shank application. A total of two applications may be made.
	4 & M1	Ridomil Gold/Copper WP (mefenoxam + copper hydroxide)	2 lb	4 lb	21	2	Follow Ridomil Gold EC at planting. Apply no more than 2 foliar applications.
	11	Reason (fenamidone)	8.2 fl oz	24.6 fl oz	2	0.5	Alternate every other application with a fungicide of dissimilar mode of action.

Table 5.11. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
White rust	21	Ranman	2.75 fl oz	13.75 fl oz	0	0.5	Do not make more than 3 sequential applications.
Continued	33	Aliette80WDG Legion 80WDG Linebacker 80WDG (fosetyl-Al)	5 lbs	35 lb	3	0.5	Caution should be used when applying in a management program including copper fungicides or adjuvants.
	43	Presidio 4L (fluopicolide)	4 oz	1 pt	2	0.5	Must be tank-mixed with a fungicide of a different mode of action. See label for rotational restrictions.
	P	Actigard 50WG (acibenzolar)	0.75 oz	2.25 oz	7	0.5	See label for specific conditions.
Cercospora spot	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ WG, Champ Formula 2, Champ WP, COC DF, COC WP, Copper Count N, Cuerva, Cuprofix Ultra, Kentan DF, Kocide DF, Kocide 2000, Kocide 3000, Kocide 4.5 LF, Nordox, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS			Varies by product from 4 h to 2 days	
	M2	(sulfur) Many brands available: Micro Sulf, Microfine Sulfur, Microthiol Disperss, Sulfur 90W, Yellow Jacket Wettable Sulfur	SEE INDIVIDUAL LABELS		1	1	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	Do not make more than 2 sequential applications.
Damping-off	M3	Defiant 75WP (thiram)	5.3 oz/ 100 lb of seed			1	Seed treatment only.
Pythium seedling blight	4	Allegiance FL (metalaxyl)	0.75 fl oz/100 lb of seed			1	Seed treatment only.
	4	Sebring 2.65ST (metalaxyl)	0.75 fl oz/ 100 lb of seed			1	Seed treatment only.
	4	Apron XL LS (mefenoxam)	0.64 fl. oz./ 100 lb seed			2	Seed treatment only.
	4	Metastar 2E AG (metalaxyl)	8 pt			2	Apply as a broadcast soil application and incorporate into top 2 inches. See label for directions.
Pythium seedling diseases	4	Ridomil Gold EC or SL (mefenoxam)	2 pts			2	Apply at seeding in a 7-12" band on soil over seed furrow
	4	Ridomil Gold GR (mefenoxam)	40 lb			2	
	4	Ultra Flourish (mefenoxam)	4 pt			2	See label for specifics regarding preplant incorporated applications and surface applications at the time of planting.
Alternaria & Powdery Mildew	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	Do not make more than 2 sequential applications.
	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	See label for details.
Stemphylium leaf spot	11	Quadris (azoxystrobin)	15.4 fl oz	3.75 qt	0	4 h	Alternate with a fungicide of dissimilar mode of action.
Various seedling diseases	12	Maxim 4FS (fludioxonil)	0.16 fl oz/ 100 lbs of seed			0.5	Seed treatment only.
	P	Actigard 50WG (acibenzolar)	0.75 oz	2.25 oz	7	0.5	Do not apply to young seedlings.

¹FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

²Information 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.

Chapter 6. Legume Production

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Botany and Planting

Snapbean - *Phaseolus vulgaris*, Fabaceae (Leguminosae).

Lima bean - *Phaseolus lunatus*.

Southernpea - *Vigna unguiculata*.

Snowpea - *Pisum sativum*.

Table 6.1. Planting information for legumes.

Planting dates	Snapbean bush	Snapbean pole	Lima bean bush	Lima bean pole	Southernpea	Snowpea
North Florida	Mar - Apr; Aug - Sept	Mar - Apr; Aug - Sept	Mar - Apr; Aug	Mar - Apr; Aug	Mar - July	Jan - Mar
Central Florida	Feb - Apr; Aug - Sept	Feb - Apr; Aug - Sept	Feb - Mar; Aug - Sept	Feb - Mar; Aug - Sept	Feb - Aug	Nov - Feb
South Florida	Sept - Apr	Sept - Apr	Sept - Apr	Sept - Apr	Sept - Apr	Nov - Feb
Planting information						
Distance between rows (in)	18 - 36	36 - 48	18 - 36	36 - 48	20 - 42	36, 2-row beds
Distance between plants (in)	2 - 4	3 - 5	3 - 6	8 - 12	3 - 6	2 - 6
Seeding depth (in)	1 - 1.5	1 - 1.5	1 - 1.5	1 - 1.5	1 - 1.5	1 - 1.5
Seed per acre (lb)	45 - 80	30 - 45	40 - 60	20 - 40	15 - 30	25 - 50
Days to maturity from seed	45 - 60	50 - 70	60 - 80	80 - 100	75 - 90	60 - 80
Plant populations	172,240	58,000	116,160	21,780	104,544	87,120

Cultivars

Table 6.2. Commercial legume cultivars.

Green Bush			Lima		
Ambition	HM 4955	Prevail	Early Thorogreen	Fordhook 242	Jackson Wonder
Bronco	Inspiration	Thoroughbred	Nemagreen	Bridgeton	
Caprice	Momentum	Valentino	Southernpea		
Yellow Bush			CA Blackeye No.5	Knuckle Purplehull	White Acre
Carson	Gold Mine	Golden Rod	Cream 8	Magnolia	Zipper Cream
Gold Rush			Cream 12	Pinkeye Purplehull	
Green Pole			Early Acre	Texas Cream 40	
Dade	Macaslan		Snowpea		
			Oregon Sugarpod II		

Pesticides for Weed, Arthropod and Disease Management for Legume Production.

Table 6.3. Selected herbicides approved for managing weeds in legume production.

Active ingredient lb. a.i./acre	Trade name product/acre	Crops	Weeds controlled / remarks
*** PREEMERGENCE ***			
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Bean (all), pea (all)	Emerged broadleaf control. Burndown treatment before planting or crop emergence. Include a crop oil concentration or nonionic surfactant at recommended rates.
EPTC 2.0 - 4.0	(Eptam) 7 E 2.25 - 4.5 pt.	Bean (green, dry)	Broadleaf and nutsedge weeds. Incorporate in the same operation to reduce volatilization. Do not exceed 9 pt./acre per crop.
Fomesafen 0.25 - 0.38	(Reflex) 2 EC 1.0 - 1.5 pt.	Bean (dry, snap)	Annual broadleaf and grass weeds and nutsedge. Not for use in Miami-Dade county. Do not apply more than 1.5 pt./acre per year.
Glyphosate	(various formulations) consult labels	Bean (all), pea (all)	Emerged broadleaf and grass weeds. Consult individual labels for restrictions.
Halosulfuron 0.02	(Sanda) 75 DF 0.5 oz.	Bean (blackeyed, cowpea, southern pea)	Broadleaf weeds and nutsedge. Apply after planting but before crop emergence. May cause significant, temporary stunting and delay maturity of peas, resulting in delayed harvest.
Imazethapyr 0.02	(Pursuit) 2 L 1.5 fl. oz.	Bean (snap)	Only one application a year. Preplant incorporate within 1 week of planting or preemergence application within 1 day after planting. PHI 30 days.
Imazethapyr 0.05	(Pursuit) 2 L 3.0 fl. oz.	Bean (dry, lima, southern pea, cowpea), pea (dry, English), chickpea	Only one application a year. Preplant incorporate within 1 week of planting or preemergence application within 1 day after planting. Can apply up to 4 oz./acre to southern pea only. Consult label for preharvest interval.
S-metolachlor 0.95 - 1.27	(Brawl, Dual Magnum) 7.62 EC 1.0 - 1.33 pt.	Bean (lima, mung, pinto, snap), bean (southern pea), pea (English)	Annual broadleaf and grass weeds and yellow nutsedge. Consult label for rate based on soil type and specific tank mix directions.
Paraquat 0.5 - 1.0	(Gramoxone) 2 SL 2 - 4 pt. (Firestorm) 3 SL 1.3 - 2.7 pt.	Bean (lima, snap), pea (all)	Emerged Weeds. Apply prior, during, or after planting but before crop emergence. Only three applications a season. Use a nonionic surfactant.
Pelargonic acid	(Scythe) 4.2 EC 3 -10% v/v	Bean (all), pea (all)	Emerged weeds. Apply before crop emergence. Product is a contact, nonselective, foliar-applied herbicides. There is no residual activity.
Pendimethalin 0.5 - 0.75	(Prowl) 3.3 EC 1.2 - 1.8 pt. (Prowl H20) 3.8 1.0 - 1.5 pt.	Bean (dry, lima, snap, garbanzo) bean (southern pea, cowpea), chickpea	Annual broadleaf and grass weeds. Incorporate 1 - 2 in. deep within 7 days of application.
Pyraflufen 0.0008 - 0.003	(ET Herbicide/Defoliant) 0.5 - 2.0 fl. oz.	Bean (all), pea (all)	Emerged broadleaf and grass weeds. Plant 1 day after application. Apply as a preplant burndown treatment.
Saflufenacil 0.027	(Sharpen) 3.42 SL 1.0 fl. oz.	Bean (garbanzo), bean (dry, chickpea)	Broadleaf weeds. Apply as a preplant/preemergence burndown. Sequential application can be applied with 14 days between timings. Do not apply more than 2 fl. oz./acre per season.
Trifluralin 0.5 - 0.75	(Treflan, Trust) 4 EC 1.0 - 1.5 pt. (Treflan, Trifluralin) 10 G 5 - 7.5 lb.	Bean (lima, mung, guar, snap), bean (southern pea), pea (dry, English)	Annual broadleaf and grass weeds. Incorporate 4 in. or less within 8 h. Results in Florida are erratic on soils with low organic matter and clay content. Consult label for rotation restrictions.
*** POSTEMERGENCE ***			
Bentazon 0.5 - 1.0	(Basagran) 4 L 1.0 - 2.0 pt.	Bean (dry, succulent), bean (southern pea), pea (garden, English)	Broadleaf weeds. Apply after the first trifoliate leaf is fully expanded in bean and three pairs of leaves in pea. Yellowing, bronzing, speckling, or leaf burning may occur under certain conditions. This injury is generally outgrown without delaying pod set or maturity. PHI 30 days.
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Bean (all), pea (all)	Emerged broadleaf control. Direct application to row middles for burndown of emerged broadleaf weeds. Include crop oil concentrate or nonionic surfactant at recommended rates. PHI 0 days.
Clethodim 0.094 - 0.25	(Arrow) 2 EC 6 - 16 fl. oz. (Select Max) 1 EC 9 - 32 fl. oz.	Bean (dry), pea (dry)	Annual and perennial grass control. Consult label for bean and pea types. PHI 30 days.
Clethodim 0.094 - 0.25	(Arrow) 2 EC 6 - 16 fl. oz. (Select Max) 1 EC 9 - 32 fl. oz.	Bean (succulent), pea (succulent)	Annual and perennial grass control. Consult label for bean types. PHI 21 days.

Table 6.3. Continued.

Active ingredient lb. a.i./acre	Trade name product/acre	Crops	Weeds controlled / remarks
*** POSTEMERGENCE ***			
EPTC 3.1 -4.0	(Eptam) 7 E 3.5 - 4.5 pt.	Bean (green, dry)	Broadleaf and nutsedge weeds. Apply as layby treatment during the last cultivation of the season. Direct spray solution to the base of the crop. Do not exceed 9 pt./acre per crop.
Fluazifop 0.19 - 0.38	(Fusilade DX) 2 EC 12 - 24 fl. oz.	Bean (dry)	Annual and perennial grass weeds. Do not apply to cowpea. Do not apply more than 48 fl. oz./acre per season. Include a COC or NIS in the spray solution. PHI 60 days.
Fomesafen 0.25 - 0.38	(Reflex) 2 EC 1.0 - 1.5 pt.	Bean (dry, snap)	Annual broadleaf and grass weeds and nutsedge. Not for use in Miami-Dade County. Consult label for rate based on size of specific weed species. Some bronzing, crinkling, or spotting may occur, but the crop will outgrow these effects and develop normally. Do not apply more than 1.5 pt./acre per year.
Halosulfuron 0.02 - 0.03	(Sandea) 75 DF 0.5 - 0.66 oz.	Bean (dry)	Broadleaf weeds and nutsedge. Row middles only. Avoid contact with planted crop. If crop grown on plastic, keep the application off the plastic. Do not apply more than 1 oz./acre per crop.
Halosulfuron 0.02 - 0.03	(Sandea) 75 DF 0.5 - 0.66 oz.	Bean (snap, lima)	Broadleaf weeds and nutsedge. Directed sprays. Apply after the two to four trifoliate leaf stage but before flowering.
Imazethapyr 0.14	(Pursuit) 2 L 3.0 oz.	Bean (dry), bean (southern pea), pea (dry, English)	Do not apply before bean has at least one trifoliate leaf. Apply to peas at least 3 in. in height, but prior to the fifth node and before flowering. Consult label for preharvest intervals.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Bean (all), pea (all)	Emerged weeds. Row middles only. Use a shielded sprayer directed to the row middles to reduce drift to the crop.
Quizalofop 0.04 - 0.08	(Assure II) 6 - 12 fl. oz.	Bean (snap, dry), pea (succulent, dry)	Annual and perennial grass weeds. Allow 7 days between sequential applications to allow for regrowth. Include a COC or NIS in the spray solution. PHI 30 days for succulent pea and dry bean. PHI 60 days for dry pea.
Sethoxydim 0.19 - 0.47	(Poast) 1.5 EC 1.0 - 2.5 pt.	Bean (dry, succulent), pea (dry, succulent)	Growing grass weeds. Decreased efficacy if weeds are under stress. Do not exceed 4.0 pt./acre per season. Include a crop oil concentrate in the spray solution. PHI 30 days for dry bean and dry pea. PHI 15 days for succulent bean and succulent pea.

Table 6.4. Selected insecticides approved for managing insect pests of beans and peas.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Acramite-50 WS (bifenazate)	1.0-1.5 lb	12	3	Twospotted mite, southern red mite	un	Succulent beans and peas and succulent shelled soybeans.
Admire Pro (imidacloprid)	7-10.5 fl oz	12	21	aphids, leafhoppers, thrips, whiteflies	4A	Do not apply more than 10.5 fl oz per acre per season.
Agree WG (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11A	Apply when larvae are small for best control. OMRI-listed ² .
*Agri-Mek SC (abamectin)	1.75-3.5 fl oz	12	7	<i>Liriomyza</i> leafminers, spider mites	6	Dry beans only. Must be mixed with a non-ionic activator type wetting, spreading and/or penetrating adjuvant. Do not use binder or sticker type adjuvants.
*Asana XL (esfenvalerate)	2.9-9.6 fl oz	12	3 - snap 21 - dry	beet armyworm (aids in control), cabbage looper, corn earworm, corn rootworm (adults), cowpea curculio, cucumber beetles, cutworms, European corn borer, flea beetles, grasshoppers, green cloverworm, leafhoppers, Mexican bean beetle, painted lady butterfly (larvae), pea aphid, saltmarsh caterpillar, velvetbean caterpillar	3A	Do not feed or graze livestock on treated vines. Do not apply more than 0.2 lb ai/acre per season (4 applications at highest rate).
Assail 30SG (acetamiprid)	2.5-5.3 oz	12	7	aphids, bean leaf beetle, cucumber beetles, leafhoppers, Mexican bean beetles, thrips, whitefly	4A	Edible podded legumes and succulent shelled peas and beans. Limited to 3 applications per season.
Avaunt (indoxacarb)	3.5 oz	12	7	corn earworm	22	Southern pea (dry) varieties only.
Aza-Direct (azadirachtin)	1-2 pts (max 3.5 pts)	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, mites, stink bugs, thrips, weevils, whiteflies	un	Anti-feedant, repellent, insect growth regulator. OMRI-listed ² .
Azatin XL (azadirachtin)	5-21 fl oz	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, mites, stink bugs, weevils, whiteflies	un	Anti-feedant, repellent, insect growth regulator.
*Baythroid XL (beta-cyfluthrin)	0.8-3.2 fl oz – dry beans & peas 0.8-2.1 fl oz – southern pea	12	7 – dry beans & peas 3 – southern pea	beet armyworm (1 st & 2 nd instar), blister beetle, corn earworm, cowpea curculio, cutworms, fall armyworm (1 st & 2 nd instar), grasshoppers, plant bugs, potato leafhopper, southern armyworm (1 st & 2 nd instar), stinkbugs, yellowstriped armyworm	3A	Maximum amount for dry beans & peas = 6.4 fl oz. Maximum for southern peas = 10.5 fl oz. Not for use on succulent beans or peas, except southern pea. Do not feed treated vines or hay to livestock. Do not use on southern pea or cowpea varieties grown for livestock feed.

Table 6.4. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Belt SC (flubendiamide)	2-3 fl oz	12	1 – edible podded and succulent shelled 14 – dry 3 – forage	armyworms, loopers, corn earworm, cutworms, green cloverworm, skeletonizer and tiers, lesser cornstalk borer, saltmarsh caterpillar, velvetbean caterpillar, others	28	Do not apply more than 6 oz per acre per crop season. Not for soybean.
*Besiege (lambda-cyhalothrin, chlorantraniliprole)	5-9 fl oz	24	edible podded and succulent shelled: 7, dried shelled: 21	cutworms, green cloverworm, Mexican bean beetle, saltmarsh caterpillar, velvetleaf caterpillar, aphids, armyworms, bean leaf beetle, blister beetles, corn earworm, cucumber beetle adults, flea beetles, flea hoppers, grasshoppers, loopers, meadow spittlebug, plant bugs, stink bugs, thrips, tobacco budworm, webworms	3A, 28	Edible podded, succulent shelled, or dried shelled. Soybeans as edible podded only. See label for specific details. Do not exceed 31.0 fl oz of Besiege per acre per year
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11A	Treat when larvae are young. Good coverage is essential. Can be used in the greenhouse. For organic production.
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.
*Brigade 2 EC (bifenthrin)	1.6-6.4 fl oz	12	3 – succulent 14 – dry	aphids, armyworms, bean leaf beetle, cloverworm, corn earworm, corn rootworm adults, cucumber beetles, cutworms, grasshoppers, leafhoppers, loopers, <i>Lygus</i> spp., mites, pea leaf weevil, pea weevil, plant bugs, sap beetles, stink bugs, thrips, webworms, whiteflies	3A	Do not apply more than 12.8 ounces of product per acre per season to succulent beans, peas and dry peas. Maximum of 19.2 oz for dry beans per acre per season.
*Brigadier (bifenthrin, imidacloprid)	3.8-5.5 fl oz	12	Succulent beans and peas: 7, dried beans and peas, 14	aphids, grasshoppers, leafhoppers, <i>Lygus</i> spp., foliage feeding adult thrips, armyworms except beet armyworm, bean leaf beetle, cloverworm, corn earworm, cucumber beetle, loopers, Mexican bean beetle, pea leaf weevil, sap beetle, saltmarsh caterpillar, webworm, whitefly	3A, 4A	Do not apply more than 16.64 fl oz pf Brigadier per acre per season.
*Capture LFR (bifenthrin)	3.4-8.5 fl oz	12	at planting	corn rootworm larvae, wireworm, grubs, root maggot, cutworms, armyworms.	3A	Dried beans and peas. For mixing with liquid fertilizer for soil application. Do not exceed 0.1 lb ai per acre per season as an at-plant application.
Coragen (rynaxypyr)	3.5-7.5 fl oz	4	1	corn earworm, beet armyworm, fall armyworm, <i>Liriomyza</i> leafminer at high rate	28	Foliar application only. No more than 4 applications or 15.4 fl oz per acre per crop. Not for soybeans.
Courier 40SC (buprofezin)	9.0-13.6 fl oz.	12	14	leafhopper nymphs, planthopper nymphs, whitefly nymphs	16	For snap beans only. Allow 14 days between applications. Do not exceed 0.76 lb ai/acre per crop (2 applications at high rate).
Crymax WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2 lb	4	0	caterpillars	11A	Use high rate for armyworms. Treat when larvae are young. Not for organic production.
Deliver (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11A	Use higher rates for armyworms. OMRI-listed ² .
*Diazinon 50W *Diazinon AG500 (diazinon)	4-8 lb 2-4 qt	72	preplant	cutworms, wireworms	1B	Succulent beans and peas only. One application.
*Dibrom 8E (naled)	1-1.5 pt	48	1	aphids, leafhoppers, loopers, <i>Lygus</i> bugs, spider mites	1B	Ground application only, not for cowpeas and field peas for livestock feeding.
Dimethoate 4EC (dimethoate)	0.5-1 pt	48	0: mechanical harvesting	aphids, bean leaf beetle, grasshoppers, leafhoppers, leafminers, <i>Lygus</i> bug, Mexican bean beetle, mites	1B	Do not feed treated vines. Highly toxic to bees.
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2 lb	4	0	looper, soybean looper, green cloverworm, velvetbean caterpillar, 1st and 2nd instar armyworms and podworms	11A	Treat when larvae are young. Good coverage is essential. For organic production.
Entrust SC (spinosad)	3-6 fl oz	4	3 28 - dry	armyworms, corn earworm, leafminers, loopers, thrips	5	Succulent - Do not apply more than 29 fl oz/acre per crop. Dry - Do not apply more than 12.0 fl oz/acre per crop. OMRI-listed ² .
Esteem Ant Bait ((pyriproxyfen)	1.5-2.0 lb	12	1	red imported fire ant	7C	
Extinguish ((S)-methoprene)	1-1.5 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 6.4. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Grandevo (<i>Chromobacterium</i> <i>subtsugae</i> strain PRAA4-1)	1-3 lb	4	0	aphids, armyworms, cabbage looper, corn earworm, green cloverworm, mites, podworms, soybean looper, thrips, velvetbean caterpillar, whiteflies	–	Succulent or dried
Intrepid 2F (methoxyfenozide)	4-16 fl oz	4	7	armyworms, corn earworm (suppression), loopers	18	Do not apply more than 64 fl oz per acre per season or make more than 4 applications per season. Succulent and dried beans & peas
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.50 lbs	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms).	11A	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
Kanemite 15 SC (acequinocyl)	31 fl oz	12	7	twospotted spider mite	20B	Do not make more than two applications per year. Succulent beans, including succulent soybean vegetable, only.
Knack IGR (pyriproxyfen)	8-10 fl oz	12	7	banded wing whitefly, silverleaf whitefly, sweetpotato whitefly	7C	Do not make more than 2 applications per season.
*Lannate LV, *SP (methomyl)	LV: 0.75-3 pts SP: 0.25-1.0 lb	48	See label: varies with rate and crop use	aphids, beet armyworm, corn earworm, cucumber beetles, European corn borer, fall armyworms, leafhoppers, loopers, Lygus bugs, Mexican bean beetle, saltmarsh caterpillar, thrips, variegated cutworm, yellowstriped armyworm	1A	Do not make more than 10 applications per crop.
Malathion 8F (malathion)	1.0 pt	12	3	aphids	1B	Green and dried peas only. Do not make more than two applications per year. Do not graze or feed forage to livestock.
Movento	4-5 fl oz	24	1: succulent 7: dry	aphids, whiteflies	23	Maximum of 10 fl oz per acre per season.
M-Pede 49% EC Soap, insecticidal	1-2% V/V	12	0	aphids, leafhoppers, mites, plant bugs, thrips, whiteflies	--	OMRI-listed ² .
*Mustang (zeta-cypermethrin)	1.4-4.3 oz	12	1 - succulent 21 - dried shelled peas or beans	bean leaf beetle, corn earworm, cowpea curculio, cutworms, fall armyworm, flea beetles, grasshoppers, leafhoppers, lesser cornstalk borer (aids in control), Mexican bean beetle, plant bugs, potato leafhopper, saltmarsh caterpillar, southern armyworm, stink bugs, thrips (aids in control), true armyworm, velvetbean caterpillar, whiteflies (aids in control), yellow-striped armyworm	3A	Do not make applications less than 5 days apart. Not for soybeans. Do not apply more than 0.3 lb ai/acre per season.
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, bean leaf beetle, cabbage looper, corn earworm, cutworms, garden webworm, leafminers, loopers, soybean looper, webworms, whiteflies	un	Acts as IGR and feeding repellent. Does not kill adult insects. OMRI-listed ² .
Orthene 97 (acephate)	0.25-1.0 lb	24	14 - snap beans or dry beans 1 - lima beans, succulent form	aphids (excluding black bean aphid), armyworms (excluding beet armyworm), bean leaf beetle, bean leafroller, cabbage looper, corn earworm, cutworms, European corn borer, fleahoppers, grasshoppers, green cloverworm, leafhoppers, Mexican bean beetle, plant bugs (<i>Lygus</i>), soybean looper, thrips, whiteflies (except silverleaf or sweetpotato whiteflies)	1B	Do not apply more than 2 lb active ingredient per acre per season.
Portal (fenpyroximate)	2.0 pt	12	1	mites, whiteflies	21A	Do not apply more than twice per season. Allow 14 days between applications. Supplemental label.
*Proaxis Insecticide (gamma-cyhalothrin)	1.92-3.84 fl oz	24	7 – edible podded and succulent shelled, 21 – dry beans and peas.	Aphids ⁽¹⁾ , armyworms ⁽²⁾ , bean leaf beetle, blister beetles, corn earworm, cucumber beetles, cowpea curculio ⁽³⁾ , cutworms, flea beetles, grasshoppers, green cloverworm, leafhoppers, leafhoppers, lesser cornstalk borer ⁽¹⁾ , loopers, meadow spittlebug, Mexican bean beetle, painted lady butterfly (larvae), plant bugs, saltmarsh caterpillar, spider mites ⁽¹⁾ , stink bugs, thrips ⁽¹⁾ , tobacco budworm, velvetleaf caterpillar, webworms, whiteflies ⁽¹⁾	3A	⁽¹⁾ Suppression only ⁽²⁾ First and second instars only. ⁽³⁾ For control before larvae bore into the plant stalk or pods. Do not apply more than 1.92 pints per acre per season. Do not graze livestock in treated areas or harvest vines for forage or hay.
Provado 1.6 F (imidacloprid)	3.5 oz	12	7	aphids, leafhoppers, whiteflies	4A	Not recommended following a soil application of Admire. Not for dry soybeans.
Pyganic 5.0 (pyrethrins)	4.5-18 oz	12	0	insects	3A	Treat when insects first appear.
Radiant SC (spinetoram)	3-8 fl oz	4	3 – succulent 28 – dry	armyworms, corn earworm, loopers, <i>Liriomyza</i> leafminers, thrips	5	Do not apply more than 28 fl oz per acre per crop for succulent or 12 fl oz for dry.
Requiem 25EC (<i>Chenopodium</i> <i>ambrosioides</i>)	2.0-4.0 qt	4	0	leafminers (suppression), thrips (western flower thrips and melon thrips), whiteflies	--	Supplemental label. Start applications when pest populations are still low.

Table 6.4. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Rimon 0.83EC (novaluron)	6-12 fl oz	12	1	armyworms, bean leaf beetle, cucumber beetle, loopers, Mexican bean beetle, Lygus, thrips, whiteflies	15	See label for rates for specific pests. Do not apply more than 36 fl oz per acre per season. Do not apply more often than every 7 days.
Sevin 80S, 4 F (carbaryl)	80S: 0.63-1.88 lb 4F: 0.5-1.5 qt	12	14 days for grazing or harvest for forage, or within 3 days of harvest of fresh beans or peas, or within 21 days of harvest of dried beans or peas, seed or hay.	armyworms, bean leaf beetle, blister beetles, corn earworm, cowpea curculio (suppression), cucumber beetles, cutworms, fall armyworm, flea beetles, garden webworm, green cloverworm, leafhoppers, Mexican bean beetle, plant bugs, saltmarsh caterpillar, stink bugs, tarnished plant bug, three-cornered alfalfa hopper, thrips, velvetbean caterpillar, webworms, yellowstriped armyworm	1A	Repeat, as needed, up to 4 times. Applications should be at least 7 days apart.
Sun Spray 98.8%, JMS Stylet-Oil, Saf-T-Side, others (oil, insecticidal)	3-6 qts/100 gal (JMS) 1-2 gal/100 gal (others)	4	0	aphids, leafhoppers, leafminers, mites, thrips, whiteflies	--	Organic Stylet -Oil and Saf-T-Side are OMRI-listed ² .
*Thimet 20 G (phorate)	No more than 7.6 lb	48	60	aphids, leafhoppers, <i>Lygus</i> bugs, Mexican bean beetles, mites, seedcorn maggots, thrips	1B	At planting only. Avoid direct contact with seed.
Trigard (cyromazine)	2.66 oz	12	7	leafminers	17	Dry beans, except soybeans, also succulent beans. Limited to 6 applications.
Trilogy (extract of neem oil)	0.5-2% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .
Vetica Insecticide (flubendiamide, buprofezin)	12.0-17.0 fl oz	12	14	Armyworms, bean leafroller, bean leaf skeletonizer, corn earworm, cutworm species, garden webworm, green cloverworm, lesser cornstalk borer, loopers, saltmarsh caterpillar, leafhoppers, planthoppers, whiteflies	28,16	Snap beans only. Do not make more than 3 applications per crop cycle or apply more than 38 fl oz per acre per crop cycle.
*Warrior II (lambda-cyhalothrin)	0.96-1.92	24	7 - edible podded and succulent shelled 21 - dried, shelled	aphids, bean leaf beetle, beet armyworm ⁽²⁾ , corn earworm, cutworms, cucumber beetle adults, green clover worm, fall armyworm (1 st & 2 nd instar), flea beetles, grasshoppers, leafhoppers, leafminers, lesser cornstalk borer ⁽²⁾ , loopers, Mexican bean beetle, plant bugs, spider mites ⁽²⁾ , stink bugs, thrips ⁽¹⁾ , whiteflies ⁽²⁾ , yellowstriped armyworm (1 st & 2 nd instar)	3A	⁽¹⁾ Does not include western flower thrips. ⁽²⁾ Suppression only.
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

* Restricted use insecticide.

Table 6.5. Bean, pea, and other legume fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Anthracnose	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ Formula 2, Champ WG, COC DF, COC WP, Copper Count N, Cueva, Cuprofix Ultra, Kentan DF, Kocide DF, Kocide 2000, Kocide 3000, MasterCop, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		Varies	Varies from 4 h to 2 days	
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weatherstik, Bravo ZN, Chloronil 720, Chlorothalonil 720 SC, Echo 720, Echo 90 DF, Echo ZN, Equus 500 ZN-Fungicide, Equus -DF Fungicide, Equus 720 SST, Initiate 720	SEE INDIVIDUAL LABELS		7 or 14	0.5	Do not use on crops for livestock

Table 6.5. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Anthracnose Continued	1	(thiophanate-methyl) Many brands available: Thiophanate-methyl 85 WDG Topsin M 70WP, Topsin 4.5FL, Topsin M 70 WDG, Topsin M WSB	SEE INDIVIDUAL LABELS		14 to 28 (see label)	1 (succulent beans) 3 (dry beans)	Apply once at 50-70% bloom or twice (max.=1 ½ lbs/appl.) with first at 10-30% bloom and second at peak bloom.
	3	Tilt (propiconazole)	4 fl oz	12 oz	7		Supplemental label: For control of web blight caused by <i>Rhizoctonia solani</i> . Not labeled for cowpea used for livestock feed.
	7	Fontelis Vertisan (penthioopyrad)	30 fl oz 20 fl oz	72 fl oz 41 fl oz	0 (Fontelis) 21 (Vertisan)	0.5	No more than 2 sequential appl. Before alternating to a non-FRAC 7 fungicide. Vertisan only labeled for dry edible beans.
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	16 fl oz	7 or 21	12 h	Limit 2 appl/season. Crop can not be used for livestock until 14 days after last application.
	11	Headline (pyraclostrobin)	9 fl oz	18 fl oz	7 or 21	4 h	No more than 2 sequential appl. before alternating to a non-FRAC 11 fungicide.
	11	Quadris (azoxystrobin)	15.5 fl oz	92.3 fl oz	14 (dry) 0 (succulent)	4 h	No more than 2 sequential appl. before alternating to a non-FRAC 11 fungicide.
	11 & M5	Quadris Opti	2.4 pt	9.6 pt	14 (dry)	0.5	Only labeled for dry edible beans. Limit 4 appl/crop. No more than 2 sequential appl. before alternating to a non-FRAC 11 fungicide.
	11 & 3	Quilt Xcel Quilt (azoxystrobin + propiconazole)	14 fl oz	42 fl oz	14 (dry) 7 (succulent)	0.5	Supplemental label: Do not use on cowpea cultivars intended for livestock.
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weatherstik, Bravo ZN, Chloronil 720, Chlorothalonil 720 SC, Echo 720, Echo 90 DF, Echo ZN, Equus 500 ZN-Fungicide, Equus –DF Fungicide, Equus 720 SST, Initiate 720	SEE INDIVIDUAL LABELS		7 or 14	0.5	Do not use on crops for livestock
	3	Tilt (propiconazole)	4 fl oz	12 oz	7		Supplemental label: For control of web blight caused by <i>Rhizoctonia solani</i> . Not labeled for cowpea used for livestock feed.
Ascochyta blight	3	Proline 480SC (prothioconazole)	5.7 fl oz	17.1 fl oz	7	0.5	Only labeled for chickpea, lentils and dry-edible peas and beans.
	7	Endura (boscalid)	11 oz	22 oz	21 (dry) 7 (succulent)	0.5	Limit 2 appl/crop & alternate chemistry
	7	Fontelis Vertisan (penthioopyrad)	30 fl oz 20 fl oz	72 fl oz 41 fl oz	0 (Fontelis) 21 (Vertisan)	0.5	No more than 2 sequential appl. Before alternating to a non-FRAC 7 fungicide. Vertisan only labeled for dry edible beans.
	7 & 3	Propulse (fluopyram + prothioconazole)	10.3 fl oz	20.5 fl oz	14	2	For dry-edible beans and peas. Do not use on crops for livestock.
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	16 fl oz	7 or 21	12 h	Limit 2 appl/season. Crop can not be used for livestock until 14 days after last application.
	11	Headline (pyraclostrobin)	9 fl oz	18 fl oz	7 or 21	4 h	No more than 2 sequential appl. before alternating to a non-FRAC 11 fungicide.
	11	Quadris (azoxystrobin)	15.5 fl oz	92.3 fl oz	14 (dry) 0 (succulent)	4 h	No more than 2 sequential appl. before alternating to a non-FRAC 11 fungicide.
	11 & M5	Quadris Opti	2.4 pt	9.6 pt	14 (dry)	0.5	Only labeled for dry edible beans. Limit 4 appl/crop. No more than 2 sequential appl. before alternating to a non-FRAC 11 fungicide.
	11 & 3	Quilt Xcel Quilt (azoxystrobin + propiconazole)	14 fl oz	42 fl oz	14 (dry) 7 (succulent)	0.5	Supplemental label: Do not use on cowpea cultivars intended for livestock.

Table 6.5. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Bacterial Brown spot, Bacterial blight, Common blight, Halo blight	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ Formula 2, Champ WG, COC DF, COC WP, Copper Count N, Cueva, Cuprofix Ultra, Kentan DF, Kocide DF, Kocide 2000, Kocide 3000, MasterCop, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		Varies	Varies from 4 h to 2 days	
	M1 & M2	Top Cop with Sulfur (basic copper sulfate; sulfur)	4 pt		0	1	Do not use in aluminum tanks
Botrytis or Gray mold	M1	Cueva (copper) (copper octanoate)	2 gal	-	0	4 h	
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weatherstik, Bravo ZN, Chloronil 720, Chlorothalonil 720 SC, Echo 720, Echo 90 DF, Echo ZN, Equus 500 ZN-Fungicide, Equus –DF Fungicide, Equus 720 SST, Initiate 720	SEE INDIVIDUAL LABELS		7 or 14	0.5	Do not use on crops for livestock
	1	(thiophanate-methyl) Many brands available: Thiophanate-methyl 85 WDG, Topsin M 70WP, Topsin 4.5FL, Topsin M 70 WDG, Topsin M WSB	SEE INDIVIDUAL LABELS		14 to 28 (see label)	1 (succulent beans) 3 (dry beans)	Apply once at 50-70% bloom or twice (max.=1 ½ lbs/appl.) with first at 10-30% bloom and second at peak bloom.
	2	Enclosure 4 Iprodione 4L AG, Nevado 4F, Rovral 4 Flowable Fungicide (iprodione)	2 pt	4 pt	0	1	Limit 2 applications per season. Not for use as livestock feed
	7	Endura (boscalid)	11 oz	22 oz	7 (succulent)	0.5	Limit 2 appl/crop & alternate chemistry
	7	Fontelis (penhiopyrad)	30 fl oz	72 fl oz	0	0.5	
	7	Vertisan (penhiopyrad)	20 fl oz	41 fl oz	21	0.5	Only labeled for dried shelled beans and peas.
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	16 fl oz	7 or 21	12 h	Limit 2 appl/season. Crop can not be used for livestock until 14 days after last application.
	9 & 12	Switch 62.5 WG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	
	12	Cannonball WP (fludioxonil)	7 oz	28 oz	7	0.5	Not labeled for cowpeas. After 2 appl. must alternate with a non-FRAC 12 fungicide for 2 appl.
	19	Oso 5%SC (polyoxin D zinc salt)	13 fl oz	75.8 fl oz	-	4 h	Limit 6 appl/crop.
	29	Omega 500F (fluazinam)	0.85 pt	1.75 pt	14 (edible-podded and succulent)	2	
Cercospora leaf spot	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ Formula 2, Champ WG, COC DF, COC WP, Copper Count N, Cueva, Cuprofix Ultra, Kentan DF, Kocide DF, Kocide 2000, Kocide 3000, MasterCop, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		Varies	Varies from 4 h to 2 days	
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weatherstik, Bravo ZN, Chloronil 720, Chlorothalonil 720 SC, Echo 720, Echo 90 DF, Echo ZN, Equus 500 ZN-Fungicide, Equus –DF Fungicide, Equus 720 SST, Initiate 720	SEE INDIVIDUAL LABELS		7 or 14	0.5	Do not use on crops for livestock

Table 6.5. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Cercospora leaf spot Continued	7	Endura (boscalid)	11 oz	22 oz	7 (succulent)	0.5	Limit 2 appl./crop & alternate chemistry
	7	Fontelis (penthioopyrad)	30 fl oz	72 fl oz	0	0.5	
	7	Vertisan (penthioopyrad)	20 fl oz	41 fl oz	21	0.5	Only labeled for dried shelled beans and peas.
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	16 fl oz	7 or 21	12 h	Limit 2 appl./season. Crop can not be used for livestock until 14 days after last application.
	11	Headline, Headline SC, (pyraclostrobin)	9 fl oz	18 fl oz	7	0.5	Limit 2 appl./crop & alternate chemistry
	11	Quadris (azoxystrobin)	15.5 fl oz	92.3 fl oz	14 (dry) 0 (succulent)	4 h	No more than 2 sequential appl. before alternating to a non-FRAC 11 fungicide.
Downy mildew	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ Formula 2, Champ WP, COC DF, Cueva, Cuprofix Ultra, Kentan DF, Kocide 3000, Nordox, Nordox 75 WG, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS			4 h to 2 days (see label)	
	M1 & M2	Top Cop with Sulfur (basic copper sulfate + sulfur)	4 pt		0	1	Do not use in aluminum tanks
	M1 & 4	Ridomil Gold /Copper (copper hydroxide + mefenoxam)	2 lb	8 lb	3	2	Limit 4 appl./crop
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weatherstik, Bravo ZN, Chloronil 720, Chlorothalonil 720 SC, Echo 720, Echo 90 DF, Echo ZN, Equus 500 ZN-Fungicide, Equus –DF Fungicide, Equus 720 SST, Initiate 720	SEE INDIVIDUAL LABELS		7 or 14	0.5	Do not use on crops for livestock
	4	Ridomil Gold SL (mefenoxam)	0.2 pt	0.8 pt	3	2	Must be tank mixed with other effective fungicides.
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	16 fl oz	7 or 21	12 h	Limit 2 appl./season. Crop can not be used for livestock until 14 days after last application.
	11	Headline, Headline SC, (pyraclostrobin)	9 fl oz	18 fl oz	7	0.5	Limit 2 appl./crop & alternate chemistry
	11	Quadris (azoxystrobin)	15.5 fl oz	92.3 fl oz	14 (dry) 0 (succulent)	4 h	No more than 2 sequential appl. before alternating to a non-FRAC 11 fungicide.
	21	Ranman (cyazofamid)	2.75 fl oz	16.5 fl oz	0	0.5	Not labeled for cowpea used for livestock feed. Limit 6 appl./crop. No more than three sequential appl. before rotating chemistry.
	40	Forum (dimethomorph)	6 fl oz	30 fl oz	-	0.5	Labeled for lima beans intended for harvest as succulent seed only. Limit 5 appl./season. Do not add spreading/penetrating adjuvant.
	4	Allegiance FL Acquire Sebring 2.65 ST (metalaxyl)	0.75 fl oz/100 lb seed	-	-	1	Seed treatment
	4	Apron XL (mefenoxam)	0.64 fl oz/100 lbs of seed	-	-	2	Seed treatment only
Phytophthora	4	Ridomil Gold SL (mefenoxam)	0.2 pt	0.8 pt	3	2	Must be tank mixed with other effective fungicides.
	4 & 12	Apron Maxx RFC (mefenoxam + fludioxonil)	1.5 fl oz/100 lbs seed	-	-	2	Seed treatment only
	4 & 12	Apron Maxx RTA (mefenoxam + fludioxonil)	5 fl oz/100 lbs seed	-	-	2	Seed treatment only
	21	Ranman (cyazofamid)	2.75 fl oz	16.5 fl oz	0	0.5	Not labeled for cowpea used for livestock feed. Limit 6 appl./crop. No more than three sequential appl. before rotating chemistry.

Table 6.5. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Pod tip rot	3	Rally 40WSP Sonoma 40 WSP (myclobutanil)	4-5 oz	1.25 lb	0	1	Observe a 30-day plantback interval
	4 & 12	Apron Maxx RFC (mefenoxam + fludioxonil)	1.5 fl oz/100 lbs seed	-	-	2	Seed treatment only
	4 & 12	Apron Maxx RTA (mefenoxam + fludioxonil)	5 fl oz/100 lbs seed	-	-	2	Seed treatment only
Powdery mildew	M1	(copper compounds) Many brands available: Basic Copper 53, Cueva, Cuprofix Ultra, Nu-Cop 3L	SEE INDIVIDUAL LABELS			4 h to 2 days (see label)	
	M2	(sulfur) Many brands available: Kumulus DF Fungicide-Acaricide, Micro Sulf, Microfine Sulfur, Microthiol Disperss, Sulfur 90W, Wettable Sulfur, Yellow Jacket Dusting Sulfur, Yellow Jacket Wettable Sulfur	SEE INDIVIDUAL LABELS			1	Do not apply during periods of warm weather to avoid phytotoxicity
	M1 & M2	Top Cop with Sulfur (basic copper sulfate + sulfur)	4 pt/ treated acre		0	1	Do not use in aluminum tanks
Pythium damping-off & root rot	11	Headline, Headline SC, (pyraclostrobin)	9 fl oz	18 fl oz	7	0.5	Limit 2 appl/crop & alternate chemistry
	4	Allegiance FL Acquire Sebring 2.65 ST (metalaxyl)	0.75 fl oz/100 lb seed	-	-	1	Seed treatment
	4	Metastar 2E AG (metalaxyl)	4 pt	-	-	2	Preplant incorporated at planting or soil surface after planting. Do not use in greenhouse or field- grown bedding plants.
	4	Apron XL (mefenoxam)	0.64 fl oz/100 lbs of seed	-	-	2	Seed treatment only
	4	Ridomil Gold SL (mefenoxam)	0.2 pt	0.8 pt	3	2	Must be tank mixed with other effective fungicides.
	4	Ultra Flourish (mefenoxam)	2 pt	-	-	2	Apply as a broadcast soil application at preplant or as a surface application at planting
	4 & 12	Apron Maxx RFC (mefenoxam + fludioxonil)	1.5 fl oz/100 lbs seed	-	-	2	Seed treatment only
	4 & 12	Apron Maxx RTA (mefenoxam + fludioxonil)	5 fl oz/100 lbs seed	-	-	2	Seed treatment only
	4 & 14	Ridomil Gold PC GR (mefenoxam + PCNB)	12 oz / 1000 row feet	-	-	2	Do not use on crops for livestock. Apply directly soil surrounding seed at planting.
Rhizoctonia diseases (root & stem rot)	3	Tilt (propiconazole)	4 fl oz	12 oz	7	0.5	Supplemental label: For control of web blight casued by <i>Rhizoctonia solani</i> . Not labeled for cowpea used for livestock feed.
	4 & 12	Apron Maxx RFC (mefenoxam + fludioxonil)	1.5 fl oz/100 lbs seed	-	-	2	Seed treatment only
	4 & 12	Apron Maxx RTA (mefenoxam + fludioxonil)	5 fl oz/100 lbs seed	-	-	2	Seed treatment only
	4 & 14	Ridomil Gold PC GR (mefenoxam + PCNB)	12 oz / 1000 row feet	-	-	2	Do not use on crops for livestock. Apply directly soil surrounding seed at planting.
	11	Dynasty (azoxystrobin)	0.765 fl oz/100 lbs seed	-	-	4 h	Seed treatment only
	11	Quadris (azoxystrobin)	15.5 fl oz	92.3 fl oz	14 (dry) 0 (succulent)	4 h	No more than 2 sequential appl. before alternating to a non-FRAC 11 fungicide.
	11	Trilex FL (trifloxystrobin)	0.32 fl oz/ 100 lbs seed	-	-	0.5	Seed treatment only

Table 6.5. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Rhizoctonia diseases (root & stem rot) Continued	11 & M5	Quadris Opti	2.4 pt	9.6 pt	14 (dry)	0.5	Only labeled for dry edible beans. Limit 4 appl/crop. No more than 2 sequential appl. before alternating to a non-FRAC 11 fungicide.
	11 & 3	Quilt Xcel Quilt (azoxystrobin + propiconazole)	14 fl oz	42 fl oz	14 (dry) 7 (succulent)	0.5	Supplemental label: Do not use on cowpea cultivars intended for livestock.
	11 & 4	Uniform (azoxystrobin + mefenoxam)	0.34 fl oz/1000 row ft	-	-	0	Apply to furrow or covering soil at planting. Only one application per season.
	12	Maxim 4FS (fludioxonil)	0.16 fl oz/100 lbs seed	-	-	0.5	Seed treatment only
	14	Blocker 4F Blocker Flowable (PCNB)	2 pt 3 pt	- -	0 0	0.5 0.5	Avoid tank mixing with highly acidic pesticides as this may reduce efficacy; Apply to seed furrow and covering soil; Do not spray seed directly.
Rust	M1 & M2	Top Cop with Sulfur (basic copper sulfate + sulfur)	4 pt		0	1	Do not use in aluminum tanks
	M2	(sulfur) Many brands available: Kumulus DF Fungicide-Acaricide, Micro Sulf, Microfine Sulfur, Microthiol Disperss, Sulfur 90W, Wettable Sulfur, Yellow Jacket Dusting Sulfur, Yellow Jacket Wettable Sulfur	SEE INDIVIDUAL LABELS			1	Do not apply during periods of warm weather to avoid phytotoxicity
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weatherstik, Bravo ZN, Chloronil 720, Chlorothalonil 720 SC, Echo 720, Echo 90 DF, Echo ZN, Equus 500 ZN-Fungicide, Equus -DF Fungicide, Equus 720 SST, Initiate 720	SEE INDIVIDUAL LABELS		7 or 14	0.5	Do not use on crops for livestock
	3	Rally 40WSP Fungicide Sonoma 40 WSP (myclobutanil)	5 oz	1.25 lb	0	1	Observe a 30-day plantback interval
	3	Monsoon, Orius 3.6 F, Tebustar 3.6L, Tebuzol 3.6F, Toledo (tebuconazole)	6 fl oz	24 fl oz (fresh) 12 fl oz (dry)	7 (fresh) 14 (dry)	0.5	
	3	Tilt (propiconazole)	4 fl oz	12 oz	7	0.5	Supplemental label: For control of web blight caused by <i>Rhizoctonia solani</i> . Not labeled for cowpea used for livestock feed.
	3	Proline 480SC (prothioconazole)	5.7 fl oz	17.1 fl oz	7	0.5	Only labeled for chickpea, lentils and dry-edible peas and beans.
	7	Fontelis Vertisan (penthiopyrad)	30 fl oz 20 fl oz	72 fl oz 41 fl oz	0 (Fontelis) 21 (Vertisan)	0.5	No more than 2 sequential appl. Before alternating to a non-FRAC 7 fungicide. Vertisan only labeled for dry edible beans.
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	16 fl oz	7 or 21	12 h	Limit 2 appl/season. Crop can not be used for livestock until 14 days after last application.
	11	Headline (pyraclostrobin)	9 fl oz	18 fl oz	7 or 21	4 h	No more than 2 sequential appl. before alternating to a non-FRAC 11 fungicide.
	11	Quadris (azoxystrobin)	15.5 fl oz	92.3 fl oz	14 (dry) 0 (succulent)	4 h	No more than 2 sequential appl. before alternating to a non-FRAC 11 fungicide.
	11 & M5	Quadris Opti	2.4 pt	9.6 pt	14 (dry)	0.5	Only labeled for dry edible beans. Limit 4 appl/crop. No more than 2 sequential appl. before alternating to a non-FRAC 11 fungicide.
	11 & 3	Quilt Xcel Quilt (azoxystrobin + propiconazole)	14 fl oz	42 fl oz	14 (dry) 7 (succulent)	0.5	Supplemental label: Do not use on cowpea cultivars intended for livestock.

Table 6.5. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Rust	19	Oso 5%SC	13 fl oz	75.8 fl oz		4 h	Limit 6 appl/crop.
Continued		(polyoxin D zinc salt)					
White mold	1	(thiophanate-methyl) Many brands available: Thiophanate-methyl 85 WDG Topsin M 70WP, Topsin 4.5FL, Topsin M 70 WDG, Topsin M WSB	SEE INDIVIDUAL LABELS		14 to 28 (see label)	1 (succulent beans) 3 (dry beans)	Apply once at 50-70% bloom or twice (max.=1 ½ lbs/appl.) with first at 10-30% bloom and second at peak bloom.
	2	Iprodione 4L AG, Enclosure 4, Nevado 4F, Rovral 4 F (iprodione)	2 pt	4 pt	0	1	Limit 2 applications per season. Not for use as livestock feed
	3	Proline 480SC (prothioconazole)	5.7 fl oz	17.1 fl oz	7	0.5	Only labeled for chickpea, lentils and dry-edible peas and beans.
	3	Tilt (propiconazole)	4 fl oz	12 oz	7	0.5	Supplemental label: For control of web blight caused by <i>Rhizoctonia solani</i> . Not labeled for cowpea used for livestock feed.
	7	Endura (boscalid)	11 oz	22 oz	7 (succulent)	0.5	Limit 2 appl/crop & alternate chemistry
	7	Fontelis Vertisan (penthiopyrad)	30 fl oz 20 fl oz	72 fl oz 41 fl oz	0 (Fontelis) 21 (Vertisan)	0.5	No more than 2 sequential appl. Before alternating to a non-FRAC 7 fungicide. Vertisan only labeled for dry edible beans.
	7 & 3	Propulse (fluopyram + prothioconazole)	10.3 fl oz	20.5 fl oz	14	2	For dry-edible beans and peas. Do not use on crops for livestock.
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	16 fl oz	7 or 21	12 h	Limit 2 appl/season. Crop can not be used for livestock until 14 days after last application.
	9 & 12	Switch 62.5 WG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	
	12	Cannonball WP (fludioxonil)	7 oz	28 oz	7	0.5	Not labeled for cowpeas. After 2 appl. must alternate with a non-FRAC 12 fungicide for 2 appl.
	14	Blocker 4F (PCNB)	2 pt	-	0	0.5	Avoid tank mixing with highly acidic pesticides as this may reduce efficacy; Apply to seed furrow and covering soil; Do not spray seed directly.
	14	Botran 5F (DCNA dicloran)	1.6 qt	3.2 qt	2	0.5	Do not feed treated plants to livestock
	29	Omega 500F (fluzinam)	0.85 pt	1.75 pt	14 (edible-podded and succulent beans)	2	

¹ FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <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.

Chapter 7. Specialty and Minor Vegetable Crop Production

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I. Asian Vegetables

The term “Asian vegetable” is a broad one which encompasses both vegetables grown in the countries that comprise Asia and those eaten by people of Asian extraction or who like Asian cuisine. Since many of the vegetables which are described in this chapter are members of families that are covered in depth in other chapters in this volume, that information will not be duplicated.

Crucifers

This group includes mostly crops with edible leaves. The exceptions are kohlrabi, with an edible swollen stem and daikon which is an edible root. They can be grown on raised beds without mulch (or with mulch if it is cost effective) and with drip, overhead or subsurface irrigation. Fertilizer recommendations for these crops are found in under broccoli, cabbage or Chinese cabbage. For pest control products, these crops are included under Cole crops, with the exception of daikon.

Botany and Planting

Cabbage - flat - *Brassica oleracea* var. *capita*, Brassicaceae (cruciferae)

Chinese broccoli - gailan or gai lan / kailan or kai lan / flowering kale - *Brassica oleracea* var. *alboglabra*

Chinese cabbage - [includes: napa (tight headed) and chi-hili (semi-loose headed)] - *Brassica rapa* var. *pekinensis*

Chinese mustard - (includes: bok choy, Shanghai choy / baby bok choy, yuchoi / yuchoy / u-choi / choy sum - *Brassica rapa* subsp. *chinensis*)

Kohlrabi - *Brassica oleracea* var. *gongylodes*

Oriental radish - Daikon (Japanese) / lobok or lo bok (Chinese) – *Raphanus sativus* var. *longipinnatus*

Table 7.1. Planting information for Asian brassicas.

Planting dates	Chinese broccoli	Chinese cabbage	Chinese mustard	Daikon
North Florida	Aug - Feb	Aug - Feb	Aug - Feb	Sept- Mar
Central and South Florida	Sept- Apr	Sept- Apr	Sept- Apr	Sept- Apr
Planting information				
Number of rows/44-inch wide beds (6-ft centers)	3-4	2-3	4	3 (fall/spring); 4 (winter)
Distance between rows (in)	11	14 or 24	14 - mustard 11 - others (below)	11
Distance between plants (in)	3-5	14-18	12-18 (mustard); 8-12 (Shanghai/choy sum); 6-10 (baby bok choy); 2-4 (u-choy)	6-9
Seeding depth (in)	0.25 – 0.5	0.25 – 0.5	0.25 – 0.5	0.25
Plant populations (acre)	116,160	18,671	29,040 (mustard); 43,560 (Shanghai/choy sum); 58,080 (baby bok choy); 174,240 (u-choy)	58,080

Cultivars

Table 7.2. Asian brassicas cultivars.

Cabbage, flat	Drumhead, KK Cross, KY Cross
Chinese broccoli / gailan / flowering kale	Green Lance
Chinese cabbage napa (tight-headed) chihili (semi-loose headed)	China Express, China Pride Michihili, Monument, Jade Pagoda
Chinese mustard bok choy Shanghai choy / baby bok choy yuchoi / u-choi / choy sum	Canton Choice, Ching-Chiang, Hybrid Lucky choy, Long White, Short White Dynasty, Shanghai Green Dwarf, Extra Dwarf
Kohlrabi	Peking, Purple
Oriental radish	Daikon (Japanese): Everest, Hybrid Everest, Mikura Cross, Mino Early, Relish Lobok / lo bok (Chinese): Red Meat

Cucurbits

This group includes species eaten either immature or mature, and several vegetables with edible tender stems and leaves. All can be grown on raised beds, with or without plastic mulch, and with drip, overhead or subsurface irrigation. Most of the crops are trellised, primarily to maximize space, minimize bud drop and fruit rot caused by over shading and exposure to soil moisture and diseases and promote straight fruit. Winter melon is the exception since it is generally too heavy to trellis. Fertilizer recommendations for cucumbers are applicable for fuzzy melon, long gourd, both luffas, bittermelon and snake gourd. Recommendations for watermelon should be followed for winter melon and chayote. With the exception of chayote, where the entire fruit is planted, these crops are started from seed and grown as transplants prior to being set in the field. For pest control products, these crops are included in the cucurbit crop chapter.

Table 7.3. Planting information for Asian cucurbits.

Planting dates	Bittermelon	Long gourd	Angled luffa	Smooth luffa
North Florida	Feb – Apr; July – Aug	Feb – Apr; July – Aug	Feb – Apr; July – Aug	Feb – Apr; July – Aug
Central Florida	Jan – Mar; Sept	Jan – Mar; Sept	Jan – Mar; Sept	Jan – Mar; Sept
South Florida	Sept - Feb	Sept - Feb	Sept - Feb	Sept - Feb
Palnting information				
Distance between rows (in)	60 – 72	60 – 72	60 – 72	60 – 72
Distance between plants (in)	36 – 60	36 – 60	36 – 60	36 – 60
Days to maturity from seed	80 – 100			
Plant populations (acre)	2904	2904	2904	2904
Planting dates	Fuzzy melon	Snake gourd	Chayote	Winter melon
North Florida	Feb – Apr; July – Aug	Feb – Apr; July – Aug	Not recommended	Feb 15 – Apr 15
Central Florida	Jan – Mar; Sept	Jan – Mar; Sept	Not recommended	Jan 15 – Mar 15
South Florida	Sept - Feb	Sept - Feb	Sept - Feb	Dec 15 – Mar 1
Planting information				
Distance between rows (in)	60 – 72	60 – 72	60 – 72	72 – 108
Distance between plants (in)	36 – 60	36 – 60	36 – 60	36 – 72
Seeding depth (in)	1.5 – 2.0	1.5 – 2.0	Whole fruit is used: It should be covered half way	1.5 – 2.0
Seed per acre			2904 – whole fruit	
Plant populations (acre)	2904	2904	2904	1452-2420

Botany and Planting

Bittermelon - (Chinese and Indian types) - *Momordica charantia*

Chayote - *Sechium edule*

Fuzzy melon - (immature fruit) and winter melon (mature fruit)
- *Benincasa hispida*

Long gourd - (oopoh) - *Lagenaria siceraria*

Angled luffa - (silk squash) - *Luffa acutangula*

Smooth luffa - *Luffa aegyptica* (cylindrica)

Snake gourd - *Trichosanthes cucumerina*

Cultivars

Table 7.4. Cultivars and trellising requirements of Asian cucurbits.

Crop	Cultivars	Trellising
Bittermelon – Chinese	Chinese: Hong Kong Green, Hybrid Bangkok Large, Japan Green Sprinkle, Taiwan Large	Yes
Bittermelon - Indian	Indian: Hybrid India Star NS, India Green Queen, India Long Green	
Chayote (short lived perennial)	The seed is the viviparous fruit itself. There is some debate as to whether varieties remain true. Fruit purchased from grocery stores may not sprout	Yes
Fuzzy melon	Chiang Shin Joker, Seven Star Long	Yes
Long gourd	Hybrid India Long, Hybrid Asia Short	Yes
Angled luffa	Hybrid Green Glory, Lucky Boy, Summer Long	Yes
Smooth luffa	Smooth Beauty, Smooth Boy	Yes
Snake gourd	Extra Long Dancer, Hybrid Snaky, Long EX	Yes
Winter melon	Hybrid Asia Sweet, Hybrid Red Doll, Hybrid Wonder Wax	No

Legumes

The Asian legume group includes fruits (usually known as pods), which are eaten at the immature stage, crop with edible immature seeds (green shell), and stem tips. The winged bean also has edible leaves and roots, though the latter do not appear to be cultivated commercially in the continental U.S. All the pole or indeterminate types can be grown on raised beds without mulch using drip, overhead or subsurface irrigation. Fenugreek does not grow well in rocky soils, such as those found in Miami-Dade County. Pigeon peas are a semi-perennial shrub in warmer areas. Many pigeon pea and winged bean varieties are short day and only flower during the fall. There are some day neutral varieties available of both crops. Edamame varieties, especially those from seed companies in the U.S., are sensitive to daylength, so care must be taken to select varieties for one's growing area. Japanese varieties are classified as "summer" or "fall" types, which indicates when they flower. Fertilizer recommendations for pole beans are generally applicable to this group. All of these crops

are started from seed, though winged beans require scarification prior to planting. All the indeterminate types need some type of support, ranging from individual bamboo stakes to trellises. For pest control products, these crops are included in the legume crop chapter, with the exception of pea shoots which are not in a crop group at present.

Botany and Planting

Cluster bean, Guar – *Cyamopsis tetragonolobus*

Edamame – *Glycine max*

Fenugreek, methi – *Trigonella foenum-gracum*

Hyacinth bean, lablab bean – *Lablab purpureus* (*Dolichos lablab*, *D. nigar*, *Lablab vulgaris*)

Pigeon pea – *Cajanus cajan*

Snow / snap (edible podded) pea – *Pisum sativum*

Winged bean – *Psophocarpus tetragonolobus*

Yard-long bean – *Vigna unguiculata*

Table 7.5. Planting and information for Asian legumes.

Planting dates	Cluster bean/Guar	Fenugreek	Edamame	Hyacinth bean
North Florida	Mar – Apr; Aug	Mar – Apr; Aug	Mar – Apr; Aug	Mar – Apr; Aug
Central Florida	Feb – Mar; Aug – Sept	Feb – Mar; Aug – Sept	Feb – Mar; Aug – Sept	Feb – Mar; Aug – Sept
South Florida	Sept – Apr	Sept – Apr	Sept – Apr	Sept – Apr
Planting information				
Distance between rows (in)	24	9	20 – 24	20
Distance between plants (in)	6	2 – 3, thin to 4 (if only growing a small amount)	2 – 6	4 – 6
Seeding depth (in)	1 – 1.5	1 – 1.5	1 – 1.5	1 – 1.5
Seed per acre	43,560	348,480	156,820	78,409
Days to maturity from seed	90 – 120			
Plant populations (acre)				
Planting dates	Pigeon pea	Snow / snap pea	Winged bean	Yard-long bean
North Florida	Not recommended	Jan – Mar	Not recommended	Mar – July
Central Florida	Not recommended	Nov – Feb	Not recommended	Feb – Aug
South Florida	Mar – Apr	Nov – Feb	Mar – Apr	Sept – Apr
Planting information				
Distance between rows (in)	24 – 36	30 – 36 (hand harvest) 8 – 10 (machine harvest)	36	28 – 36
Distance between plants (in)	24 – 36	1.2 – 2	8	2 – 4
Seeding depth (in)	1 – 1.5	1 – 1.5	1 – 1.5	1 – 1.5
Days to maturity from seed	180 (early varieties); 270 – 365 days (late varieties)		90 (day neutral varieties)	70
Plant populations (acre)	10,890	174,240 (hand)	21,7801	112,012

Cultivars

Table 7.6. Names, life cycle, cultivars and trellising requirements for Asian legumes.

Crop	Life cycle	Cultivars	Trellising
Cluster bean, Guar	Annual		Yes
Edamame	Annual	Green Legend, Lucky Lion	No
Fenugreek, methi	Annual		No
Hyacinth bean, lablab bean	Annual	Asia Purple, Asia White	No
Pigeon pea (a short-lived perennial)	Short-lived perennial		No
Snow / snap (edible podded) pea	Annual	Mammoth Melting Sugar, Dou Miao	Yes
Winged bean, Goa bean	Annual	Youdou	Yes
Yard-long bean	Annual	Orient Extra Long, Stickless Wonder	Yes

Solanums

The Asian solanum group includes three types of eggplant and bird's eye pepper. The harvestable product includes fruits which are eaten at the immature or mature stage. All can be grown on raised beds with or without plastic mulch and using either drip or subsurface irrigation. As with most eggplants, these types tend to be short-lived perennials, especially the Thai eggplant which is a relatively compact, stocky plant. They can be severely pruned and allowed to regrow if staking does not prohibit this operation. Fertilizer recommendations for eggplant should be used for the three types of eggplant, while those for peppers should be followed for bird's eye peppers. These crops can be started from seed or transplants. All the indeterminate types need some type of support.

Botany and Planting

Oriental eggplant, Japanese / Chinese - *Solanum melongena*

Thai eggplant – *Solanum melongena*

Indian eggplant – *Solanum melongena*

Bird's-eye pepper – *Capsicum frutescens* (= *C. chinense*)

Table 7.7. Planting and information for Asian solanums.

Planting dates	Eggplant			Bird's eye pepper
	Japanese/Chinese	Thai	Indian	
North Florida	Feb – Mar	Feb – Mar	Feb – Mar	Aug 15; Feb – Mar
Central Florida	Aug – Sept; Jan – Feb	Aug – Sept; Jan – Feb	Aug – Sept; Jan – Feb	Aug – Sept; Jan – Mar
South Florida	Aug - Feb	Aug - Feb	Aug - Feb	Aug – Feb
Planting information				
Distance between rows (in)	36 – 72	36 – 72	36 – 72	36 – 48
Distance between plants (in)	18 – 40	36 – 60	18 – 40	10 – 24
Seeding depth (in)	0.5 – 0.75	0.5 – 0.75	0.5 – 0.75	0.5 – 0.75
Seed per acre to transplant (lbs)	0.25 – 0.5	0.25 – 0.5	0.25 – 0.5	0.25 – 0.5
Plant populations (acre)	9,680	9,680	4,840	17,500

Cultivars

Table 7.8. Names, cultivars and trellising requirements for Asian solanums.

Crop	Cultivars	Staking
Oriental eggplant, Japanese / Chinese	Japanese: Hybrid Mangan	Yes
	Chinese: Hybrid Purple Charm, Ma-Zu Purple	
Thai eggplant – this can be a short-lived perennial	White: Hybrid White Ball; Green: Green Beauty	Maybe
	Purple: Hybrid Violet Prince; Variegated: Hybrid Tiger	
Indian eggplant, dark & wine colored	Hybrid Bharata Star, Hybrid Chu-Chu	Yes
Bird's-eye pepper		Maybe

II. Beet, Carrot, Celery and Parsley

Botany and Planting

Beet - *Beta vulgaris*, Chenopodiaceae

Carrot - *Daucus carota*, Apiaceae (Umbelliferae)

Celery - *Apium graveolens*, Apiaceae (Umbelliferae)

Parsley - *Petroselinum crispum*, Apiaceae (Umbelliferae)

Table 7.9. Planting information for beets, celery and parsley.

	Beets	Carrots	Celery	Parsley
Planting Dates				
North Florida	Aug - Feb	Aug-Mar	Aug - Feb	Sept - Mar
Central Florida	Sept – Feb	Aug-Mar	Sept - Mar	Sept - Mar
South Florida	Oct - Jan	Sept-Mar	Oct - Mar	All year
Planting Information				
Distance between rows (in)	12 - 30	10 - 12	18-40	6 - 12
Distance between plants (in)	2 - 4	1 - 3	6-12	drilled
Seeding depth (in)	0.5 - 1.0	1/4	on surface	0.25
Seed per acre (lb)	10 - 15	2 - 4	1 - 2	6 - 8
Days to maturity from seed	50 - 70	70 - 120	75 - 90	70 - 80
Plant population (acre)	261,360	630,000	58,080	1 million+

Cultivars

Table 7.10. Common minor crop cultivars.

Beets	Carrots	Celery	Parsley
Asgrow Wonder	Apache	Floribelle - M9	Forest Green (CL)
Bulls Blood (tops)	Choctaw	June Belle	Jade (CL, H)
Golden Beets (yellow)	Navajo	Florida 683	Improved Market Gardeners (CL)
Green Top	Top Notch		Dark Green Italian (PL)
Pacemaker III			
Red Ace		CL=Curley Leaf; PL=Plain Leaf; H=hybrid	

III. Okra

Botany and Planting

Okra - *Abelmoschus esculentus*, Malvaceae

Table 7.11. Planting information for okra.

Planting dates	
North Florida	Mar - Jun
Central Florida	Feb - Aug
South Florida	Jan – Mar/Aug - Oct
Planting information	
Distance between rows (in)	36 - 60
Distance between plants (in)	4 - 10
Seeding depth (in)	0.5 - 1.0
Seed per acre (lb)	6 - 81
Days to first harvest from seed	60 - 70
Plant population (acre)	43,560

Cultivars

Table 7.12. Okra cultivars.

Annie Oakley II (H)	Millionaire (H)
Cajun Delight (H)	North and South (H)
Clemson Spineless	Spike (H)
Clemson Spineless 80	(H=hybrid)

IV. Onion, Leek and Chives

Botany and Planting

Onion - *Allium cepa*, Alliaceae (Amaryllidaceae)

Leek - *Allium ampeloprasum*

Chive - *Allium schoenoprasum*

Bunching onion - *Allium fistulosum*

Table 7.13. Planting information for onion and allies.

Planting dates	Seeded	Transplanted
North Florida	Mid Sept - mid Nov	Nov - Jan
Central Florida	Oct	Dec - Jan
South Florida	Oct	Dec - Jan
Planting information		
Distance between rows (in)	14 - 18	14 - 18
Distance between plants (in)	3 - 4	4 - 6
Seeding depth (in)	0.25 - 0.5	-
Seed per acre (lb)	3 - 4	1.0
Days to maturity	100 - 130	100 - 1302
Plant populations (acre)	149,343	112,123

V. Radish

Botany and Planting

Radish - *Raphanus sativus*, Brassicaceae (Cruciferae)

Table 7.15. Planting information for radish.

Planting dates	
North Florida	Sept - Mar
Central Florida	Sept - Mar
South Florida	Oct - Mar
Seeding information	
Distance between rows (in)	6
Distance between plants (in)	1
Seeding depth (in)	0.25
Seed per acre (lb)	10 - 20
Days to maturity from seed	20-30
Plant population (acre)	1 million +

Cultivars

Table 7.14. Onion and leek cultivars.

Onion		
Amelia (H)	Granex 33 (H)	Sweet Caroline (H)
Caramelo (H)	Prowler (H)	Sweet Deal (H)
Dawn (H)	Pumba (H)	Sweet Harvest (H)
Don Victor (H)	Ringo (H)	Sweet Success (H)
Frontier (H)	Sweet Agent (H)	WI-3115 (H)
Bunching Onion		
Perfecto Blanco	Tokyo Long White	White Portugal
Leeks		
King Richard	Tivi	Verina
Chives		
Staro	(H=hybrid)	

Cultivars

Escala F1. Round roots with fine and strong foliage in difficult climates, red, very uniform in shape and size, medium top size.

Fuego. Oval-round, deep scarlet red roots, tops medium-short. R to For, T to Ar and Rs.

Red Castle. Globe, deep red, medium top size, matures in 25-28 days, very uniform root size and shape, medium upright tops, use for bunching, cello, slicing, excellent flesh quality with white interior, field tolerance to pithing.

Red Satin F1. Globe, glossy red, medium top size, matures in 26-30 days, very uniform root size and shape, crisp flesh, excellent field holding ability with thick cuticle, medium tops, and field tolerance to pithing.

Red Silk. Open pollinated, globe, red, medium top size, silky smooth shoulders, matures in 26-30 days, use for bunching, and excellent flesh quality with white interior, highly adaptable to Florida muck and similar growing conditions, low pH soils. R to pithing, IR to Ar, For, Pb, and Rs.

Rudi. Round roots, red, sturdy dark green foliage, slow to turn 'pithy', adapts to difficult weather or climates very well.

Disease key: Black root (Ar = *Aphanomyces raphani*), Yellows (For = *Fusarium oxysporum* f.sp. *raphani*), Clubroots (Pb = *Plasmodiophora brassica*), Rhizoctonia scurf (Rs = *Rhizoctonia solani*), R – Resistant, IR – Intermediate resistance, T – Tolerant

VI. Sweet Potato Botany and Planting

Sweet potato - *Ipomoea batatas*, Convolvulaceae

Table 7.16. Planting information for sweet potato.

Planting dates	
North Florida	Mar - June
Central Florida	Feb - June
South Florida	Dec - Sept
	(orange fleshed types)
	Year-round (boniato/batatas types)
Planting information	
Distance between rows (in)	36 - 48
Distance between plants (in)	10 - 12
Planting depth (in)	3 - 4
Transplants needed per acre	9,000 - 15,000
Days to maturity from transplant	85 - 130
Plant populations (acre)	9,000 - 15,000

VII. Tropical Root Crops

Tropical root crops are planted primarily for their edible roots, corms or cormels. Some people also eat the edible leaves of both cassava and taro. In the case of both these crops, plants grown for edible leaves can be grown in cooler locations than would otherwise be possible. For pest control products, these crops are included in root and tuber vegetables.

Botany and Planting

Table 7.18. Planting information for cassava, taro and taniar.

Planting dates	Cassava	Taro	Tanier
Miami-Dade County	Year-round (mainly February to April)	Year-round	Year-round
Planting information			
Distance between rows (in)	48	52	52
Distance between plants (ft)	2	1	1
Planting depth (in)	3 - 4	4-6	4-6
Propagules needed per acre	5,445	2,420-3,630	2,420-3,630
Minimum propagule size	10-12" stick or micro- propagules	2 oz	2 oz
Bedded	No	Yes	Yes
Days Months to harvest from planting	9-12	10-14	12-14
Plant populations (acre)	5,445	10,052	10,052

Cultivars

Table 7.17. Sweet potato cultivars.

Beauregard	Hernandez	Picadito (Boniato)
Covington	Jewel	

Cultivars

Cassava – varieties are often separated based of their cyanogenic glucoside (HCN) content into either low HCN, a.k.a. “sweet,” or high HCN, a.k.a. “bitter,” types. The term “bitter” comes from a bitter flavor that is commonly believed to accompany the HCN. No named varieties are currently known in southern Florida. ‘Senorita’ was locally popular in the 1980s and attempts were made to introduce the CIAT variety ‘Mantiqueira’ at that same time because it was able to produce acceptable yields even with high levels of rootknot nematode. The range of local genotypes covers a few unnamed clones that have been imported from various Caribbean basin countries. Federal regulations prohibit further importation of cuttings or botanical seed.

For people who are able to find cuttings, follow the technique developed by scientists at the International Institute for Tropical Agriculture (IITA) in Ibadan, Nigeria where one makes 2-node cuttings or minis stakes that can provide a 5-fold increase the production of propagules from each parent cassava plant. According to IITA, “[t]hese minis stakes are easily moved and protected in plastic sacks until they can be grown on and hardened in individual plastic bags or nursery beds before being planted in the field.”

Preferences for specific varieties of cassava used for edible leaves may exist among consumers, though the ability to satisfy these requests is very limited given the very small number of varieties currently grown in the U.S.

Taro – ‘Malanga Isleña,’ produces one large white-fleshed central corm; a few unnamed Polynesian types are grown for the Asian market.

Tannia – ‘South Dade White,’ producing white-fleshed cormels; ‘Malanga Amarilla,’ producing a yellow-fleshed edible corm; and ‘Vinola,’ producing purple-fleshed cormels.

Tropical sweetpotato – ‘Picadito’ is the main variety grown in Miami-Dade County. It has deeply lobed leaves and wine colored skin.

It is illegal to import sweetpotatoes into the U.S. and there is no program to produce disease-free planting material of ‘Picadito’ in Florida. Other sweetpotato growing states have developed red-skinned, white-fleshed sweetpotatoes which may grow well in Florida and which may be available from those plant breeders or through certified slip producers.

Pesticides for Weed, Arthropod and Disease Management for Specialty and Minor Vegetable Crops

Table 7.19. Selected herbicides approved for managing weeds in beets.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides.
Ethofumisate 1.88	(Norton) 4 SC 60 fl. oz.	Annual broadleaf and grass weeds. No more than 9.6 fl. oz./acre should be applied in a single growing season
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burn down. Consult labels for individual product directions.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Apply as a preplant burn down treatment. Scythe is a contact and nonresidual herbicide and can be tank mixed residual preemergence herbicides to lengthen control.
Pyrazon 1.95 - 2.28	(Pyramin) 65 DF 3.0 - 3.5 lb.	Use lower rate on lighter soils. If rain doesn't fall in 10 days irrigate or cultivate.
Pyrflufen 0.001 - 0.003	(ET Herbicide) 0.208 EC 0.5 - 2.0 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burndown treatment.
*** POSTEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a hooded application to row middles only. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides. Do not exceed 6.1 fl. oz. per cropping season. PHI 0 days.
Clethodim 0.09 - 0.13 0.07 - .25	(Select, Arrow) 2 EC 6 - 8 fl. oz. (Select Max) 1 EC 9 - 16 fl. oz.	Perennial and annual grass weeds. In fields with heavy grass pressure or larger grass weeds, use higher rates or repeat application 14 days apart. Use a crop oil concentrate at 1% v/v in the finished spray volume. Nonionic surfactant with Select Max. PHI 30 days.
Ethofumisate 0.16 - 0.33	(Norton) 4 SC 5.25 - 10.5 fl. oz.	Annual broadleaf and grass weeds. Consult label for rates based on table beet stage of growth. Do not exceed 96 fl. oz./acre in a single growing season.
Pelargonic acid	(Sythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Direct spray to row middles. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with several soil residual compounds.
Phenmedipham 0.24 - 0.73	(Spin-aid) 1.3 EC 1.5- 3.0 pt.	Apply after the 4 to 6 true-leaf stage of beet. Allow 5 to 7 days after between applications. Do not exceed 3 applications. PHI 60 days.
Phenmedipham + desmedipham	(Betamix) 1.3 EC 1.5 - 3.0 pt.	Sequential application should be used at 5 to 7 day intervals. Consult label for rate based on weed size. Do not exceed 0.96 lb. a.i./acre per season of demedipham and phenmedipham. PHI 14 days for tops. PHI 50 days for roots.
Pyrazon 1.95 - 2.28	(Pyramin) 65 DF 3.0 - 3.5 lb.	Apply after beets have 2 expanded true leaves and before any weeds have more than 2 true leaves.
Sethoxydim 0.28 - 0.47	(Poast) 1.5 EC 1.5 - 2.5 pt.	Emerged grass weeds. A maximum of 5 pt./acre applied in one season. Include a crop oil concentrate. Unsatisfactory results may occur if applied to grasses under stress. PHI 60 days.

Table 7.20. Selected herbicides approved for managing weeds in carrot.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides.
Glyphosatet	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burn down. Consult label for individual product directions.
Linuron 0.5 - 1.0	(Lorox DF) 50 DF 1 - 2 lb.	A single application after planting and before crop emergence. Plant seed at least 0.5 in. deep. Preemergence and postemergence application should not exceed 4 lb./acre per season.
Paraquat 0.5 - 1.0	(Gramoxone) 2 SL 2.0 - 4.0 pt. (Firestorm) 3 SL 1.3 - 2.7 pt.	Emerged broadleaf and grass weeds. Apply as a preplant burn down treatment. Apply before crop emergence. Use a nonionic surfactant.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Apply as a preplant burn down treatment. Scythe is a contact and nonresidual herbicide and can be tank mixed with a residual preemergence herbicide to lengthen time of control
Pendimethalin 0.95	(Prowl H20) 3.8 2.0 pt.	Broadleaf and grass control. Apply within 2 days of planting before the emergence of the crop. PHI 60 days.
Prometryn 1.0 - 2.0	(Caparol) 4 L 2 - 4 pt.	Most annual broadleaf and grass weeds. Do not exceed one application. Consult label for rotational crop restrictions.
Pyraflufen 0.001 - 0.003	(ET Herbicide) 0.208 EC 0.5 - 2.0 fl. oz.	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment.
Trifluralin 0.5	(Treflan, Trifluralin) 4 EC 1 pt. (Treflan TR-10) 5 lb.	Annual broadleaf and grass weeds. Do not apply to muck soils. Mineral soils with 2 - 5% organic material, apply 0.75 lb. a.i./acre. Incorporate 4 inches or less with 8 h. of application. PHI 60 days.
*** POSTEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as hooded application to row middles only. Use crop oil concentrate or nonionic surfactant at recommended rate. May be tank mixed with other herbicides. Do not exceed 6.1 fl. oz. per cropping season. PHI 0 days.
Clethodim 0.09 - 0.13 0.07 - 0.13	(Select, Arrow) 2 EC 6 - 8 fl. oz. (Select Max) 1 EC 9 - 16 fl. oz.	Perennial and annual grass weeds. In fields with heavy grass pressure or larger grass weeds, use higher rates or repeat applications 14 days apart. Use a crop oil concentrate at 1% v/v in the finished spray volume. Nonionic surfactant with Select Max. PHI 30 days.
Fluazifop 0.188	(Fusilade DX) 2 EC 12 fl. oz.	Actively growing grass weeds. Maximum is 48 fl. oz./acre. per growing season. Withhold field flooding 45 to 60 days following application. In Palm Beach and Hendry counties a 60 day interval must be observed for flooding. PHI 45 days.
Linuron 0.5 - 1.0	(Lorox DF) 50 DF 1 - 2 lb.	Apply after carrots are 3 inches tall. Repeat applications may be made but do not exceed 4 lb./acre. Can be applied following Stoddard Solvent provided that the applications are at least one day apart. Do not tank mix with Stoddard Solvent.
Metribuzin 0.25	(Metribuzin, Metri, Tricor) 75 DF 0.3 lb. (Metri, Tricor) 4 F 0.5 pt.	Broadleaf and grass control. Total amount applied in a season should not exceed 0.5 lb. a.i./acre. Apply after carrots have 5 - 6 true leaves and weeds are less than 1 in. in height. If needed, a second application may be made after an interval of at least 3 wk. PHI 60 days.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Direct spray to row middles. Product is a contract, nonselective, foliar applied herbicide with no residual control. May be tank mixed with several soil residual compounds.
Prometryn 1.0 - 2.0	(Caparol) 4 L 2 - 4 pt.	Most annual broadleaf and grass weeds. Apply up to 6 leaf stage of carrot. One application of 4 pt./acre or two application of 2 pt./acre. For POST control of weeds, include NIS or COC. Consult label for rotational crop restrictions. PHI 30 days.
Sethoxydim 0.28 - 0.38	(Poast) 1.5 EC 1.5 - 2.0 pt.	Emerged grass weeds. A maximum of 5 pt./acre applied in one season. Include a crop oil concentrate. Unsatisfactory results may occur if applied to grasses under stress. PHI 30 days

Table 7.21. Selected herbicides approved for managing weeds in celery.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREPLANT / PREEMERGENCE ***		
Bensulide 5.0 - 6.0	(Prefar) 4 E 5 - 5 qt.	Broadleaf and grass weeds. Incorporate mechanically 1 - 2 in. deep or with irrigation 2 - 4 in. deep.
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides.
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burn down. Consult label for individual product directions.
S-metolachlor 0.95 - 1.26	(Dual Magnum) 1.0 - 1.33 pt.	Broadleaf and grass weeds and nutsedge. Label is a third party registration (TPR, Inc.) and authorization and waiver agreements must be obtained prior to use. Rates are based on organic matter.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Apply as a preplant burn down treatment. Scythe is a contact and nonresidual and can be tank mixed residual preemergence herbicides to lengthen control.
Prometryn 1.0 - 2.0	(Caparol) 4 L 2 - 4 pt.	Most annual broadleaf and grass weeds. Do not exceed one application. Consult label for rotational crop restrictions.
Trifluralin 0.5	(Treflan, Trifluralin) 4 EC 1 pt. (Treflan, Trifluralin) 10 G 5 lb.	Annual broadleaf and grass weeds. Do not apply to muck soils. Mineral soils with 2 - 5% organic material, apply 0.75 lb. a.i./acre. Incorporate 4 in. or less with 8 h. of application.
*** POSTTRANSPLANT / POSTEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. apply as hooded application to row middles only. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides. Do not exceed 6.1 fl. oz. per cropping season. PHI 0 days.
Clethodim 0.09 - 0.13	(Select, Arrow) 2 EC 6 - 8 fl. oz. (Select Max) 1 EC	Perennial and annual grass weeds. In fields with heavy grass pressure or larger grass weeds, use higher rates or repeat applications 14 days apart. Use a crop oil concentrate at 1% v/v in the finished spray volume. Nonionic surfactant with Select Max. PHI 30 days.
0.07 - 0.13	9 - 16 fl. oz.	
Linuron 0.5 - 1.0	(Lorox DF) 50 DF 1 - 2 lb.	Broadleaf and grass weeds. Apply after transplanting but before celery is 8 in. tall. Do not apply when temperatures exceed 85F nor as a tank mix with surfactants, nitrogen, or fertilizer solution. PHI 45 days.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Direct spray to row middles with hooded or shielded sprayer. Product is a contact, nonselective herbicide with no residual control. May be tank mixed with several soil residual compounds.
Prometryn 0.8 - 1.6	(Caparol) 4 L 1.6 - 3.2 pt.	Broadleaf weeds. Apply one application during the 2 to 6 wk. period after transplanting. Weeds should not exceed 2 in.
S-metolachlor 0.95 - 1.26	(Dual Magnum) 1.0 - 1.33 pt.	Broadleaf and grass weeds and nutsedge. Label is a third party registration (TPR, Inc.) and authorization and waiver agreements must be obtained prior to use. Rates are based on organic matter
Sethoxydim 0.28	(Poast) 1.5 EC 1.5 pt.	Emerged grass weeds. A maximum of 3 pt./acre per season. Include a crop oil concentrate. Unsatisfactory results may occur if applied to grasses under stress. PHI 30 days.
*** CELERY SEEDBEDS ***		
Prometryn 0.6 - 0.8	(Caparol) 4 L 1.2 - 1.6 pt.	Broadleaf weeds. Apply once per year to seedbeds. Apply after celery has 2-5 true leaves. Apply after seedbed covers have been removed for at least one week.

Table 7.22. Selected herbicides approved for managing weeds in okra.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. Maximum rate of 0.096 lb. a.i./acre per season. May be tank mixed with other herbicides.
Flumioxazin up to 0.128	(Chateau) 51 WDG up to 4 oz.	Annual broadleaf weeds. Apply to row middles of raised plastic mulched beds that are at least 4 in. higher than the treated row middle and 24 in. bed width. Label is a Third-Party Registration (TPR, Inc.). Use without a signed authorization is a waiver of liability is a misuse of the product. Tank mix with a burn down herbicide to control emerged weeds.
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weed control. Apply as a preplant burn down for emerged weeds. Read label for amount of formulation allowed.
Lactofen 0.25 - 0.5	(Cobra) 2 EC 16 - 32 fl. oz.	Broadleaf weed control. Apply to row middles only with a shielded or hooded sprayer. A minimum of 24 fl. oz./acre is required for residual control. Add a crop oil concentrate or nonionic surfactant for control emerged weeds. Registration is through Third Party Registrations, Inc. (TPR, Inc.) and a copy of the label must be on-hand at time of application. PHI 30 days.
Mesotrione 0.19	(Callisto) 4 L 6 fl. oz.	Apply to row middles only. Leave one foot untreated area or 6" on either side of the plant row. Injury risk is greatest on coarse textured soils (sand, sandy loam, or loamy sand). Apply as one preemergence application OR one postemergence application. Callisto will cause whitening of the okra leaves.
Paraquat 0.5 - 1.0	(Gramoxone) 2 SL 2.0 - 4.0 pt.	Emerged broadleaf and grass weed control. Apply one application before crop emergence. Do not exceed 8 pt./acre per season.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Broadleaf and grass weed control. Scythe is a contact, nonselective herbicide with no residual activity. May be tank mixed with trifluralin for soil residual activity. Consult label for rates and other information.
Prometryn 0.75 - 1.5	(Caparol) 4 L 1.5 - 3.0 pt.	Apply after planting, but before crop emergence. Apply as one PRE application at 3 pt. Or 1 PRE application at 1.5 pt. followed by one POST-directed application at 1.5 pt. Do not exceed 3 pt./acre per crop cycle
Trifluralin 0.5 - 0.75	(Treflan, Trifluralin) 4 EC 0.5 - 1.5 pt. (Treflan, Trifluralin) 10 G 5.0 - 7.5 lb.	Annual broadleaf and grass weeds. Incorporate 4 in. or less within 8 h. Results in Florida are erratic on soils with low organic matter and clay contents. Note precautions against planting non-registered crops within 5 months.
*** POSTEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply to row middles only with a hooded sprayer. Maximum rate of 0.096 lb. a.i./ A per season. Rates apply to mineral and muck soils. Use crop oil concentrate or nonionic surfactant at recommended rates. PHI 0 days.
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply to row middles only with a hooded sprayer. PHI 14 days.
Halosulfuron 0.024 - 0.05	(Sanda) 75 WG 0.5 - 1.0 oz.	Broadleaf and purple/yellow nutsedge control. Apply to row middles of direct-seeded or transplanted okra. If plastic is used, prevent herbicide contact with the plastic. Do not apply more than 2 oz./acre per 12-month period. PHI 30 days.
Lactofen 0.25 - 0.5	(Cobra) 2 EC 16 - 32 fl. oz.	Broadleaf weed control. Apply to row middles only with a shielded or hooded sprayer. A minimum of 24 f. oz./acre is required for residual control. Add a crop oil concentrate or nonionic surfactant for control of emerged weeds. One POST application may be made per growing season at 18 days after transplanting. Cobra contacting green foliage or fruit can cause excessive injury. Registration is through Third Party Registration, Inc. and a copy of the label must be on hand at time of application. PHI 30 days.
Mesotrione 0.09	(Callisto) 4 L 3 fl. oz.	Broadleaf and grass control. Direct spray with hooded sprayer to minimize contact with okra plants. Okra must be at least 3 in. tall. Use of a nonionic surfactant is required. Injury risk is greatest on coarse textured soils. Apply as one preemergence or one postemergence application. PHI 28 days.
Paraquat 0.5 - 1.0	(Gramoxone) 2 SL 2.0 pt.	Emerged broadleaf and grass weed control. Apply to row middles only and do not allow contact to okra plants. Limit of 2 applications after crop emergence. Do not exceed 8 pt./acre pre-season. PHI 60 days.
*** POSTEMERGENCE ***		
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Broadleaf and grass weed control. Apply to row middles only with a shielded sprayer.
Prometryn 0.75	(Caparol) 4 L 1.5 pt.	Apply 1 postemergence application directed to the base of the crop. If a PRE application was made do not exceed 3 pt./acre. PHI 14 days.
Sethoxydim 0.19 - 0.28	(Poast) 1.5 EC 1.0 - 1.5 pt.	Grass weed control. Efficacy will be decreased if grass weeds are under stress. Include a crop oil concentrate or methylated seed oil in the spray. PHI 14 days.

Table 7.23. Selected herbicides approved for managing weeds in onion.

Active ingredient lb. a.i./acre	Trade name product/acre	Crops	Weeds controlled / remarks
*** PREEMERGENCE ***			
Bensulide 5.0 - 6.0	(Prefar) 4 E 5 - 6 qt.	Dry bulb vegetables: onion, garlic, shallot	Annual broadleaf and grass control. Incorporate or irrigate 1 to 2 in. deep within 36 h. of application. Consult label for rotational restrictions.
Bromoxynil 0.25 - 0.38	(Buctril) 2 EC 1.0 - 1.5 pt.	Onion (dry bulb)	Broadleaf weeds. Preemergence is restricted to muck soils containing greater than 10% organic matter. Apply at least 3 to 4 days prior to emergence. Weeds should not exceed the 4-leaf stage, 2 in. in height or 1 in. in diameter.
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Onion, garlic, leek, chive, shallot	Emerged broadleaf control. Post-direct hooded application to row middles for burndown of emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates.
DCPA 4.5 - 6.0	(Dacthal) W-75 6 - 8 lb. (Dacthal) 6 F 6 - 8 lb.	Onion (dry bulb, green), leek, shallot	Annual grasses and certain broadleaf control. Apply at seeding or planting. Maximum rate of 10.5 lb. a.i./acre per season.
Flumioxazin up to 0.06	(Chateau) 51 WDG up to 2 fl. oz.	Onion (dry bulb), garlic	Broadleaf control. Apply to transplanted onions between the 2- and 6- leaf stage. Apply to direct seeded onions between the 3- and 6- leaf stage.
Glyphosate	(various formulations) consult label	Onion, garlic, leek, chive, shallot	Control of emerged broadleaf and grass weeds. Consult individual labels for restrictions.
Oxyfluorfen 2	(Goal 2XL) 2 EC 2.0 pt. (GoalTender) 4 EC 1.0 pt.	Onion (dry bulb), garlic (dry bulb)	Certain broadleaf weeds. Transplanted only. Apply within 2 days of transplanting. Necrotic lesions, twisting or stunting of plants can occur if applications are made during cool, wet weather or prior to the full development of the true leaves.
Paraquat 0.5 - 1.0	(Gramoxone) 2 SL 2 - 4 pt.	Onion (dry bulb)	Controls emerged weeds. Apply prior, during, or after planting, but before crop emergence. Only 2 applications a season. Use a non-ionic surfactant.
Paraquat 0.63 - 1.0	(Gramoxone) 2 SL 2.5 - 4.0 pt. (Firestorm) 3 SL 1.7 - 2.7 pt.	Onion (seeded), garlic	Emerged broadleaf and grass weeds. Apply as a preplant burndown. A maximum of 1 lb. a.i./acre per season.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Onion, garlic, leek, chive, shallot	Emerged broadleaf and grass weeds. Apply before emergence of crop. Product is a contact, nonselective, foliar applied herbicide. There is no residual activity.
Pendimethalin mineral 0.5 - 0.75 muck 1.0 - 2.0	(Prowl) 3.3 EC mineral 1.2 - 1.8 pt. muck 2.4 - 4.8 pt. (Prowl H20) 3.8 mineral 1.0 - 1.5 pt. muck 2.0 - 4.0 pt.	Onion (dry bulb), shallot (dry bulb)	Mineral soils: Apply when crop has 2 to 9 true leaves. Muck soils: May be applied as sequential application: preemergence through loop stage, early postemergence (2 to 6 true leaf stage), late postemergence (6 to 9 true leaf stage). Do not exceed 5.9 lb. a.i./acre in a growing season. PHI 45 days.
Pyraflufen 0.001 - 0.003	(ET Herbicide/Defoliant) 0.5 - 2.0 fl. oz.	Bulb vegetables	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment
*** POSTEMERGENCE ***			
Bromoxynil 0.25 - 0.38	(Buctril) 2 EC 1.0 - 1.5 pt.	Onion (Dry bulb)	Broadleaf weeds. Soil and onion leaves should be dry before application. Waxy coating on leaves reduces chances for injury. Varieties vary in sensitivity and use on a trial basis.
Bromoxynil 0.38 - 0.5	(Buctril) 2 EC 1.5 - 2.0 pt.	Garlic	Broadleaf weeds. Apply after emergence but before 12 in. tall. Weeds are most susceptible up to the 4-leaf stage or 2 in. height or 1 in. wide. PHI 112 days.
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Onion (dry bulb), garlic, leek, chive, shallot	Emerged broadleaf control. Post-direct hooded application to row middles for burndown of emerged weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. PHI 0 days.
Clethodim 0.09 - 0.25 0.07 - 0.25	(Arrow, Select) 2 EC 6 - 16 fl. oz. (Select Max) 1 EC 9 - 32 fl. oz.	Onion (dry bulb), garlic, shallot (dry bulb)	Annual and perennial grass control. Some labels include green onion. Consult label for use of a crop oil concentrate or nonionic surfactant. PHI 45 days.
Clethodim 0.09 - 0.13	(Arrow, Select) 2 EC 6 - 8 fl. oz. (Select Max) 1 EC 12 - 16 fl. oz.	Chive, leek	Emerged annual and perennial grasses. Consult labels rate of COC or NIS. Do not apply more than 0.5 lb. a.i./acre per season. Select Max is not registered in leek. PHI 14 days.

Table 7.23. Continued.

Active ingredient lb. a.i./acre	Trade name product/acre	Crops	Weeds controlled / remarks
*** POSTEMERGENCE ***			
DCPA 4.5 - 6.0	(Dacthal) W-75 6 - 8 lb. (Dacthal) 6 F 6 - 8 pt.	Onion (dry bulb, green), leek, shallot	Annual grasses and certain broadleaf control. Apply at layby up to 14 weeks after planting. If weeds have emerged then cultivate or hand weed. Maximum rate of 10.5 lb. a.i./acre per season.
Dimethanamid-p up to 1.0	(Outlook) 6 EC up to 21 fl. oz.	Onion (dry bulb), garlic, leek, shallot (dry bulb, green)	Broadleaf and grass weeds. Apply after the 2 true-leaf stage. Apply as a single application or split application. Split application of 10 - 14 fl. oz. followed by 7 to 10 fl. oz./acre with 14 days between applications. Do not exceed 21 fl. oz./acre per growing season. PHI 30 days.
Fluazifop 0.188	(Fusilade DX) 12 fl. oz.	Onion (dry bulb), garlic	Annual and perennial grass weeds. Do not apply more than 48 fl. oz./acre per season. Include a COC or NIS. PHI 45 days.
Oxyfluorfen 0.5	(Goal 2 XL) 2 EC 0.5 pt. direct seeded (GoalTender) 4 EC 0.25 pt. direct seeded	Onion (dry bulb), garlic (dry bulb)	Certain broadleaf weeds. Direct seeded only. Apply after the crop has 2 true leaves. Multiple treatments can be applied and do not exceed 0.5 lb. a.i./acre. Necrotic lesions, twisting or stunting of plants can occur if applications are made during cool, wet weather or prior to development of true leaves. PHI 60 days.

Table 7.24. Selected herbicides approved for managing weeds in parsley.

Active ingredient lb. a.i./acre	Trade name product/acre	Crops	Weeds controlled / remarks
*** PREEMERGENCE ***			
Bensulide 5.0 - 6.0	(Prefar) 4 E 5 - 6 qt.	Parsley, cilantro	Annual broadleaf and grass weeds. Incorporate or irrigate 1-2 in. deep within 36 h. of application. Consult label for rotation restrictions.
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Parsley, cilantro	Emerged broadleaf weeds. Apply as a burndown herbicide before planting.
Glyphosate	(various formulations) consult label	Parsley, cilantro	Control emerged broadleaf and grass weeds. Consult individual labels for restrictions.
Linuron 0.5 - 1.5	(Lorox DF) 50 DF 1 - 3 lb.	Parsley	Mineral and muck soils. Apply after planting and before crop emergence. Use lower rates on coarse soils.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Parsley, cilantro	Controls emerged weeds. Apply before emergence of crop. Product is a contact, nonselective, foliar applied herbicide. There is no residual activity.
Prometryn 1.0 - 1.6	(Caparol) 4 L 1.0 pt.	Parsley	A single preemergence application can be applied up to 14 days after planting. A second application can be made up to 30 days prior to harvest. Do not apply on sand or loamy sand. Read label for rotation restrictions.
Pyraflufen 0.001 - 0.003	(ET Herbicide) 0.5 - 2.0 fl. oz.	Parsley	Emerged broadleaf and grass weeds. Plant 1 day after application. Apply as a preplant burndown treatment.
*** POSTEMERGENCE ***			
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Parsley, cilantro	Emerged broadleaf control. Post-direct hooded application to row middles. Read the label for adjuvant requirements. PHI 0 days.
Clethodim 0.10 - 0.13 0.07 - 0.13	(Arrow, Select) 2 EC 6 - 8 fl. oz. (Select Max) 1 EC 9 - 16 fl. oz.	Parsley, cilantro	Annual and perennial grass control. Read the label for required adjuvants.
Linuron 0.5	(Lorox DF) 50 DF 1 lb.	Parsley	Apply after the crop has a minimum of 3 true leaves or crop injury may result. Apply when weeds are in the 1 to 3 true leaf stage. Do not exceed 3 lb. of Lorox per acre per season. PHI 30 days.
Prometryn 0.5	(Caparol) 4 L 1.0 pt.	Parsley	An application can be made up to 30 days prior to harvest. Another application can be applied after harvest to the new regrowth. Do not use on sand or loamy sands. Read label for rotation restrictions.
Sethoxydim 0.19 - 0.28	(Poast) 1.5 EC 1.0 - 1.5 pt.	Parsley, cilantro	Growing grass weeds. Decreased efficacy if weeds are under stress. Do not exceed 3.0 pt./acre per season. Include a COC in the spray solution. PHI 15 days.

Table 7.25. Selected herbicides approved for managing weeds in radish.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREPLANT / PREEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides.
DCPA 4.5 - 10.5	(Dacthal) 75 WP 6 - 14 lb.	Broadleaf and grass weeds. Apply after seeding or up to 3-leaf stage. If weeds have emerged they must be cultivated or weeded before application.
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burndown. Consult label for individual product directions.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Apply as a preplant burndown before planting.
Pyraflufen 0.001 - 0.003	(ET Herbicide) 0.208 EC 0.5 - 2.0 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burndown treatment.
Trifluralin 0.5 - 0.75	(Treflan HFP, Trifluralin, Trilin) 4 EC 1.0 - 1.5 pt. (Treflan) 4 L 1.0 - 1.5 pt.	Annual broadleaf and grass weeds. Incorporate or irrigate 4 in. within 8 h. Results in Florida are erratic on soils with low organic matter and clay contents.
*** POSTEMERGENCE ***		
Clethodim 0.09 - 0.13	(Select, Arrow) 2 EC 6 - 8 fl. oz. (Select Max) 1 EC	Emerged annual and perennial grass weeds. For repeat application, minimum of 14 days between applications. Do not exceed 0.25 lb. a.i./ha. PHI 15 days
0.07 - 0.13	9 - 16 fl. oz.	
Sethoxydim 0.47	(Poast) 1.5 EC 2.5 pt.	Emerged grass weeds. Do not exceed 3.0 pt./acre. per season. Include a crop oil concentrate. Head lettuce and radicchio PHI 30 days. Leaf lettuce and endive PHI 15 day.

Table 7.26. Selected herbicides approved for managing weeds in sweet potato.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PRETRANSPLANT ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides.
Clomazone 0.49 - 0.75	(Command) 3 ME 1.3 - 2.0 pt.	Annual broadleaf and grass weeds. Use lower rates on coarse soils. Apply within 5 days of transplanting.
DCPA 4.5 - 6.0	(Dacthal) W-75 6 - 8 lb. (Dacthal) 6 F 6 - 8 pt.	Annual broadleaf and grass weeds. Apply immediately after transplanting. May be applied as a layby later in the season for preemergence control.
Flumioxazin 0.096	(Valor) 51 WDG 3 oz.	Annual broadleaf weeds. Do not use on sweetpotato varieties other than 'Beauregard' unless user has tested other varieties and found crop tolerance. Apply 2-5 days before transplant and minimize soil disturbance after application.
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burndown. Consult label for individual product directions.
Napropamide 1.0 - 2.0	(Devrinol DF XT) 50 DF 2.0 - 4.0 lb.	Annual broadleaf and grass weeds. Apply immediately after transplanting. If rainfall does not occur within 24 h. after application then incorporate or irrigate 2-4 in. deep.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with soil residual compounds.
Pyraflufen 0.001 - 0.003	(ET Herbicide) 0.208 EC 0.5 - 2.0 fl. oz.	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment.
*** POSTTRANSPLANT ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as hooded application to row middles only. Use of COC or NIS at recommended rates. Contact with the leaves will cause injury. PHI 0 days.

Table 7.26. Continued.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** POSTTRANSPLANT ***		
Clethodim 0.09 - 0.25	(Arrow, Select) 2 EC 6 - 16 fl. oz. (Select Max) 1 EC	Perennial and annual grass weeds. Use higher rates under heavy grass pressure or larger grass weeds. Do not apply more than 0.5 lb. a.i./acre. Consult the label for required adjuvant. PHI 30 days.
0.07 - 0.25	9 - 32 fl. oz.	
Fluazifop 0.1 - 0.25	(Fusilade DX) 2 EC 6 - 16 fl. oz.	Perennial and annual grass weeds. Include a NIS or COC in the spray solution. PHI 55 days.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Apply as a hooded application to row middles only. Contact with the leaves will cause injury.
Sethoxydim 0.19 - 0.47	(Poast) 1.5 EC 1.0 - 2.5 pt.	Controls growing grass weeds. A total of 5.0 pt./acre applied in one season. Include a COC. Unsatisfactory results may occur if applied to grasses under stress. PHI 30 days.

Table 7.27. Selected insecticides approved for managing insect pests of celery.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Actara (thiamethoxam)	1.5-5.5 oz	12	7	aphids, flea beetles, leafhoppers, whiteflies	4A	Do not use if other 4A insecticides have been or will be used.
Admire Pro (imidacloprid)	4.4-10.5 fl oz	12	45	aphids, leafhoppers, whiteflies, foliage feeding thrips	4A	Do not apply more than 0.38 lb ai per acre per year.
Agree WG (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11	Apply when larvae are small for best control. OMRI-listed ² .
*Agri-Mek SC (abamectin)	1.75-3.5 fl oz	12	7	<i>Liriomyza</i> leafminers, spider mites	6	No more than 2 sequential applications. Must be used with an adjuvant (but not binder sticker types). Not for use on leafy vegetables grown for transplant.
*Ambush 25W (permethrin)	6.4-12.8 oz	12	1	beet armyworm, cabbage looper, corn earworm, cutworms, fall armyworm, leafminers	3A	Do not apply more than 128 oz/acre per season.
Assail 30SG (acetamiprid)	2.0-4.0 oz	12	7	aphids, whiteflies	4A	Begin applications for whiteflies when first adults are noticed. Do not apply more than 5 times per season or apply more often than every 7 days.
Avaunt (indoxacarb)	3.5 oz	12	3	beet armyworm, cabbage looper,	22	Do not apply more than 14 ounces of product per acre per crop.
Aza-Direct (azadirachtin)	1-2 pts, up to 3.5 pts	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, weevils, whiteflies	un	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	un	Antifeedant, repellent, insect growth regulator.
*Baythroid XL (beta-cyfluthrin)	0.8-3.2 fl oz	12	0	beet and southern armyworm (1 st and 2 nd instars), cabbage looper, corn earworm, cutworms, flea beetles, grasshoppers, potato leafhopper, saltmarsh caterpillar, thrips, vegetable weevil, yellowstriped armyworm, suppression of adult whitefly	3A	Maximum of 12.8 fl oz per acre per season.
Belay 50 WDG (clothianidin)	1.6-3.2 oz	12	7	aphids, flea beetles, leafhoppers, leafminers (suppression), whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Toxic to bees. Supplemental label for rates over 2.1 oz.
Belay 50 WDG (clothianidin)	4.8 -6.4 oz (soil application)	12	Apply at planting	aphids, flea beetles, leafhoppers, leafminers (suppression), whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. See label for application instructions.
Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	0	aphids, plant bugs	9C	Do not apply more than 8.4 oz/acre per season. Begin applications before pests reach damaging levels.
Belt SC (flubendiamide)	1.5 fl oz	12	1	armyworms, corn earworm, green cloverworm, loopers, saltmarsh caterpillar	28	Do not apply more than 4.5 fl oz/acre per season.
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11	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.

Table 7.27. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Confirm 2F (tebufenozide)	6.0-8.0 fl oz	4	7	armyworms, cabbage looper, garden webworm	18	Do not exceed 56 ounces of product per acre per season.
Coragen (rynaxypyr)	3.5-7.5 fl oz	4	1	beet armyworm, cabbage looper, corn earworm, leafminers, suppression of whitefly nymphs	28	May be applied via drip chemigation in addition to foliar and various soil application methods.
Courier 40SC (buprofezin)	9.0-13.6 fl oz	12	7	leafhoppers, planthoppers, whiteflies	16	Do not make more than 2 applications per crop cycle. IGR targets immatures.
Crymax WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Use high rate for armyworms. Treat when larvae are young.
Deliver (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11	Use higher rates for armyworms. OMRI-listed ² .
Dimethoate 4EC (dimethoate)	1 pt	48	7	leafminers, mites	1B	Use ground equipment. Florida only.
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Good coverage is essential. See label for rates for specific pests. For organic production.
Durivo (thiamethoxam, chlorantraniliprole)	10.0-13.0 fl oz	12	30	aphids, beet armyworm, cabbage looper, corn earworm, fall armyworm, flea beetles, leafhoppers, whiteflies	4A, 28	Do not exceed more than 13 fl oz per acre per season.
Entrust SC (spinosad)	1.5-10.0 fl oz	4	1	armyworms, cabbage looper, leafminers, thrips	5	See label for resistance management recommendations. Apply no more than 29 oz per acre per year. OMRI-listed ² .
Extinguish ((S)-methoprene)	1-1.5 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.
Grandevo <i>Chromobacterium</i> <i>subtsugae</i> strain PRAA4-1	1-3 lb	4	0	aphids, armyworm, cabbage looper, cutworms, diamondback moth, green cloverworm, mites, tobacco budworm, thrips, whiteflies	—	Can be used in organic production. OMRI-listed ² .
Fulfill (pymetrozine)	2.75 oz	12	7	aphids, suppression of whiteflies	9B	Apply when aphids first appear, before populations build to damaging levels. Two applications (maximum allowed) may be needed to control persistent aphid populations.
Intrepid 2F (methoxyfenozide)	4-10 fl oz	4	1	armyworms, cabbage looper, webworms	18	Do not apply more than 64 fl oz per acre per season.
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.5 lb	4	0	most caterpillars, but not Spodoptera species (armyworms)	11	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
*Lannate LV, *SP (methomyl)	LV: 0.75-3 pt SP: 0.25-1.0 lb	48	7	armyworms, aster leafhopper, beet armyworm, loopers, variegated cutworm	1A	Do not apply more than 24 pt of LV or 8 lb SP per acre per season.
*Larvin 3.2 (thiodicarb)	16-30 fl oz	48	14	armyworms, beet armyworm, cabbage looper, corn earworm, fall armyworm, southern armyworm	1A	Do not exceed 60 fluid ounces of Larvin per acre per season.
Lepinox WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	1.0-2.0 lb	12	0	most caterpillars, including beet armyworm (see label)	11	Treat when larvae are small. Thorough coverage is essential.
Malathion 8F (malathion)	1-1.5 pt	24	7	aphids, spider mites	1B	Do not apply more than twice per year.
Movento (spirotetramat)	4.0-5.0 fl oz	24	3	aphids, whiteflies	23	Do not apply more than 10 fl oz/acre/crop.
M-Pede 49% EC (Soap, insecticidal)	1-2% V/V	12	0	whiteflies	--	OMRI-listed ² .
*Mustang (zeta-cypermethrin)	2.4-4.3 oz	12	1	corn earworm, cucumber beetles, cutworms, flea beetles, leafhoppers, saltmarsh caterpillar, tobacco budworm, aphids, whiteflies, armyworms, ground beetles, crickets, loopers, <i>Lygus</i> bugs, stink bugs, wireworm adults	3A	A maximum of 0.3 lb ai/acre per season may be applied. Do not make applications less than 7 days apart.
Neemix 4.5 EC (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, cabbage looper, cutworms, leafminers, webworms, whiteflies	un	IGR and feeding repellent. OMRI-listed ² .
Orthene 97 (acephate)	0.5-1.0 lb	24	21	cabbage looper, fall armyworm, green peach aphid	1B	Do not use more than 2 lb active ingredient per acre per season. All tops must be removed before shipment.
Platinum Platinum 75SG (thiamethoxam)	5.0-11.0 fl oz 1.66-3.67 oz	12	30	aphids, flea beetles, leafhoppers, leafminers (suppression), whiteflies	4A	Maximum = 11 oz/acre or 3.67 oz/acre (75SG) per season. Do not use in conjunction with other 4A insecticides.

Table 7.27. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
*Pounce 25 WP (permethrin)	3.2-12.8 oz	12	1	aphids, beet armyworm, cabbage looper, corn earworm, cutworms, fall armyworm, leafhoppers, leafminers, loopers, southern armyworm, tobacco budworm	3A	Do not apply more than 1.0 lb active ingredient per acre per season.
*Proclaim (emamectin benzoate)	2.4-4.8 oz	12	7	beet armyworm, corn earworm, fall armyworm, <i>Liriomyza</i> leafminers, loopers, tobacco budworm	6	Provides suppression of leafminers. Rotate with other products with different modes of action.
PyGanic Crop Protection EC 5.0 (pyrethrins)	4.5-18 fl oz	12	0	Aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, whiteflies, others	3A	Can be used in greenhouses. Thorough coverage is essential. Breaks down rapidly in sunlight. OMRI-listed ² .
Pyronyl Crop Spray (pyrethrins + piperonyl butoxide)	1-12 fl oz	12	0	ants, aphids, armyworms, cabbage looper, corn earworm, flea beetles, leafhoppers, leafhoppers, leafhoppers, leafhoppers, webworms, whiteflies	3A	
Radiant SC (spinetoram)	5-10 fl oz	4	1	armyworms (not yellowstriped), cabbage looper, corn earworm, <i>Liriomyza</i> leafminer, thrips	5	Maximum of 6 applications, no more than 2 consecutive applications before rotating to another MOA.
Requiem 25EC (extract of <i>Chenopodium ambrosioides</i>)	2.0-4.0 qt	4	0	green peach aphid, suppression of <i>Liriomyza</i> leafminers, potato aphid, turnip aphid, whiteflies	un	
Scorpion 35 SL insecticide (dinotefuran)	Foliar: 2-5.25 fl oz Soil: 9-10.5 fl oz	12	foliar - 7, soil - 21	brown stink bug, cucumber beetle, flea beetles, grasshoppers, green stink bug, harlequin bug, leafhoppers, leafminers, southern green stink bug, thrips, whiteflies, suppression of green peach aphid	4A	No more than 2 applications at highest rate per acre per season.
Sevin XLR; 4F; 80S (carbaryl)	XLR; 4F: 0.5-2 qt 80S: 0.63-2.5 lb	12	14	armyworms, aster leafhopper, corn earworm, fall armyworm, flea beetles, leafhoppers, Lygus bug, spittlebugs, stink bugs, tarnished plant bug	1A	Repeat, as needed, up to 5 times, with at least 7 days between applications.
SunSpray 98.8%, JMS Stylet-Oil, Saf-T-side, others (Oils, insecticidal)	3-6 qt/100 gal (JMS) 1-2 gal/100 gal	4	0	aphids, beetle larvae, leafhoppers, leafminers, mites, thrips, whiteflies (pests controlled vary by product)	--	See label for cautions on tank mixes. Organic Stylet-Oil and Saf-T-Side are OMRI-listed ² .
Trigard (cyromazine)	2.66 oz	12	7	leafminers	17	Do not make more than six applications per crop.
Trilogy (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .
Venom Insecticide (dinotefuran)	foliar: 1-3 oz soil: 5-6.0 oz	12	7	Foliar: brown stink bug, cucumber beetle, flea beetle, grasshopper, green stink bug, suppression of green peach aphid and potato aphid, southern green stink bug, whiteflies Soil: suppression of green peach aphid and potato aphid, leafhoppers, leafminers, whiteflies	4A	Do not apply more than 6 oz per acre per season (foliar) or 12 oz per acre per season (soil). Do not use both methods of application.
Vetica (flubendiamide and buprofezin)	12.0-17.0 fl oz	12	7	armyworms, cabbage looper, corn earworm, cutworms, green cloverworm, imported cabbageworm, leafhoppers, saltmarsh caterpillar, tobacco budworm, whitefly	28, 16	Do not apply more than three times per season or apply more than 38 fl oz per acre per season. Use high rate for leafhoppers and whitefly.
Voliam Flexi (thiamethoxam, chlorantraniliprole)	4.0-7.0 oz	12	7	aphids, beet armyworm, cabbage looper, corn earworm, fall armyworm, flea beetles, leafhoppers, southern armyworm, tobacco budworm, whiteflies	4A, 28	Do not apply more than 14 oz per acre per growing season. An adjuvant may be used when applying to celery.
*Vydate L (oxamyl)	2-4 pt	48	21	leafminers (except <i>Liriomyza trifolii</i>)	1A	
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

* Restricted use insecticide.

Table 7.28. Selected insecticides approved for managing insect pests of okra.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Acramite-50WS (bifenazate)	0.75-1.0 lb	12	3	twospotted spider mite	un	One application per season.
Admire Pro (imidacloprid)	7-14 fl oz	12	21	aphids, flea beetles, leafhoppers, foliage feed- ing thrips, whiteflies	4A	No more than 14 oz per acre.
*Asana XL (0.66 EC) (esfenvalerate)	5.8-9.6 fl oz	12	1	cabbage looper, corn earworm, southern armyworm	3A	Florida only.
Avaunt (indoxacarb)	2.5-3.5 oz	12	3	beet armyworm, hornworms, loopers, south- ern armyworm, tomato fruitworm	22	Maximum = 14 oz/acre per crop
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	un	Antifeedant, repellent, insect growth regulator. OMRI-listed ² .
Azatin XL (azadirachtin)	5-21 fl oz	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, mites, stink bugs, thrips, weevils, whiteflies	un	Antifeedant, repellent, insect growth regulator.
Beleaf 50SG (flonicamid)	2.0-2.8 oz	12	0	aphids, plant bugs	9C	Do not apply more than 8.4 oz/acre per season.
Belt SC (flubendiamide)	1.5 fl oz	12	1	armyworms, cutworms, hornworms, loopers, tomato fruitworm	28	Do not apply more than 4.5 fl oz/acre per season.
*Brigade 2EC (bifenthrin)	2.1-6.4 fl oz	12	7	aphids, armyworms, corn earworm, cucumber beetles, cutworms, flea beetles, leafminers, loopers, mites (broad, carmine, twospotted), stink bugs, thrips, whitefly	3A	Do not apply more than 0.2 lb ai/acre per season.
BotaniGard 22 WP, ES (<i>Beauveria bassiana</i>)	WP: 0.5-2.0 lb/100 gal ES: 0.5-2 qt/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 LFR (bifenthrin)	3.4-6.8 fl oz	12	at planting	cutworms, flea beetle larvae, wireworms	3A	For mixing with liquid fertilizer and applied to soil at planting.
Coragen (rynaxypyr)	3.5-7.5 fl oz	4	1	armyworms, corn earworm, loopers, tomato fruitworm, garden webworm	28	Can be applied by drip chemigation or as a soil application at planting as well as a foliar spray. See label. For hornworms, can use as little as 2.0 fl oz/acre when applied as a foliar spray. Make no more than 4 applications per crop.
Courier 40SC (buprofezin)	9.0-13.6 fl oz	12	1	immature stages of leafhoppers, mealybugs, planthoppers, whiteflies	16	Make no more than 2 applications per crop cycle.
Crymax WDG (<i>Bacillus thuringiensis</i> <i>subspecies kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Use high rate for armyworms. Treat when larvae are young.
Deliver (<i>Bacillus thuringiensis</i> <i>subspecies kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11A	Use higher rates for armyworms. OMRI-listed ² .
Entrust SC (spinosad)	1.5-10 fl oz	4	1	armyworms, flower thrips, leafminers, loop- ers, other caterpillars, <i>Thrips palmi</i> , tomato fruitworm	5	Do not apply more than 29 oz per acre per crop. OMRI-listed ² .
Esteem Ant Bait (pyriproxyfen)	1.5-2.0 lb	12	1	red imported fire ant	7C	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.
Grandevo <i>Chromobacterium subspug- ae strain PRAA4-1</i>	1-3 lb	4	0	armyworms, hornworms, loopers, saltmarsh caterpillar, tomato fruitworm, tomato pin- worm, variegated cutworm	—	Can be used in organic production. OMRI- listed ² .
Intrepid 2F (methoxyfenozide)	4-16 fl oz	4	1	beet armyworm, cabbage looper, fall army- worm, hornworms, southern armyworm, true armyworm, yellowstriped armyworm	18	Do not apply more than 64 fl oz per acre per season.
Javelin WG (<i>Bacillus thuringiensis</i> <i>subspecies kurstaki</i>)	0.12-1.50 lb	4	1	most caterpillars, but not <i>Spodoptera species</i> (armyworms)	11	Treat when larvae are young. Thorough cover- age is essential OMRI-listed ² .
JMS Stylet-Oil (oil, insecticidal)	3-6 qts/100 gal	4	0	leafminers, mites, whiteflies	--	See label for tank mix cautions. Organic Stylet- Oil is OMRI-listed ² .
Kanemite 15 SC (acequinocyl)	31 fl oz	12	7	broad mite, twospotted spider mite	20B	Two applications per year, at least 21 days apart.

Table 7.28. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Knack IGR (pyriproxyfen)	8-10 fl oz	12	1	whiteflies (immatures)	7C	Do not make more than 2 applications per season.
Malathion 8F (malathion)	1.2	12	1	aphids	1B	Maximum of 5 applications per year.
Movento (spirotetramat)	4-5 fl oz	24	1	aphids, whiteflies	23	Do not apply more than 10 fl oz per acre per season.
*Mustang (zeta-cypermethrin)	2.4-4.3 oz	12	1	brown stink bugs, cabbage looper, cutworms, fall armyworm, flea beetles, grasshoppers, green stink bugs, hornworms, leafhoppers, plant bugs, southern armyworm, tomato fruitworm, tomato pinworm, true armyworm, yellowstriped armyworm	3	Do not make applications less than 7 days apart. Do not apply more than 0.3 lb ai/acre per season.
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, leafhoppers, leafminers, loopers, whiteflies	un	IGR and feeding repellent. OMRI-listed ² .
Portal (fenpyroximate)	2 pt	12	1	mites, including broad mites	21A	Do not make more than two applications per season.
Provado 1.6F (imidacloprid)	3.8-6.2 fl oz	12	0	aphids, leafhoppers, whiteflies	4A	Do not apply more than 19.2 oz per acre per year.
Pyganic Crop Protection EC 5.0 (pyrethrins)	4.5-18 fl oz	12	0	Aphids, beetles, caterpillars, crickets, grasshoppers, mites, stink bugs, whiteflies, thrips, others	3	OMRI-listed ²
Radiant SC (spinetoram)	5-10 fl oz	4	1	armyworms, dipterous leafminers, hornworms, loopers, thrips, tomato fruitworm	5	Control of leafminers and thrips may be improved with an adjuvant.
Requiem 25EC (Chenopodium ambrosioides)	2.0-4.0 qt	4	0	thrips, whiteflies	--	Apply before pests reach damaging levels.
Sevin XLR, 4F, 80S (carbaryl)	XLR, 4F: 1-1.5 qt 80S: 1.25-1.88 lb	12	3	corn earworm, stink bugs	1A	Do not apply more than a total of 6 qt or 7.5 lb per acre per season.
Trilogy (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	18B	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .
Vetica (flubendiamide and buprofezin)	12.0-17.0 fl oz	12	1	armyworms, cabbage looper, cutworms, garden webworm, leafhoppers and mealybugs, saltmarsh caterpillar, tobacco budworm, tomato hornworm, tomato fruitworm, tomato pinworm, whiteflies	28, 16	Do not apply more than 3 times per season or apply more than 38 fl oz per acre per season. Use high rate for whiteflies and leafhoppers.
Zeal Miticide (etoxazole)	2-3 oz	12	7	twospotted spider mite	10B	Do not make more than one application per season. Do not use with an adjuvant or surfactant.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

* Restricted use insecticide.

Table 7.29. Selected insecticides approved for managing insect pests of onions and other bulb vegetables.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Admire Pro (imidacloprid)	14.0 fl oz	12	21	foliage-feeding thrips	4A	See supplemental label for application methods.
Agree WG (<i>Bacillus thuringiensis</i> <i>subspecies aizawai</i>)	1.0-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11A	Apply when larvae are small for best control. OMRI-listed ² .
*Agri-Mek SC (abamectin)	1.75-3.5 fl oz	12	30	<i>Liriomyza</i> leafminers, thrips	6	Must be used with a non-ionic activator type wetting, spreading and/or penetrating adjuvant., not a binder sticker type adjuvant. Maximum of 10.25 fl oz per acre per season.
*Ambush 25W (permethrin)	6.4-19.2 oz	12	1	armyworms, cutworms, leafminers, onion maggot (adults), onion thrips, stink bugs	3A	Dry bulb and garlic only. Maximum of 2 lb ai/acre per season.
Assail 30SG (acetamiprid)	5.0-8.0 oz	12	7	thrips	4A	No more than 4 applications or 32 oz of product per acre per season.
Aza-Direct (azadirachtin)	1-2 pts, up to 3.5, if needed	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, mites, stink bugs, thrips, weevils, whiteflies	un	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	un	Antifeedant, repellent, insect growth regulator.
Biobit HP (<i>Bacillus thuringiensis</i> <i>subspecies kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11A	Treat when larvae are young. Good coverage is essential. Can be used in the greenhouse. For organic production.
BotaniGard 22 WP, ES (<i>Beauveria bassiana</i>)	WP: 0.5-2 lb/100 gal ES: 0.5-2 qt/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.
Coragen (chlorantraniliprole)	3.5-5.0 fl oz	4	1	beet armyworm	28	No more than 4 applications or 15.4 fl oz of product per acre per crop. For entire Bulb Vegetable Group.
Crymax WDG (<i>Bacillus thuringiensis</i> <i>subspecies kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Use high rate for armyworms. Treat when larvae are young.
Deliver (<i>Bacillus thuringiensis</i> <i>subspecies kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11A	Use higher rates for armyworms. OMRI-listed ² .
*Diazinon AG500, *Diazinon 50W (diazinon)	AG500: 2-4 qt 50W: 4-8 lb	72	preplant	onion maggots, wireworms	1B	Do not make more than one soil application per year. For onions, bulb and green, leeks, garlic shallots.
DiPel DF (<i>Bacillus thuringiensis</i> <i>subspecies kurstaki</i>)	0.25-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. Good coverage is essential. OMRI-listed ² .
Entrust SC (spinosad)	3-8 fl oz	4	1	armyworms, dipteran leafminers, flea beetle, loopers, suppression of thrips	5	No more than 5 applications per year (29 fl oz product). OMRI-listed ² .
Esteem Ant Bait (pyriproxyfen)	1.5-2.0 lb	12	1	red imported fire ant	7C	Dry bulb only.
Extinguish ((S)-methoprene)	1-1.5 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.
Grandevo (<i>Chromobacterium subtsugae</i> strain PRAA4-1)	1-3 lb	4	0	aphids, armyworms, cutworms, leek moth, loopers, omnivorous leafroller, saltmarsh caterpillar, thrips, webworms	–	Leek, garlic, onion (bulb and green), shallot
Intrepid 2F (methoxyfenozide)	4-12 fl oz	4	1	lepidopteran larvae, including armyworms and loopers	18	Green onion subgroup only. Do not apply more than 64 fl oz per acre per year.
Javelin WG (<i>Bacillus thuringiensis</i> <i>subspecies kurstaki</i>)	0.12-1.5 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms)	11A	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
Knack IGR (pyriproxyfen)	8 fl oz	12	3	onion thrips, western flower thrips	7C	Maximum of 2 applications, at least 14 days apart. No activity against adult insects. Onion (dry bulb only).
*Lannate LV; *SP (methomyl)	LV: 1.5-3.0 pt SP: 0.5-1.0 lb	48	7	beet armyworm, black cutworm, thrips, variegated cutworm	1A	Dry bulb, green onions, only. Add a wetting agent to improve coverage.

Table 7.29 . Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
*Lannate LV; *SP (methomyl)	LV: 1.5 pt SP: 0.5 lb	48	7	beet armyworm	1A	Garlic only.
Lorsban 15G; 75WG; *Advanced (chlorpyrifos)	15G: 3.7 oz/1000 ft of row 75WG: 1.33 lb Advanced: see label	24	at planting	onion maggot, seedcorn maggot	1B	Dry bulb only. One application per year.
Malathion 8F (malathion)	1-1.56 pt	onions: 12, leeks, shallots, garlic: 24	3	onion maggot, thrips on onions, aphids and thrips on garlic, leeks, shallots	1B	Onions, bulb and green, leeks, shallots, garlic
M-Pede 49% EC Soap, insecticidal	1-2% V/V	12	0	aphids, leafhoppers, mites, plant bugs, thrips, whiteflies	--	OMRI-listed ² .
*Mustang (zeta-cypermethrin)	2. 4-4.3 oz	12	7	aphids, armyworms, cutworms, leafminer adults, onion maggot adults, onion thrips, stink bugs	3A	Do not apply more than 21.5 oz per acre per season.
Neemix 4.5 EC (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, cabbage looper, cutworms, leafminers, onion maggot, whiteflies	un	OMRI-listed ² .
*PennCap-M (methyl parathion)	2 pt	13 days	15	thrips	1B	Do not apply when onions are blooming and bees are foraging. Onions only.
*Pounce 25 WP (permethrin)	6.4-19.2 oz—onions 6.4-12.8 oz—garlic	12	1	armyworms, cutworms, leafminer adults, onion maggot adults, onion thrips, , stink bugs	3A	Bulb onions and garlic
*Proaxis Insecticide (gamma-cyhalothrin)	1.92-3.84 oz	24	14	armyworms (1 st and 2 nd instar), cutworms, leafminer adults, onion and seedcorn maggot adults, onion thrips, plant bugs, stink bugs, tobacco thrips, suppression of aphids, flower thrips, western flower thrips	3A	Bulb onions and garlic
Radiant SC (spinetoram)	5-10 fl oz	4	1	armyworms, dipterous leafminers, loopers, thrips	5	Use with an adjuvant.
Requiem 25EC (extract of <i>Chenopodium ambrosioides</i>)	1.5-3.0 qt	4	0	onion thrips, western flower thrips	un	Begin as soon as thrips are seen.
Trigard (cyromazine)	2.66 oz	12	7	leafminers	17	Maximum of 6 applications per crop.
Trilogy (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees ex- posed to direct treatment. OMRI-listed ² .
*Warrior II (lambda-cyhalothrin)	0.96-1.92 fl oz	24	14	aphids, armyworms, cutworms, onion mag- got adults, onion thrips, plant bugs, stink bugs, tobacco thrips, suppression of flower thrips, western flower thrips	3A	For bulb crops only (onions and garlic), not green onions. Do not apply more than 0.24 lb ai/acre per season.
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

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* Restricted use insecticide.

Table 7.30. Selected insecticides approved for managing insect pests of parsley.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Actara (thiamethoxam)	1.5-5.5 oz	12	7	aphids, flea beetles, leafhoppers, whiteflies	4A	Do not use if other 4A insecticides have been or will be used.
Admire Pro (imidacloprid)	4.4-10.5 fl oz	12	21	aphids, leafhoppers, thrips (foliage feeders), whiteflies	4A	Limited to 10.5 fl oz per acre per season.
Agree WG (<i>Bacillus thuringiensis</i> sub- species <i>aizawai</i>)	0.5-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11	Apply when larvae are small for best control. OMRI-listed ² .
*Agri-Mek SC (abamectin)	1.75-3.5 fl oz	12	7	<i>Liriomyza</i> leafminers, spider mites	6	No more than 2 sequential applications. Must be used with an adjuvant (but not binder sticker types). Not for use on leafy vegetables grown for transplant.
*Ambush 25W (permethrin)	6.4-12.8 oz	12	1	beet armyworm, cabbage looper, corn earworm, cutworms, fall armyworm, leafhoppers, vegetable leafminer	3A	Do not apply more than 2 lb ai/acre per season.
Assail 30SG (acetamiprid)	2.0-4.0 oz	12	7	aphids, whiteflies	4A	Begin applications for whiteflies when first adults are noticed. Do not apply more than 5 times per season or apply more often than every 7 days.
Avaunt (indoxacarb)	2.5-6.0 oz	12	3	beet armyworm, cabbage looper, corn earworm	22	Do not apply more than 24 ounces of product per acre per crop.
Aza-Direct (azadirachtin)	1-2 pts, to 3.5 pts if needed	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, mites, stink bugs, thrips, weevils, whiteflies	un	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	un	Antifeedant, repellent, insect growth regulator.
*Baythroid XL (beta-cyfluthrin)	0.8-3.2 fl oz	12	0	beet armyworm and southern armyworm (1 st and 2 nd instars), cabbage looper, corn earworm, cutworms, flea beetles, grasshoppers, potato leafhopper, saltmarsh caterpillar, thrips, vegetable weevil, yellowstriped armyworm, suppression of adult whitefly	3A	Maximum of 12.8 fl oz per acre per season.
Belay 50 WDG (clothianidin)	1.6-3.2 oz	12	7	aphids, flea beetles, leafhoppers, leafminers (suppression), whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Toxic to bees. Supplemental label for rates above 2.1 oz.
Belay 50 WDG (clothianidin)	4.8 -6.4 oz (soil application)	12	Apply at planting	aphids, flea beetles, leafhoppers, leafminers (suppression), whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. See label for application instructions.
Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	0	aphids, plant bugs	9C	Do not apply more than 8.4 oz/acre per season. Begin applications before pests reach damaging levels.
Belt SC (flubendiamide)	1.5 fl oz	12	1	armyworms, corn earworm, green cloverworm, loopers, saltmarsh caterpillar	28	Do not apply more than 4.5 fl oz/acre per season.
Biobit HP (<i>Bacillus thuringiensis</i> sub- species <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11	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.
Confirm 2F (tebufenozide)	6.0-8.0 fl oz	4	7	armyworms, cabbage looper, garden webworm	18	Do not exceed 56 ounces of product per acre per season.
Coragen (rynaxypyr)	3.5-7.5 fl oz	4	1	beet armyworm, cabbage looper, corn earworm, leafminers, suppression of whitefly nymphs	28	May be applied by drip chemigation, in addition to foliar and various soil application methods.
Courier 40SC (buprofezin)	9.0-13.6 fl oz	12	7	leafhoppers, planthoppers, whiteflies	16	Do not make more than 2 applications per crop cycle. IGR targets immatures.
Crymax WDG (<i>Bacillus thuringiensis</i> sub- species <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Use high rate for armyworms. Treat when larvae are young.
Deliver (<i>Bacillus thuringiensis</i> sub- species <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11	Use higher rates for armyworms. OMRI-listed ² .
DiPel DF (<i>Bacillus thuringiensis</i> sub- species <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Good coverage is essential. See label for rates for specific pests. Can be used for organic production.
Durivo (thiamethoxam, chlorantraniliprole)	10-13 oz	12	30	aphids, beet armyworm, cabbage looper, corn earworm, fall armyworm, flea beetles, imported cabbageworm, leafhoppers, whiteflies	4A, 28	May be applied by one of several soil application methods.

Table 7.30. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Entrust SC (spinosad)	1.5-10.0 fl oz	4	1	armyworms, cabbage looper, leafminers, thrips	5	Use no more than 29 oz per acre per crop. 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.
Confirm 2F (tebufenozide)	6.0-8.0 fl oz	4	7	armyworms, cabbage looper, garden webworm	18	Do not exceed 56 ounces of product per acre per season.
Coragen (rynaxypyr)	3.5-7.5 fl oz	4	1	beet armyworm, cabbage looper, corn earworm, leafminers, suppression of whitefly nymphs	28	May be applied by drip chemigation, in addition to foliar and various soil application methods.
Courier 40SC (buprofezin)	9.0-13.6 fl oz	12	7	leafhoppers, planthoppers, whiteflies	16	Do not make more than 2 applications per crop cycle. IGR targets immatures.
Crymax WDG (<i>Bacillus thuringiensis</i> sub-species <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Use high rate for armyworms. Treat when larvae are young.
Deliver (<i>Bacillus thuringiensis</i> sub-species <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11	Use higher rates for armyworms. OMRI-listed ² .
DiPel DF (<i>Bacillus thuringiensis</i> sub-species <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Good coverage is essential.
Durivo (thiamethoxam, chlorantraniliprole)	10-13 oz	12	30	aphids, beet armyworm, cabbage looper, corn earworm, fall armyworm, flea beetles, imported cabbageworm, leafhoppers, whiteflies	4A, 28	May be applied by one of several soil application methods.
Entrust (spinosad)	0.5-3 oz	4	1	armyworms, cabbage looper, leafminers, thrips	5	Use no more than 9 oz per acre per crop. OMRI-listed ² .
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.
Fulfill (pymetrozine)	2.75 oz	12	7	aphids, suppression of whiteflies	9B	Apply when aphids first appear, before populations build to damaging levels. Two applications (maximum allowed) may be needed to control persistent aphid populations.
Grandevo <i>Chromobacterium subtsugae</i> strain PRAA4-1	1-3 lb	4	0	aphids, armyworm, cabbage looper, cutworms, diamondback moth, green cloverworm, mites, tobacco budworm, thrips, whiteflies	—	Can be used in organic production. OMRI-listed ² .
Intrepid 2F (methoxyfenozide)	4-10 fl oz	4	1	armyworms, cabbage looper, webworms	18	Do not apply more than 64 fl oz per acre per season.
Javelin WG (<i>Bacillus thuringiensis</i> sub-species <i>kurstaki</i>)	0.12-1.5 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms)	11	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
*Larvin 3.2 (thiodicarb)	16-30 fl oz	48	14	armyworms, beet armyworm, cabbage looper, corn earworm, fall armyworm, southern armyworm	1A	Do not exceed 60 fl oz per acre per season.
Lepinox WDG (<i>Bacillus thuringiensis</i> sub-species <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 pt	24	7	aphids	1B	Do not apply more than twice per year.
Movento (spirotetramat)	4.0-5.0 fl oz	24	3	aphids, whiteflies	23	Do not apply more than 10 fl oz/acre/crop.
M-Pede 49% EC Soap, insecticidal	1-2% V/V	12	0	aphids, leafhoppers, mites, plant bugs, whiteflies	--	OMRI-listed ² .
*Mustang (zeta-cypermethrin)	2.4-4.3 oz	12	1	aphids, armyworms, corn earworm, crickets, cucumber beetles, cutworms, flea beetles, ground beetles, leafhoppers, loopers, <i>Lygus</i> bugs, saltmarsh caterpillar, stink bugs, tobacco budworm, whiteflies, wireworm adults	3A	A maximum of 0.3 lb ai/acre per season may be applied. Do not make applications less than 7 days apart.
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, leafhoppers, leafminers, loopers, whiteflies	un	IGR and feeding repellent. OMRI-listed ² .
Oberon 2SC (spiromesifen)	7.0-8.5 fl oz	12	7	whiteflies	23	Maximum amount per crop: 25.5 fl oz/acre. No more than three applications.

Table 7.30. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Platinum Platinum 75SG (thiamethoxam)	5.0-11 fl oz 1.66-3.67 oz	12	30	aphids, flea beetles, leafhoppers, leafminers (suppression), whiteflies	4A	Maximum = 11 oz/acre or 3.67 oz/acre (75SG) per season. Do not use in conjunction with other 4A insecticides.
*Pounce 25 WP (permethrin)	3.2-12.8 oz	12	1	aphids, armyworms, beet armyworm, cabbage looper, corn earworm, cutworms, fall armyworm, leafhoppers, loopers, southern armyworm, tobacco budworm, vegetable leafminer	3A	Do not apply more than 1.0 lb ai/acre per season.
*Proclaim (emamectin benzoate)	2.4-4.8 oz	12	7	beet armyworm, corn earworm, fall armyworm, loopers, tobacco budworm, suppression of leafminers	6	Do not apply more than 28.8 oz/acre per season.
Provado 1.6 F (imidacloprid)	3.8 oz	12	7	aphids, flea beetles, leafhoppers, whiteflies	4A	Maximum of 19.0 fl oz per acre per season. Do not use with other 4A insecticides.
PyGanic Crop Protection EC 5.0 (pyrethrins)	4.5-18 fl oz	12	0	Aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, whiteflies, others	3A	Can be used in greenhouses. Thorough coverage is essential. Breaks down rapidly in sunlight. OMRI-listed ² .
Radiant SC (spinetoram)	5-10 fl oz	4	1	armyworms (not yellowstriped), cabbage looper, corn earworm, <i>Liriomyza</i> leafminer, thrips	5	Maximum of 6 applications, no more than 2 consecutive applications before rotating to another MOA.
Requiem 25EC (extract of <i>Chenopodium ambrosioides</i>)	2.0-4.0 qt	4	0	green peach aphid, suppression of <i>Liriomyza</i> leafminers, potato aphid, turnip aphid, whiteflies	un	
Scorpion 35 SL insecticide (dinotefuran)	Foliar: 2-5.25 fl oz Soil: 9-10.5 fl oz	12	foliar - 7, soil - 21	brown stink bug, cucumber beetle, flea beetles, grasshoppers, green stink bug, harlequin bug, leafhoppers, leafminers, southern green stink bug, thrips, whiteflies, suppression of green peach aphid	4A	No more than 2 applications at highest rate per acre per season.
Sevin 80S; XLR; 4F (carbaryl)	80S: 0.63-2.5 lb XLR; 4F: 0.5-2.0 qt	12	14	armyworms, aster leafhopper, corn earworm, fall armyworm, flea beetles, leafhoppers, <i>Lygus</i> bug, spittlebugs, stink bug, tarnished plant bug	1A	Do not apply more than a total of 7.5 lb or 6 qt per acre per crop.
Trigard (cyromazine)	2.66 oz	12	7	leafminers	17	No more than 5 applications per crop.
Trilogy (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .
Venom Insecticide (dinotefuran)	foliar: 1-3 oz soil: 5-6.0 oz	12	foliar: 7 soil: 21	Foliar: brown stink bug, cucumber beetle, flea beetle, grasshopper, green stink bug, suppression of green peach aphid and potato aphid, southern green stink bug, whiteflies Soil: suppression of green peach aphid and potato aphid, leafhoppers, leafminers, whiteflies	4A	Use only one application method (soil or foliar, not both). Do not apply more than 6 oz/acre (foliar) or 12 oz/acre (soil) per season.
Vetica (flubendiamide and buprofezin)	12.0-17.0 fl oz	12	7	armyworms, cabbage looper, corn earworm, cutworms, green cloverworm, imported cabbageworm, leafhoppers (14-17 oz rate), saltmarsh caterpillar, tobacco budworm, whitefly (14-17 oz rate)	28, 16	No more than 3 applications per season or 38 fl oz per acre per season.
Voliam Flexi (thiamethoxam, chlorantraniliprole)	4.0-7.0 oz	12	7	aphids, beet armyworm, cabbage looper, corn earworm, fall armyworm, flea beetles, leafhoppers, southern armyworm, tobacco budworm, whiteflies	4A, 28	Do not apply more than 14 oz per acre per growing season. Do not use an adjuvant.
Xentari DF (<i>Bacillus thuringiensis</i> sub-species <i>aizawai</i>)	0.5-2 lb	4	0	caterpillars	11	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

²Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

* Restricted use insecticide.

Table 7.31. Selected insecticides approved for managing insect pests of sweet potato.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Actara (thiamethoxam)	1.5-3.0 oz	12	14	aphids, flea beetles, potato leafhopper	4A	Toxic to bees. Do not use after Platinum.
Admire Pro (imidacloprid)	4.4-10.5 fl oz - soil 1.2 fl oz - foliar	12	125 – soil 7 - foliar	aphids, flea beetles, leafhoppers, whiteflies	4A	One application to soil per season. If using as a foliar spray, no more than 3.7 fl oz per acre per season.
Agree WG (<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>)	0.5-2.0	4	0	armyworms, hornworms, loopers	11A	Treat when larvae are small.
*Agri-Mek SC (abamectin)	1.75-3.5 fl oz	12	14	<i>Liriomyza</i> leafminers, spider mites	6	Must be used with a non-ionic activator type wetting, spreading and/or penetrating adjuvant., not a binder sticker type adjuvant.
Assail 30SG (acetamiprid)	1.5-4.0 oz	12	7	aphids, cucumber beetles, flea beetles, leafhoppers, whiteflies	4A	Whiteflies not on label for sweet potatoes but are for other crops on label. No more than 4 applications per season.
Avaunt (indoxacarb)	2.5-6.0 oz	12	7	cabbage looper	22	Do not apply more than 24 oz/acre per crop.
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	un	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	un	Antifeedant, repellent, insect growth regulator.
*Baythroid XL (beta-cyfluthrin)	0.8-2.8 fl oz	12	0	cutworms, cabbage looper, flea beetles, potato leafhopper, sweetpotato weevil adults	3A	No more than 16.8 oz/acre per season.
Belay Insecticide (clothianidin)	in-furrow or side dress: 9-12 fl oz, foliar: 2-3 fl oz	12	foliar: 14	Aphids, corn wireworm, flea beetles, leafhoppers, southern potato wireworm, sweetpotato weevil, tobacco wireworm, white grubs	4A	In-furrow or side-dress application, including chemigation up to 50% ground cover.
Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	7	aphids, plant bugs	9C	Do not apply more than 8.4 oz per acre per season.
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11A	Treat when larvae are young. Good coverage is essential. Can be used in the greenhouse. For organic production.
BotaniGard 22 WP, ES (<i>Beauveria bassiana</i>)	WP: 0.5-2 lb/100 gal ES: 0.5-2 qt/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.
*Brigade 2 EC (bifenthrin)	9.6-19.2 oz at-plant (soil); 3.2-9.6 oz at lay-by (soil); 2.1-6.4 oz (foliar)	12	21	cucumber beetles, flea beetles, sweetpotato weevil adults (foliar), whitefringed beetle adults, white grub adults, white grubs (lay-by), wireworm adults, wireworms (at-plant and lay-by)	3A	No more than 2 foliar applications, at least 21 days apart. Do not apply more than 0.5 lb active ingredient per acre per season, including soil applications.
Coragen (rynaxypyr)	3.5-5.0 fl oz	4	1	beet armyworm	28	Foliar only. No more than 4 applications per crop. Do not make more than 2 successive applications in a 30-day period. Do not apply more than 15.4 fl oz per acre per crop.
Crymax WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Use high rate for armyworms. Treat when larvae are young.
Deliver (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11A	Use higher rates for armyworms. OMRI-listed ² .
Diatect V; Diatect Multipurpose Insecticide II (diatomaceous earth + pyrethrins + piperonyl butoxide)	1-6 lb	12	0	aphids, armyworms, cabbage looper	3A, --	Diatect V is OMRI-listed ² (no piperonyl butoxide)
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. Good coverage is essential.
*Endigo ZC (lambda-cyhalothrin, thiamethoxam)	3.5-4.5 fl oz	24	14	armyworms, blister beetles, corn earworm, crickets, cucumber beetles, cutworms, flea beetles, grasshoppers, leafhoppers, loopers, plant bugs, saltmarsh caterpillar, stink bugs, sweet potato leaf beetle and vine borer, thrips, webworms, whiteflies	3A, 4A	Do not exceed a total of 10 fl oz of product per acre per growing season. Do not use with other Group 4A insecticides.
Entrust SC (spinosad)	3-10 fl oz	4	7	armyworms, leafminers, <i>Liriomyza</i> , loopers, thrips	5	Do not make applications less than 7 days apart or apply more than 4 times per crop. Do not apply more than 21 fl oz/acre per crop. OMRI-listed ²

Table 7.31. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Esteem Ant Bait (pyriproxyfen)	1.5-2.0 lb	12	1	fire ants	7D	Do not exceed a total of 0.109 lb pyriproxyfen per acre (all formulations, i.e., Knack IGR). Ant Bait contains 0.5% ai, or 0.10 lb at 2-lb rate.
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.
Fulfill (pymetrozine)	2.75-5.5 oz	12	14	buckthorn aphid, green peach aphid, melon aphid, potato aphid	9B	Allow a minimum of 7 days between applications. Do not exceed 11 oz/acre/season.
Grandevo (<i>Chromobacterium</i> <i>subtsugae</i> strain PRAA4-1)	1-3 lb	4	0	aphids, armyworms, loopers, potato leafhopper, whiteflies	—	OMRI-listed ² .
Imidan 70 W (phosmet)	1.3 lb	4 days for seedbed treatment, 5 days for foliar	7	banded cucumber beetle, sweetpotato weevil, whitefringed beetle, suppression of white grub and wireworm	1B	No more than 5 applications per season. Do not apply through irrigation system. Crop must be mechanically harvested.
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.5 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms)	11A	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
Lorsban 15G, 75WG, *Advanced (chlorpyrifos)	See labels for rates	24	preplant broadcast treatment, 125 days before harvest	flea beetles, sweet potato flea beetle, wireworms (<i>Conoderus</i>)	1B	See label. Must be incorporated into soil.
Malathion 8 F (malathion)	1-1.5 pt	12	3	leafhoppers, morning glory leafminer	1B	Maximum of two applications per year.
*Mocap 15 G, *EC (ethoprop)	See labels	48	preplant see label	cucumber beetles, flea beetles, white grubs, wireworms	1B	Two to three weeks before planting.
Movento (spirotetramat)	4.0-5.0 fl oz	24	7	aphids, psyllids, whiteflies	23	Maximum of 10 fl oz/acre per season.
M-Pede 49% EC Soap, insecticidal	1-2 % V/V	12	0	aphids	—	OMRI-listed ² .
*Mustang	1.4-4.3 oz	12	1	cabbage looper, cucumber beetles, cutworms, flea beetles, grasshoppers, leafhoppers, tarnished plant bug, vegetable weevil, whitefringed beetle (adult), yellowstriped armyworm; aids in control of aphids and beet armyworm	3A	A maximum of 0.3 lb ai/acre per season may be applied. Leaves cannot be used for food or feed.
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	aphids, beetles, caterpillars, grasshoppers, leafhoppers, leafminers, weevils, whiteflies	un	Does not kill adult insects. IGR and feeding repellent. OMRI-listed ² .
Oberon 2SC (spiromesifen)	8-16 fl oz	12	7	twospotted spider mite, whiteflies	23	Maximum amount per crop: 32 oz/acre. No more than 2 applications.
Oil, insecticidal	1-2 gal/100 gal	12	Up to day of harvest	leafminers, mites, whiteflies	--	
Platinum	5-8 fl oz	12	Applied at planting	aphids, Colorado potato beetles, flea beetles, potato leafhoppers	4A	For most crops that are not on the label, a 120-day plant-back interval must be observed. To manage resistance, avoid using Actara or Provado in conjunction with Platinum.
Platinum 755G (thiamethoxam)	1.66-2.67 oz					
Provado 1.6F (imidacloprid)	3.5 oz	12	7	aphids, flea beetles, leafhoppers, whiteflies	4A	Limited to 3 applications.
Radiant SC (spinetoram)	6-8 fl oz	4	7	armyworm, Colorado potato beetle, dipterous leafminer, loopers, thrips	5	Do not make more than 4 applications per year.
Rimon 0.83 EC (novaluron)	6-12 fl oz	12	14	armyworms, loopers, other foliage feeding caterpillars, sweet potato leafminer, whiteflies	15	Do not apply more than 24 oz per acre per season. Limited to two applications for whiteflies (12-oz rate).
Sevin 80S; XLR; 4F (carbaryl)	80S: 1.25-2.5 lb XLR, 4F: 1-2 qt	12	7	corn earworm, cucumber beetles, flea beetles, sweetpotato hornworm, sweetpotato weevil (preplant dip), tortoise beetle, whitefringed beetle, yellowstriped armyworm	1A	Do not apply more than 10 lb (80S) per acre per crop or 8 qt (4F, XLR). See label for preplant dip treatment.
Trilogy (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .

Table 7.31. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Voliam Flexi (thiamethoxam and chlorantraniliprole)	4 oz	12	14	aphids, beet armyworm, cabbage looper, flea beetles, potato leafhopper	4A, 28	Do not exceed a total of 8 oz of product per acre per season.
*Voliam Xpress (lambda-cyhalothrin and chlorantraniliprole)	5-9 oz	24	14	aphids, armyworms, crickets, cutworms, flea beetle adults, grasshoppers, leafhoppers, loopers, saltmarsh caterpillar, stink bugs, sweet potato vine borer, webworms, others	3A, 28	Do not apply more than 27.0 fl. oz of product per acre per season. Supplemental label.
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

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*** Restricted use insecticide.**

Table 7.32. Beet fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Alternaria	9 & 12	Switch 62.5WDG	14 oz	56 oz	7	0.5	See label for specifics regarding preplant incorporated applications and surface applications at the time of planting.
Powdery mildew		(cyprodinil + fludioxonil)					
	7	Fontelis SC (penthiopyrad)	30 fl oz	61 fl oz	0	0.5	Apply no more than 2 sequential applications without alternating to dissimilar chemistry.
Cercospora	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ WG, Champ Formula 2, Champ WP, COC DF, COC WP, Copper Count N, Cueva, Cuprofix Ultra, Kentan DF, Kocide DF, Kocide 2000, Kocide 3000, Kocide 4.5 LF, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days	
	M2	(sulfur) Many brands available: Kumulus DF, Micro Sulf, Microthiol Disperss, Sulfur 90W, Top Cop w/ Sulfur, Wetttable Sulfur	SEE INDIVIDUAL LABELS		1	1	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
	3	Bumper 41.8EC (propiconazole)	4.0 fl oz	16.0 fl oz	7	0.5	Do not apply more than 4 appl/season.
	3	(tebuconazole) Many brands available: Folicur 3.6F, Monsoon 3.6F, Onset 3.6L, Orius 3.6F, Tebusha 3.6L, Toledo 3.6F, Tebuzol 3.6F, Tebustar 3.6L (tebuconazole)	7.2 fl oz	28.8 fl oz	7	0.5	Do not apply more than 4 appl/season.
	3	Tilt 3.6E (propiconazole)	4.0 fl oz	16.0 fl oz	7	0.5	Do not apply more than 4 appl/season.
	7	Fontelis SC (penthiopyrad)	30 fl oz	61 fl oz	0	0.5	Apply no more than 2 sequential applications without alternating to dissimilar chemistry.
	11	Amistar 80DF (azoxystrobin)	5 oz	2.5 lb	0	4 h	See label for Rhizoctonia control .
	11	Cabrio EG (pyraclostrobin)	16 oz	48 oz	0	0.5	Limit is 3 appl./crop & alternate chemistry.
	11	Flint (trifloxystrobin)	3 oz	12 oz	7	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11	Gem 500SC (trifloxystrobin)	2.9 fl oz	11.6 fl oz	7	0.5	Alternate every other application with a fungicide of dissimilar mode of action.

Table 7.32. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Cercospora Continued	11	Quadris (azoxystrobin)	15.4 fl oz	3.75 qt	0	4 h	Alternate every other application with a fungicide of dissimilar mode of action.
	11	Reason (fenamidone)	8.2 fl oz	24.6 fl oz	2	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
Damping-off	M3	Defiant 75WP (thiram)	5.3 oz/ 100 lbs of seed			1	Seed treatment only.
Downy mildew	43	Presidio (fluopicolide)	4 fl oz	12 fl oz	7	0.5	Do not exceed more than 2 sequential applications.
Pythium seedling blight	4	Allegiance FI (metalaxyl)	0.75 fl oz/100 lb seed			0.5	Seed treatment only.
	4	Apron XL LS (mefenoxam)	0.64 fl oz/100 lb seed			2	Seed treatment only.
	4	Metastar 2E AG (metalaxyl)	8 pt			1	Apply as a broadcast soil application and incorporate into top 2 inches. See label for directions.
	4	Sebring 2.65 ST (metalaxyl)	0.7 fl oz/ 100 lb seed			1	Seed treatment only.
Pythium seedling diseases	4	Ridomil Gold EC (mefenoxam)	2 pt			2	Apply at seeding in a 7-12" band on soil over seed furrow.
	4	Ridomil Gold GR (mefenoxam)	40 lb			2	See label for specifics regarding preplant incorporated applications and surface applications at the time of planting.
	4	Ultra Flourish (mefenoxam)	4 pt			2	See label for specifics regarding preplant incorporated applications and surface applications at the time of planting.
Various seedling diseases	12	Maxim 4FS (fludioxonil)	0.16 fl oz/ 100 lb of seed			0.5	Seed treatment only.
	4 & 11	Uniform SC (mefenoxam + azoxystrobin)	0.34 fl oz/ 1000' of row	1 appl.		0	Soil incorporated.

¹FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

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Table 7.33. Carrot fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Alternaria blight	M1	(copper compounds) Many labels available: Badge SC, Badge X2, Basic Copper 53, COCS WDG, Champ DP, Champ WG, Champ Formula 2, Champ WP, COC DF, COC WP, Copper Count N, Cuerva, Cuprofix Ultra, Kentan DF, Kocide DF, Kocide 2000, Kocide 3000, Kocide 4.5 LF, Mastercop, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Stretch, Tenn-Cop 5E, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		1		Varies by product from 4 h to 2 day
	M5	(chlorothalonil) Many labels available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Chloronil 720, Chlorothalonil 720SC, Echo 720, Echo 90DF, Echo ZN, Equus 720SST, Equus DF, Initiate 720, Initiate ZN (chlorothalonil)	SEE INDIVIDUAL LABELS		7	0.5	
	M5/33	Catamaran (Chlorothalonil/phosphite)	4 pt	50 pt	0	0.5	

Table 7.33. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Alternaria blight Continued	2	(iprodione) Many labels available: Iprodione 4L AG, Enclosure 4F, Nevado 4F, Rovral 4F	2 pt	8 pt	0	1	
	3	(propiconazole) Many labels available: Amcide Propiconazole, Bumper 41.8EC, Propimax, Propi-Star EC, Shar-Shield PPZ, Tilt 3.6E	4 fl oz	16 fl oz	14	0.5	Do not exceed 4 total appls.
	4 & M5	Ridomil Gold Bravo WP (mefenoxam + chlorothalonil)	2 lb		7	2	
	4 & M5	Ridomil Gold Bravo SC (mefenoxam + chlorothalonil)	2.5 pt		7	2	
	7	Endura (boscalid)	4.5 oz	22.5 oz	0	0.5	Alternate with non-FRAC code 7 fungicide. See label for directions.
	7	Fontelis (penthiopyrad)	30 fl oz	61 fl oz	0	0.5	Alternate with non-FRAC code 7 fungicide. See label for directions.
	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	
	11	Cabrio EG (pyraclostrobin)	12 oz	48 oz	0	0.5	Do not exceed 1 sequential and 4 total appl. of Amistar or other QoI fungicides. See label for soil appl.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	2.4 pt	14.4 pt	0	0.5	Do not exceed 2 sequential and 6 total appl. of Quadris Opti. or rotate with non QoI fungicides.
	11 & 3	Quilt (azoxystrobin + propiconazole)	14 fl oz	55 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11 & 3	Quilt XCEL (azoxystrobin + propiconazole)	14 fl oz	56 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
Botrytis rot	1	Mertect 340F (thiabendazole)	41 fl oz/100 gal water			0.5	
Sclerotinia white mold							
Black crown rot	2	(iprodione) Many labels available: Iprodione 4L AG, Enclosure 4F, Nevado 4F, Rovral 4F	2 pt	8 pt	0	1	
Cavity spot	4	Metastar 2E AG (metalaxyl)	8 pt			2	Apply as a broadcast soil application and incorporate into top 2 inches. See label for directions.
	4	Ridomil Gold EC (mefenoxam)	2 pt			2	Apply at seeding in a 7-12" band on soil over seed furrow.
	4	Ridomil Gold SL (mefenoxam)	2 pt			2	See label for specifics regarding preplant incorporated applications and surface applications at the time of planting.
	4 & M1	Ridomil Gold Copper (mefenoxam + copper hydroxide)	2 lb	8 lb	7	2	
	4 & M5	Ridomil Gold Bravo WP (mefenoxam + chlorothalonil)	2 lb		7	2	
	4 & M5	Ridomil Gold Bravo SC (mefenoxam + chlorothalonil)	2.5 pt		7	2	
	11	Reason (fenamidone)	8.2 fl oz	24.6 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	21	Ranman (cyazofamid)	6 fl oz	30 fl oz	14	0.5	Alternate with fungicides of dissimilar chemistry.
	M5	(chlorothalonil) Many labels available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Chloronil 720, Chlorothalonil 720SC, Echo 720, Echo 90DF, Echo ZN, Equus 720SST, Equus DF, Initiate 720, Initiate ZN	SEE INDIVIDUAL LABELS		7	0.5	
Cercospora leaf spot	M1	(copper compounds) Many labels available: Badge SC, Badge X2, Basic Copper 53, COCS WDG, Champ DP, Champ WG, Champ Formula 2, Champ WP, COC DF, COC WP, Copper Count N, Cuerva, Cuprofix Ultra, Kentan DF, Kocide DF, Kocide 2000, Kocide 3000, Kocide 4.5 LF, Mastercop, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Stretch, Tenn-Cop 5E, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		1		Varies by product from 4 h to 2 day

Table 7.33. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Cercospora leaf spot Continued	3	(propiconazole) Many labels available: Amcide Propiconazole, Bumper 41.8EC, Propimax, Propi-Star EC, Shar-Shield PPZ, Tilt 3.6E	4 fl oz	16 fl oz	14	0.5	Do not exceed 4 total appls.
	4 & M5	Ridomil Gold Bravo WP (mefenoxam + chlorothalonil)	2 lb		7	2	
	4 & M5	Ridomil Gold Bravo SC (mefenoxam/chlorothalonil)	2.5 pt		7	2	
	7	Fontelis (penthiopyrad)	30 fl oz	61 fl oz	0	0.5	Alternate with non-FRAC code 7 fungicide. See label for directions.
	11	Cabrio EG (pyraclostrobin)	12 oz	48 oz	0	0.5	Do not exceed 1 sequential and 4 total appl. of Amistar or other QoI fungicides. See label for soil appl.
Damping Off	M3	Defiant 75WP (thiram)	5.3 oz/ 100 lbs of seed			1	Seed treatment only.
Powdery mildew	M2	(sulfur compounds) Many brands available: Dusting Sulfur – IAP, Kumulus DF, Micro Sulf, Microfine Sulfur, Microthiol Disperss, Sulfur 90W, Super-Six, Top Cop w/ Sulfur, Yellow Jacket Wettable Sulfur	-	-	1	1	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
	3	(propiconazole) Many labels available: Amcide Propiconazole, Bumper 41.8EC, Propimax, Propi-Star EC, Shar-Shield PPZ, Tilt 3.6E	4 fl oz	16 fl oz	14	0.5	Do not exceed 4 total appls.
	7	Fontelis (penthiopyrad)	30 fl oz	61 fl oz	0	0.5	Alternate with non-FRAC code 7 fungicide. See label for directions.
	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	2.4 pt	14.4 pt	0	0.5	Do not exceed 2 sequential and 6 total appl. of Quadris Opti. or rotate with non QoI fungicides.
	11 & 3	Quilt (azoxystrobin + propiconazole)	14 fl oz	55 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11 & 3	Quilt XCEL (azoxystrobin + propiconazole)	14 fl oz	56 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	33 & M2	Sanction (potassium phosphate and sulfur)	6 pt			2	
Pythium	21	Ranman (cyazofamid)	6 fl oz	30 fl oz	14	0.5	Alternate with fungicides of dissimilar chemistry.
Pythium damping-off	4	Sebring 2.65ST (metalaxyl)	0.7 fl oz/ 100 lbs of seed			1	Seed treatment only.
Pythium seedling blight	4	Apron XL LS (mefenoxam)	0.64 fl. oz./100 lb seed			2	Seed treatment only.
	4	Metastar 2E AG (metalaxyl)	8 pt			2	Apply as a broadcast soil application and incorporate into top 2 inches. See label for directions.
	4	Ridomil Gold EC (mefenoxam)	2 pt			2	Apply at seeding in a 7-12" band on soil over seed furrow.
	4	Ridomil Gold SL (mefenoxam)	2 pt			2	See label for specifics regarding preplant incorporated applications and surface applications at the time of planting.
Various (see label)	7 & 11	Pristine (boscalid + pyraclostrobin)	10.5 oz	63 oz	0	0.5	Limit is 6 appl/crop and alternate chemistry.
	11	Amistar 80DF (azoxystrobin)	5 oz or 0.25 oz/1000 row ft	20 oz	0	4 h	Do not exceed 1 sequential and 4 total appl. of Amistar or other QoI fungicides. See label for soil appl.
	11	Flint (trifloxystrobin)	3 oz	12 oz	7	0.5	Alternate every other application with a fungicide of dissimilar mode of action.

Table 7.33. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Various (see label) Continued	11	Gem 500SC (trifloxystrobin)	2.9 fl oz	11.6 fl oz	7	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11	Heritage (azoxystrobin)	10.5 oz	4 lb	0	4 h	Do not apply more than 3 sequential applications without alternating to a fungicide of dissimilar mode of action.
	11	Quadris (azoxystrobin)	15.4 fl oz or 0.8 fl oz/1000 row ft	3.75 qt	0	4 h	Do not exceed 1 sequential and 4 total appl. of Amistar or other QoI fungicides. See label for soil appl.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	2.4 pt	14.4 pt	0	0.5	Do not exceed 2 sequential and 6 total appl. of Quadris Opti. or rotate with non QoI fungicides.
	11 & 3	Quilt (azoxystrobin + propiconazole)	14 fl oz	55 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11 & 3	Quilt XCEL (azoxystrobin + propiconazole)	14 fl oz	56 fl oz	14 day	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
Various seedling diseases	12	Maxim 4FS (fludioxonil)	0.16 fl oz/ 100 lb of seed			0.5	Seed treatment only.

¹FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

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Table 7.34. Celery fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Alternaria Botrytis Sclerotinia	7	Endura (boscalid)	9 oz	18 oz	0	0.5	Alternate with non-FRAC code 7 fungicide.
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	Alternate with non-FRAC code 7 fungicide.
Bacterial blight	M1	(copper compounds) Many labels available: Badge SC, Badge X2, Basic Copper 53, COCS WDG, Champ DP, Champ WG, Champ Formula 2, Champ WP, COC DF, COC WP, Copper Count N, Cuerva, Cuprofix Ultra, Kentan DF, Kocide DF, Kocide 2000, Kocide 3000, Kocide 4.5 LF, Mastercop, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Stretch, Tenn-Cop 5E, Top Cop w/ Sulfur	-	-	1	Varies by product from 4 h to 2 day	
	25	Agri-mycin 17 Bac-Master Firewall 17 WP (streptomycin)	200 ppm			0.5	See label for details. For transplant production.
Early blight (Cercospora)	M2	(sulfur) Many labels available: Dusting Sulfur – IAP, Kumulus DF, Micro Sulf, Microfine Sulfur, Microthiol Dispers, Sulfur 90W, Super-Six, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		1	1	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
	M5	(chlorothalonil) Many labels available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Chloronil 720, Chlorothalonil 720 SC, Echo 720, Echo 90DF, Echo ZN, Equus 500 ZN, Equus 720SST, Equus DF, Initiate 720, Initiate ZN	SEE INDIVIDUAL LABELS		7	0.5	

Table 7.34. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Early blight (Cercospora)	M5 & 33	Catamaran	4 pt	60 pt	7	0.5	
Continued		(Chlorothalonil + phosphite)					
	11	Aftershock (fluoxastrobin)	5.7 fl oz	22.8 fl oz	3	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11	Evito 480SC (fluoxastrobin)	5.7 fl oz	22.8 fl oz	3	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11	Flint (trifloxystrobin)	3 oz	12 oz	7	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11	Gem 500SC (trifloxystrobin)	2.9 fl oz	11.6 fl oz	7	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.7 pt	22.2 pt	7	0.5	Do not exceed 2 sequential and 6 total appl. of Quadris Opti. or rotate with non QoI fungicides.
	11 & 3	Quilt (azoxystrobin + propiconazole)	14 fl oz	56 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11 & 3	Quilt XCEL (azoxystrobin + propiconazole)	14 fl oz	56 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	27 & 11	Tanos (cymoxanil + famoxadone)	8 oz	72 oz	3	0.5	Do not alternate or tank mix with another FRAC group 11 fungicide.
Late blight (Septoria)	M2	(Sulfur)	SEE INDIVIDUAL LABELS		1	1	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
		Many labels available: Dusting Sulfur – IAP, Kumulus DF, Micro Sulf, Microfine Sulfur, Microthiol Disperss, Sulfur 90W, Super-Six, Top Cop w/ Sulfur					
	M5	(chlorothalonil)	SEE INDIVIDUAL LABELS		7	0.5	
		Many labels available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Chloronil 720, Chlorothalonil 720 SC, Echo 720, Echo 90DF, Echo ZN, Equus 500 ZN, Equus 720SST, Equus DF, Initiate 720, Initiate ZN					
	M5/33	Catamaran (chlorothalonil + phosphite)	4 pt	60 pt	7	0.5	
	27 & 11	Tanos (cymoxanil + famoxadone)	8 oz	72 oz	3	0.5	Do not alternate or tank mix with another FRAC group 11 fungicide.
	3	(propiconazole)	4 fl oz	16 fl oz	14	0.5	Do not exceed 4 total appls.
		Many labels available: Amtide Propiconazole, Bumper 41.8EC, Propi-Star EC, Propimax EC, Shar-Shield PPZ, Tilt 3.6E					
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	Alternate with non-FRAC code 7 fungicide. See label for directions.
	11	Aftershock (fluoxastrobin)	5.7 fl oz	22.8 fl oz	3	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11	Evito 480SC (fluoxastrobin)	5.7 fl oz	22.8 fl oz	3	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11	Reason (fenamidone)	8.2 fl oz	24.6 fl oz	2	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11	Flint (trifloxystrobin)	3 oz	12 oz	7	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11	Gem 500SC (trifloxystrobin)	2.9 fl oz	11.6 fl oz	7	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.7 pt	22.2 pt	7	0.5	Do not exceed 2 sequential and 6 total appl. of Quadris Opti. or rotate with non QoI fungicides.
	11 & 3	Quilt (azoxystrobin + propiconazole)	14 fl oz	56 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11 & 3	Quilt XCEL (azoxystrobin + propiconazole)	14 fl oz	56 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
Pink rot (Sclerotinia)	14	Botran 75W (dichloran)	2 lb	5.33 lb	7	0.5	Direct spray to base of plant.

Table 7.34. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Powdery mildew	M2	(sulfur) Many labels available: Dusting Sulfur – IAP, Kumulus DF, Micro Sulf, Microfine Sulfur, Microthiol Disperss, Sulfur 90W, Super-Six, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		1	1	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
Pythium	33	Aliette WDG	5 lb	20 lb		0.5	
		Legion 80WDG	5 lb	20 lb		0.5	
		Linebacker WDG	5 lb	20 lb		0.5	
		(fosetyl-Al)					
Pythium seedling blight	4	Apron XL LS (mefenoxam)	0.64 fl. oz./100 lb seed			2	Seed treatment only.
	4	Metastar 2E AG (metalaxyl)	8 pt			2	Apply as a broadcast soil application and incorporate into top 2 inches. See label for directions.
Pythium seedling diseases	4	Ridomil Gold EC (mefenoxam)	2 pt			2	Apply at seeding in a 7-12" band on soil over seed furrow.
	4	Ridomil Gold GR (mefenoxam)	40 lb			2	See label for specifics regarding preplant incorporated applications and surface applications at the time of planting.
	4	Ultra Flourish (mefenoxam)	4 pt			2	See label for specifics regarding preplant incorporated applications and surface applications at the time of planting.
Stalk rot (Rhizoctonia)	M5	(chlorothalonil) Many labels available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Chloronil 720, Chlorothalonil 720 SC, Echo 720, Echo 90DF, Echo ZN, Equus 500 ZN, Equus 720SST, Equus DF, Initiate 720, Initiate ZN	SEE INDIVIDUAL LABELS		7	0.5	
	3	(propiconazole) Many labels available: Amcide Propiconazole, Bumper 41.8EC, Propi-Star EC, Propimax EC, Shar-Shield PPZ, Tilt 3.6E	4 fl oz	16 fl oz	14	0.5	Do not exceed 4 total appls.
	11	Aftershock (fluoxastrobin)	5.7 fl oz	22.8 fl oz	3	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11	Evito 480SC (fluoxastrobin)	5.7 fl oz	22.8 fl oz	3	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11	Flint (trifloxystrobin)	3 oz	12 oz	7	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11	Gem 500SC (trifloxystrobin)	2.9 fl oz	11.6 fl oz	7	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.7 pt	22.2 pt	7	0.5	Do not exceed 2 sequential and 6 total appl. of Quadris Opti. or rotate with non Qol fungicides.
Various	11	Cabrio EG (pyraclostrobin)	16oz	64 oz	0	0.5	Do not exceed 1 sequential and 4 total appl. of Amistar or other Qol fungicides. See label for soil appl.
	11	Quadris (azoxystrobin)	15.4 fl oz or 0.8 fl oz/1000 row ft	2.88 qt	0	4 h	Do not exceed 1 sequential and 4 total appl. of Amistar or other Qol fungicides. See label for soil appl.
Various seedling diseases	12	Maxim 4FS (fludioxonil)	0.16 fl oz/100 lb of seed			0.5	Seed treatment only.
	4 & 11	Uniform SC (mefenoxam + azoxystrobin)	0.34 fl oz/1000' of row	1 appl.		0	Soil incorporated.

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Table 7.34. Okra fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Anthracnose	M1	Kentan	1.5 lb	7.5 lb	0	2	
		Kocide 2000	3 lb	15 lb	0	2	
		Kocide 3000	1.75 lb	17.5 lb	0	2	
		(copper hydroxide)					
	M1	Mastercop	1.5 pt	9 pt	0	2	
		(copper sulfate pentahydrate)					
	M5	Bravo Ultrex	1.4 lb	10.9 lb	3	0.5	
		Bravo Weather Stik	1.5 pt	12 pt	3	0.5	
		Chloronil 720	1.5 pt	12 pt	3	0.5	
		Echo 720	1.5 pt	12 pt	3	0.5	
		(chlorothalonil)					
	3 & 9	Inspire Super	20 fl oz	47 fl oz	0	0.5	
		(difenoconazole + azoxystrobin)					
	11	Quadris	15.5 fl oz	61.5 fl oz	0	4 h	
		(azoxystrobin)					
	11 & 3	Quadris Top	14 fl oz	55.3 fl oz	0	0.5	
		(azoxystrobin + difenoconazole)					
Bacterial leaf spot	M1	Kentan	1.5 lb	7.5 lb	0	2	
		Kocide 2000	3 lb	15 lb	0	2	
		Kocide 3000	1.75 lb	17.5 lb	0	2	
		(copper hydroxide)					
	M1	Mastercop	1.5 pt	9 pt	0	2	
		(copper sulfate pentahydrate)					
Cercospora leaf spot	M5	Bravo Ultrex	1.4 lb	10.9 lb	3	0.5	
		Bravo Weather Stik	1.5 pt	12 pt	3	0.5	
		Chloronil 720	1.5 pt	12 pt	3	0.5	
		Echo 720	1.5 pt	12 pt	3	0.5	
		(chlorothalonil)					
Leaf spot	M1	Kentan	1.5 lb	7.5 lb	0	2	
		Kocide 2000	3 lb	15 lb	0	2	
		Kocide 3000	1.75 lb	17.5 lb	0	2	
		(copper hydroxide)					
	M1	Mastercop	1.5 pt	9 pt	0	2	
		(copper sulfate pentahydrate)					
	M2	Cosavet DF	10 lb	-	-	1	May cause leaf burn if applied during high temperatures
		Microthiol-Disperss	10 lb	-	-	1	
		Sulfur 90W	20 lb	-	-	1	
		(sulfur)					
Pod spot	M1	Kentan	1.5 lb	7.5 lb	0	2	
		Kocide 2000	3 lb	15 lb	0	2	
		Kocide 3000	1.75 lb	17.5 lb	0	2	
		(copper hydroxide)					
	M1	Mastercop	1.5 pt	9 pt	0	2	
		(copper sulfate pentahydrate)					
Powdery mildew	M1	Kentan	1.5 lb	7.5 lb	0	2	
		Kocide 2000	3 lb	15 lb	0	2	
		Kocide 3000	1.75 lb	17.5 lb	0	2	
		(copper hydroxide)					
	M1	Mastercop	1.5 pt	9 pt	0	2	
		(copper sulfate pentahydrate)					
	M2	Cosavet DF	10 lb	-	-	1	May cause leaf burn if applied during high temperatures
		Microthiol-Disperss	10 lb	-	-	1	
		Sulfur 90W	20 lb	-	-	1	
		(sulfur)					
	M5	Bravo Ultrex	1.4 lb	10.9 lb	3	0.5	
		Bravo Weather Stik	1.5 pt	12 pt	3	0.5	
		Chloronil 720	1.5 pt	12 pt	3	0.5	
		Echo 720	1.5 pt	12 pt	3	0.5	
		(chlorothalonil)					

Table 7.34. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Powdery mildew Continued	3	Rally 40 WSP Sonoma 40WSP (myclobutanil)	5 oz	20 oz	0	1	Do not make more than 4 applications per season
	3	Folicur 3.6-F Monsoon, Orius 3.6F Tebustar 3.6L Tebuzol 3.6F Toledo (tebuconazole)	6 fl oz	24 fl oz	3	0.5	Apply in a preventative spray program. For optimum control, tank mix with the lowest labeled rate of spray surfactant.
	3 & 9	Inspire Super (difenoconazole + azoxystrobin)	20 fl oz	47 fl oz	0	0.5	
	11	Quadris (azoxystrobin)	15.5 fl oz	61.5 fl oz	0	4 h	
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	55.3 fl oz	0	0.5	
Phytophthora damping-off	4	Allegiance FL Serbing 2.65 ST (metalaxyl)	0.75 fl oz/100 lb seed	-	-	1	Seed treatment; Do not use with other seed treatment products without previous experience.
Pythium damping-off	4	Allegiance FL Serbing 2.65 ST (metalaxyl)	0.75 fl oz/100 lb seed	-	-	1	Seed treatment; Do not use with other seed treatment products without previous experience.
	4	Apron XL (mefenoxam)	0.64 fl oz/100 lb seed	-	-	2	Seed treatment only.
Rhizoctonia seedling rot	11	Quadris (azoxystrobin)	0.8 fl oz/1000 row feet	61.5 fl oz	0	4 h	

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Table 7.35. Onion fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Bacterial blight (<i>Xanthomonas axonopodis</i> pv. <i>allii</i>)	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Champ DP, Champ F2 FL, Champ WG, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Master Cop, Nordox, Nordox 75WG, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABEL		0	Varies by product from 4 h to 2 days.	Frequent use of copper fungicides may cause foliar burn
	M1 & M3	Mankocide (copper hydroxide + mancozeb)	2.25 lbs	160 lb (per crop)	7	2	Do not apply to exposed bulbs.
Bacterial blight (<i>Xanthomonas axonopodis</i> pv. <i>allii</i>) (Suppression only)	21	Actigard 50 WG (acibenzolar-S-methyl)	1 oz.	4 oz	7	0.5	Do not apply to plants that are stressed or prior or within 5 days transplanting. Suppression only
(Suppression only)	27 & 11	Tanos (cymoxanil + famoxadone)	8 oz	84 oz	3	0.5	See label
Black mold (<i>Aspergillus niger</i>)	9 & 12	Switch 62.5 WG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	Do not make more than 2 consecutive appl. Do not plant crops not on the label for 30 days after last appl.

Table 7.35. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Botrytis leaf blight (<i>Botrytis squamosa</i>)	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABEL		7	1	Do not apply to exposed bulbs
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Chlorothalonil 720 EC, Echo 720, Echo 90 DF, Echo Zn, Equus 500 Zn, Equus 720 SST, Equus DF, Initiate 720, Initiate Zn	SEE INDIVIDUAL LABEL		7 (dry bulb); 14 (green)	1	
	M1 & M3	Mankocide (copper hydroxide + mancozeb)	2.25 lbs	160 lb (per crop)	7	2	Do not apply to exposed bulbs.
	2	(iprodione) Many brands available: Enclosure 4, Iprodione 4L AG, Meteor, Nevada 4F, Rovral 4 Flowable	SEE INDIVIDUAL LABEL		7	1	
(Suppression only)	3	(propiconazole) Many brands available: Amtide proiconazole 41.8% EC, Bumper 41.8 EC, Bumper ES, Propimax EC, Propistar EC, Shar-Shield PPZ, Tilt	SEE INDIVIDUAL LABEL		See label	0.5	
	14	Botran 5F (DCNA dicloran)	2 to 3 1/5 lbs	See label	14	See label	See label
	4 & M5	Ridomil Gold Bravo SC, (mefenoxam + chlorothalonil)	See label		7 (dry bulb); 14/21 (green)	2	
	7	Endura (boscalid)	6.8 oz	41 oz	7	0.5	Alternate applications with a different fungicide group.
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	See label
	9	Vanguard WG (cyprodinil)	10 oz	28 oz	7	0.5	Do not make more than 2 consecutive applications.
	9	Scala SC (pyrimethanil)	18 fl oz	54 fl oz	7	0.5	Do not make more than 2 consecutive applications.
	11	Quadris, (azoxystrobin)	See label	92.3 fl oz	See label	4 h	Alternate applications with a different fungicide group.
(Suppression only)	11	Cabrio EG (pyraclostrobin)	12 oz	72 oz	7	0.5	Alternate applications with a different fungicide group. Make no more than 5 applications/crop.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl.oz	See label	14 (green); 7 (dry bulb)	0.5	Do not make more than 2 applications before alternate with a different fungicide group
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.7 pt	See label	14	0.5	Alternate applications with different fungicide groups. Make no more than 3 applications/crop. Do not tank mix with COC, MSO or silicon adjuvant.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	42 fl oz	7	0.5	Make no more than 1 application before alternating to another fungicide with a non- QoI (Group 11) mode of action
	11 & 3	Quilt Xcel (azoxystrobin + propiconazole)	21 fl oz (dry); 26 fl oz (green)	56 fl oz	14 (dry bulb); 0 (green)	0.5	Make only 1 appl. before alternating to a non-group 11 fungicide
	11 & 7	Pristine (pyraclostrobin + boscalid)	18.5 oz	111 oz	7	0.5	Do not make more than 2 consecutive applications. No more than 6 appl/ crop.
	9 & 12	Switch 62.5 WG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	Do not make more than 2 consecutive appl. Do not plant crops not on the label for 30 days after last appl.
	29	Omega 500 F (fluazinam)	1 pt	6 pt	7	2	

Table 7.35. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Botrytis neck rot (<i>Botrytis allii</i>)	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABEL		7	1	Do not apply to exposed bulbs
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Chlorothalonil 720 EC, Echo 720, Echo 90 DF, Echo Zn, Equus 500 Zn, Equus 720 SST, Equus DF, Initiate 720, Initiate Zn	SEE INDIVIDUAL LABEL		7 (dry bulb); 14 (green)	1	
	2	(iprodione) Many brands available: Enclosure 4, Iprodione 4L AG, Meteor, Nevada 4F, Rovral 4 Flowable	SEE INDIVIDUAL LABEL		7	1	
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	
	14	Botran 5F (DCNA dicloran)	3.5 lbs	See label	14	See label	
(Suppression only)	9	Vanguard WG (cyprodinil)	10 oz	28 oz	7	0.5	Do not make more than 2 consecutive applications.
	9	Scala SC (pyrimethanil)	18 fl oz	54 fl oz	7	0.5	Do not make more than 2 consecutive applications.
(Suppression only)	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.7 pt	See label	14	0.5	Alternate applications with different fungicide groups. Make no more than 3 applications/crop. Do not tank mix with COC, MSO or silicon adjuvant.
	11 & 7	Pristine (pyraclostrobin + boscalid)	18.5 oz	111 oz	7	0.5	Do not make more than 2 consecutive applications.
(Suppression only)	9 & 12	Switch 62.5 WG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	No more than 6 applications/ crop Do not make more than 2 consecutive appl. Do not plant crops not on the label for 30 days after last appl.
	29	Omega 500 F (fluazinam)	1 pt	6 pt	7	2	
Cercospora leaf spot (<i>Cercospora duggiae</i>)	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	42 fl oz	7	0.5	Make no more than 1 application before alternating to another fungicide with a non- QoI (Group 11) mode of action
Cladosporium leaf blotch (<i>Cladosporium allii</i>)	11	Quadris, (azoxystrobin)	See label	92.3 fl oz	See label	4 h	Alternate applications with a different fungicide group.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.7 pt	See label	14	0.5	Alternate applications with different fungicide groups. Make no more than 3 applications/crop. Do not tank mix with COC, MSO or silicon adjuvant.
	11 & 3	Quilt Xcel (azoxystrobin + propiconazole)	21 fl oz (dry); 26 fl oz (green)	56 fl oz	14 (dry bulb); 0 (green)	0.5	Make only 1 appl. before alternating to a non-group 11 fungicide
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	42 fl oz	7	0.5	Make no more than 1 application before alternating to another fungicide with a non- QoI (Group 11) mode of action
	9 & 3	Inspire Super (Cyprodinil + Difenoconazole)	20 fl.oz	See label	14 (green); 7 (dry bulb)	0.5	Do not make more than 2 applications before alternate with a different fungicide group
Damping-off	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABEL		7	1	Do not apply to exposed bulbs
	2	(iprodione) Many brands available: Enclosure 4, Iprodione 4L AG, Meteor, Nevada 4F, Rovral 4 Flowable	SEE INDIVIDUAL LABEL		7	1	
	12	Cannonball WP (fludioxonil)	7 oz	32 oz	7	0.5	

Table 7.35. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Damping-off Continued	12	Maxim 4FS (fludioxonil)	0.16 fl oz/100 lbs seed				Seed treatment only.
Downy mildew (<i>Peronospora destructor</i>)	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Nordox, Nordox 75WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABEL		0	Varies from 4 h to 2 days.	Frequent use of copper fungicides may cause foliar burn
(Suppression only)	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Chlorothalonil 720 EC, Echo 720, Echo 90 DF, Echo Zn, Equus 500 Zn, Equus 720 SST, Equus DF, Initiate 720, Initiate Zn	SEE INDIVIDUAL LABEL		7 (dry bulb); 14 (green)	1	
	M1 & M2	Top cop with sulfur (basic copper sulfate + sulfur)	2-3 qts	See label	0	1	Do not use during hot weather or within 4 weeks of an oil application.
	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABEL		7	1	Do not apply to exposed bulbs
	M1 & M3	Mankocide (copper hydroxide + mancozeb)	2.25 lbs	160 lb (per crop)	7	2	Do not apply to exposed bulbs.
	4 & M1	Ridomil Gold/Copper (mefenoxam + copper hydroxide)	2 lbs		7 (green); 10 (dry bulb)	2	Maximum 0.4 lbs/acre a.i. of metalaxyl or mefenoxam
	4 & M3	Ridomil Gold MZ WG (mefenoxam + mancozeb)	2.5 lbs		7 (dry bulb)	2	
	4 & M5	Ridomil Gold Bravo SC, (mefenoxam + chlorothalonil)	See label		7 (dry bulb); 14/21 (green)	2	
	11	Quadris, (azoxystrobin)	See label	92.3 fl oz	See label	4 h	Alternate applications with a different fungicide group.
	11	Reason 500 SC (fenamidone)	5.5 fl oz	22 fl oz	7	0.5	Alternate applications with a different fungicide group.
	11	Cabrio EG (pyraclostrobin)	12 oz	72 oz	7	0.5	Alternate applications with a different fungicide group. Make no more than 5 appl/crop.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.7 pt	See label	14	0.5	Alternate applications with different fungicide groups. Make no more than 3 applications/crop. Do not tank mix with COC, MSO or silicon adjuvant.
	11 & 3	Quilt Xcel (azoxystrobin + propiconazole)	21 fl oz (dry); 26 fl oz (green)	56 fl oz	14 (dry bulb); 0 (green)	0.5	Make only 1 appl. before alternating to a non-group 11 fungicide
(Suppression only)	11 & 7	Pristine (pyraclostrobin + boscalid)	18.5 oz	111 oz	7	0.5	Do not make more than 2 consecutive applications. No more than 6 appl/ crop
(Suppression only)	21	Actigard 50 WG	1 oz.	4 oz	7	0.5	Do not apply to plants that are stressed or prior or within 5 days transplanting.
	27 & 11	Tanos (cymoxanil + famoxadone)	8 oz	84 oz	3	0.5	
	29	Omega 500 F (fluazinam)	1 pt	6 pt	7	2	
	33	Aliette WDG, Linebacker WDG (fosetyl-Al)	3 lb	7 appl.	See label	See label	Do not tank mix with copper fungicides, adjuvants or foliar fertilizers

Table 7.35. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Downy mildew (<i>Peronospora destructor</i>) Continued	40	Forum (dimethomorph)	6 oz	30 oz	0	0.5	Must be applied in a tank mix with another fungicide active against downy mildew. Do not make more than 2 sequential applications.
	40	Revus (mandipropamid)	8 fl oz	32 fl oz (dry); 24 fl oz (green)	7	4 h	Make no more than 2 consecutive appl. before switching to a non-group 40 fungicide. A silicon-based adjuvant must be added at recommended rates
	43	Presidio (fluopicolide)	4 fl oz.		2	0.5	Do not make more than 4 applications of Presidio per season.
	21	Actigard 50 WG (Acibenzolar-s-methyl)	1 oz.	4 oz	7	0.5	Do not apply to plants that are stressed or prior or within 5 days transplanting. Suppression only
	40 & 45	Zampro (dimethomorph + ametoctradin)	14 fl oz	42 fl oz	0	0.5	See label
Iris Yellow Spot (<i>Iris yellow spot virus</i>) (Suppression only)	21	Actigard 50 WG (acibenzolar-S-methyl)	1 oz.	4 oz	7	0.5	Do not apply to plants that are stressed or prior or within 5 days transplanting. Suppression only.
Powdery mildew	M2	(sulfur) Many brands available: Kumulus DF, Micro Sulf, Microfine Sulfur, Microthiol Disperss, Sulfur 90W, Yellow Jacket Wettable Sulfur	SEE INDIVIDUAL LABEL		0	1	Do not use during hot weather or within 4 weeks of an oil application.
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl.oz	See label	14 (green); 7 (dry bulb)	0.5	Do not make more than 2 applications before alternate with a different fungicide group
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	42 fl oz	7	0.5	Make no more than 1 application before alternating to another fungicide with a non- QoI (Group 11) mode fo action
	11	Cabrio EG (pyraclostrobin)	12 oz	72 oz	7	0.5	Alternate applications with a different fungicide group. Make no more than 5 appl/crop.
Purple blotch (<i>Alternaria porri</i>)	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Nordox, Nordox 75WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INIDIVIDUAL LABEL		0	Varies from 4 h to 2 days.	Frequent use of copper fungicides may cause foliar burn
	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABEL		7	1	Do not apply to exposed bulbs
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Chlorothalonil 720 EC, Echo 720, Echo 90 DF, Echo Zn, Equus 500 Zn, Equus 720 SST, Equus DF, Initiate 720, Initiate Zn	SEE INDIVIDUAL LABEL		7 (dry bulb); 14 (green)	1	
	M1 & M2	Top cop with sulfur (basic copper sulfate + sulfur)	3 qts	See label	0	1	Do not use during hot weather or within 4 weeks of an oil application.
	M1 & M3	Mankocide (copper hydroxide + mancozeb)	2.25 lbs	160 lb (per crop)	7	2	Do not apply to exposed bulbs.
	2	(iprodione) Many brands available: Enclosure 4, Iprodione 4L AG, Meteor, Nevada 4F, Rovral 4 Flowable	SEE INDIVIDUAL LABEL		7	1	

Table 7.35. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Purple blotch (<i>Alternaria porri</i>) Continued	3	(propiconazole) Many brands available: Amtide proiconazole 41.8% EC, Bumper 41.8 EC, Bumper ES, Propimax EC, Propistar EC, Shar- Shield PPZ, Tilt	SEE INDIVIDUAL LABEL		See label	0.5	
	3	(tebuconazole) Many brands available: Onset 3.6L, Orius 3.6 F, Tebu-Crop 3.6F, Tebustar 3.6 L, Tebuzol 3.6F, Toledo	SEE INDIVIDUAL LABEL		7	0.5	
	4 & M5	Ridomil Gold Bravo SC, (mefenoxam + chlorothalonil)	See label		7 (dry bulb); 14/21 (green)	2	
	7	Endura (boscalid)	6.8 oz	41 oz	7	0.5	Alternate applications with a different fungicide group.
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	See label
	9	Vangard WG (cyprodinil)	10 oz	28 oz	7	0.5	Do not make more than 2 consecutive applications.
	9	Scala SC (pyrimethanil)	18 fl oz	54 fl oz	7	0.5	Do not make more than 2 consecutive applications.
	11	Quadris, (azoxystrobin)	See label	92.3 fl oz	See label	4 h	Alternate applications with a different fungicide group.
	11	Reason 500 SC (fenamidone)	5.5 fl oz	22 fl oz	7	0.5	Alternate applications with a different fungicide group.
	11	Cabrio EG (pyraclostrobin)	12 oz	72 oz	7	0.5	Alternate applications with a different fungicide group. Make no more than 5 applications/crop.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl.oz	See label	14 (green); 7 (dry bulb)	0.5	Do not make more than 2 applications before alternate with a different fungicide group
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.7 pt	See label	14	0.5	Alternate applications with different fungicide groups. Make no more than 3 applications/crop. Do not tank mix with COC, MSO or silicon adjuvant.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	42 fl oz	7	0.5	Make no more than 1 application before alternating to another fungicide with a non- QoI (Group 11) mode of action
	11 & 3	Quilt Xcel (azoxystrobin + propiconazole)	21 fl oz (dry); 26 fl oz (green)	56 fl oz	14 (dry bulb); 0 (green)	0.5	Make only 1 appl. before alternating to a non-group 11 fungicide
	11 & 7	Pristine (pyraclostrobin + boscalid)	18.5 oz	111 oz	7	0.5	Do not make more than 2 consecutive applications. No more than 6 appl/ crop.
	9 & 12	Switch 62.5 WG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	Do not make more than 2 consecutive appl. Do not plant crops not on the label for 30 days after last appl.
	27 & 11	Tanos (cymoxanil + famoxadone)	8 oz	84 oz	3	0.5	
	29	Omega 500 F (fluazinam)	1 pt	6 pt	7	2	
(Suppression only)	33	Aliette WDG, Linebacker WDG (fosetyl-Al)	3 lb	7 appl.	See label	See label	Do not tank mix with copper fungicides, adjuvants or foliar fertilizers
Pythium Damping-off	4	MetaStar 2E AG (metalaxyl)	4 pts	see label	-	2	Apply preplant or to soil surface at planting
	4	Allegiance Acquire Sebring 2.65 ST Sebring 318 FS Sebring 480 FS (metalaxyl)	SEE INDIVIDUAL LABEL				

Table 7.35. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Pythium Damping-off Continued	4	Apron XL, Ridomil Gold EC, Ridomil Gold SL, Ultra flourish (mefenoxam)	SEE INDIVIDUAL LABEL		N/A	2	
	11 & 4	Uniform (Azoxystrobin; Mefenoxam)	See label				
Rhizoctonia Damping off	11	Dynasty (azoxystrobin)	0.38 fl oz/100 lb seed	See label	See label	4 h	Seed treatment only.
	11	Quadris (azoxystrobin)					
	11 & 4	Uniform (azoxystrobin + mefenoxam)	See label				
Rust (<i>Puccinia allii</i>)	3	(tebuconazole) Many brands available: Onset 3.6L, Orius 3.6 F, Tebu-Crop 3.6F, Tebustar 3.6 L, Tebuzol 3.6F, Toledo	SEE INDIVIDUAL LABEL		7	0.5	
	11	Quadris, (azoxystrobin)	See label	92.3 fl oz	See label	4 h	Alternate applications with a different fungicide group.
	11	Cabrio EG (pyraclostrobin)	12 oz	72 oz	7	0.5	Alternate applications with a different fungicide group. Make no more than 5 appl/crop.
	11 & 3	Quilt Xcel (azoxystrobin + propiconazole)	21 fl oz (dry); 26 fl oz (green)	56 fl oz	14 (dry bulb); 0 (green)	0.5	Make only 1 appl. before alternating to a non-group 11 fungicide.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl.oz	See label	14 (green); 7 (dry bulb)	0.5	Do not make more than 2 applications before alternate with a different fungicide group.
	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABEL		7	1	Do not apply to exposed bulbs
Seedling blight	12	Maxim 4FS Spirato 480 FS (fludioxonil)	0.16 fl oz/100 lbs seed	-	-	0.5	
	11	Dynasty (azoxystrobin)	0.38 fl oz/100 lb seed	See label	See label	4 h	
	14	Botran 5F (DCNA dicloran)	3.5 lbs	See label	14	See label	
	2	(iprodione) Many brands available: Enclosure 4, Iprodione 4L AG, Meteor, Nevado 4F, Rovral 4 Flowable	SEE INDIVIDUAL LABEL		7	1	
Stemphylium Blight (<i>Stemphylium vesicarium</i>)	7	Fontelis (Penthiopyrad)	24 fl oz	72 fl oz	3	0.5	
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl.oz	See label	14 (green); 7 (dry bulb)	0.5	Do not make more than 2 applications before alternate with a different fungicide group
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	42 fl oz	7	0.5	Make no more than 1 application before alternating to another fungicide with a non- QoI (Group 11) mode fo action
	11 & 7	Pristine (pyraclostrobin + boscalid)	18.5 oz	111 oz	7	0.5	Do not make more than 2 consecutive applications. No more than 6 appl/ crop.
	9 & 12	Switch 62.5 WG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	Do not make more than 2 consecutive appl. Do not plant crops not on the label for 30 days after last appl.

Table 7.35. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
White rot (<i>Sclerotium cepivorum</i>)	1	(thiophanate-methyl) Many brands available: Incognito 4.5 F, NuFarm T-Methyl 4.5 T, NuFarm T-Methyl 70 WSB, Thiophanate-methyl 85 WDG, Topsin 4.5 FL, Topsin M 70 WP, Topsin M 70 WDG, Topsin M WSB	SEE INDIVIDUAL LABEL			3	
	3	(tebuconazole) Many brands available: Onset 3.6L, Orius 3.6 F, Tebu-Crop 3.6F, Tebustar 3.6 L, Tebuzol 3.6F, Toledo	SEE INDIVIDUAL LABEL		7	0.5	
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	3.7 pt	see label	14	0.5	Alternate applications with different fungicide groups. Make no more than 3 applications/crop. Do not tank mix with COC, MSO or silicon adjuvant.
	9 & 12	Switch 62.5 WG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	Do not make more than 2 consecutive appl. Do not plant crops not on the label for 30 days after last appl.
	12	Cannonball WP (fludioxonil)	7 oz	32 oz	7	0.5	
	12	Maxim 4FS (fludioxonil)	0.16 fl oz/100 lbs seed	-	-	0.5	
	14	Botran 5F (DCNA dicloran)	3.5 lbs	See label	14	0.5	

¹FRAC code (fungicide group): Number (1 through 45) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

²Information 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.

Table 7.36. Parsley fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Alternaria	3	Bumper 41.8EC (propiconazole)	4 fl oz	16 fl oz	14	0.5	Do not apply more than 2 sequential appl. Without alternating to different mode of action
	3	Tilt 3.6E (propiconazole)	4 fl oz	16 fl oz	14	0.5	Do not exceed 2 sequential and 4 total applications.
	3	Procure 480SC (triflumizole)	8 fl oz	18 fl oz	0	0.5	Repeat applications at 14 day intervals.
	7	Fontelis 1.67SC (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	
	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	
Bacterial blight	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, COCS WDG, Champ DP, Champ WG, Champ Formula 2, Champ WP, COC DF, COC WP, Copper Count N, Cuerva, Cuprofix Ultra, Kentan DF, Kocide DF, Kocide 2000, Kocide 3000, Kocide 4.5 LF, Nordox 75 WG, NuCop 50WP, NuCop 3L, NuCop HB, NuCop DF, Stretch,	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 day	
Basal rot	12	Cannonball WP (fludioxonil)	7 oz	28 oz	0	0.5	
Cercospora	3	Bumper 41.8EC (propiconazole)	4 fl oz	16 fl oz	14	0.5	Do not apply more than 2 sequential appl. Without alternating to different mode of action

Table 7.36. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Damping-off	33	Aliette WDG	5 lb	35 lb		0.5	
		Legion 80WDG	5 lb	35 lb		0.5	
		Linebacker WDG (fosetyl-Al)	5 lb	35 lb		0.5	
Downy mildew	21	Ranman SC (cyazofamid)	2.75 fl oz	16.5 fl oz	0	0.5	Alternate with fungicides with dissimilar modes of action.
	40	Revus (mandipropamid)	8 fl oz	32 fl oz	1	4 h	Do not exceed 2 sequential applications. See label for soil applications.
	43	Presidio (fluopicolide)	3-4 fl oz	12 fl oz	2	0.5	Must be tank-mixed with a fungicide of different mode of action. Do not exceed two sequential applications. See label for soil applications.
Powdery mildew	M2	(sulfur) Many brands available: Sulfur 90W, Super Six, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		1	1	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
	3	Bumper 41.8EC (propiconazole)	4 fl oz	16 fl oz	14	0.5	Do not apply more than 2 sequential appl. Without alternating to different mode of action
	3	Tilt 3.6E (propiconazole)	4 fl oz	16 fl oz	14	0.5	Do not exceed 2 sequential and 4 total applications.
	3	Procure 480SC (triflumizole)	8 fl oz	18 fl oz	0	0.5	Repeat applications at 14 day intervals.
Pythium damping-off; Pythium seedling blight; Pythium seedling diseases	9 & 12	Switch 62.5WDG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	
	4	Sebring 2.65ST (metalaxyl)	0.75 fl oz/ 100 lb seed			2	Seed treatment only.
	4	Allegiance FL (metalaxyl)	0.75 fl oz/ 100 lb seed			1	Seed treatment only.
	4	Apron XL LS (mefenoxam)	0.64 fl. oz./ 100 lb seed			2	Seed treatment only.
	4	Metastar 2E AG (metalaxyl)	8 pt			2	Apply as a broadcast soil application and incorporate into top 2 inches. See label for directions.
	4	Ridomil Gold EC (mefenoxam)	2 pt			2	Apply at seeding in a 7-12" band on soil over seed furrow.
	4	Ridomil Gold GR (mefenoxam)	40 lb			2	See label for specifics regarding preplant incorporated applications and surface applications at the time of planting.
	4	Ultra Flourish (mefenoxam)	4 pt			2	See label for specifics regarding preplant incorporated applications and surface applications at the time of planting.
Septoria	3	Tilt 3.6E (propiconazole)	4 fl oz	16 fl oz	14	0.5	Do not exceed 2 sequential and 4 total applications.
	7	Fontelis 1.67SC (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	
Various (see label)	7	Fontelis 1.67SC (penthiopyrad)	24 fl oz	72 fl oz	3	0.5	
	11	Cabrio EG (pyraclostrobin)	16oz	64 oz	0	0.5	Do not exceed 1 sequential and 4 total appl. of Amistar or other QoI fungicides.
	11	Heritage (azoxystrobin)	10.5 oz	4 lb	0	4 h	Do not apply more than 2 sequential applications without alternating to a fungicide of dissimilar mode of action.
	11	Quadris (azoxystrobin)	15.4 fl oz or 0.8 fl oz/1000 row ft	2.88 qt	0	4 h	Do not exceed 1 sequential and 4 total appl. of Amistar or other QoI fungicides. See label for soil appl.
	11	Reason (fenamidone)	8.2 fl oz	24.6 fl oz	2	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
Various seedling diseases	12	Maxim 4FS (fludioxonil)	0.16 fl oz/ 100 lb of seed			0.5	Seed treatment only.

Table 7.36. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Various seedling diseases	4 & 11	Uniform SC	0.34 fl oz/	1 appl.		0	Soil incorporated.
Continued		(mefenoxam + azoxystrobin)	1000 ft of row				

¹FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

²Information 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.

Table 7.37. Sweet potato ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Alternaria leaf blight	9 & 12	Switch 62.SWG	14 oz	56 oz	7	0.5	Alternate with another labeled fungicide for 2 applications after 2 applications of Switch WG
		(cyprodinil + fludioxonil)					
Black rot, Scurf, Root rot	1	Mertect 340-F	107 fl oz/100 gal water	-	0	0.5	Dip seed roots for 1-2 min
		(thiabendazole)					
Botrytis leaf spot	9	Scala SC	7 fl oz	35 fl oz	7	0.5	
Early blight		(pyrimethanil)					
Late blight	43	Presidio	4 fl oz		7	0.5	For resistance management, tank mix with a labeled fungicide having a different mode of action
		(fluopicolide)					
Phytophthora	4	Metestar 2E AG (metalaxyl)	See label	-	14	2	Apply in water or liquid fertilizer & incorporate into top 2 inches of soil.
		Ridomil Gold EC or SL	2 pt			2	
		(mefenoxam)					
	4	Ultra Flourish (mefenoxam)	4 pt		0	2	Apply as a broadcast soil application at pre-plant or as a surface application at planting.
Pink rot	43	Presidio	4 fl oz		7	0.5	For resistance management, tank mix with a labeled fungicide having a different mode of action.
		(fluopicolide)					
Powdery mildew	M2	Microthiol Disperss	10 lb	-		1	Do not use within 2 weeks of an oil spray treatment
		(sulfur)					
	9 & 12	Switch 62.SWG	14 oz	56 oz	7	0.5	Alternate with another labeled fungicide for 2 applications after 2 applications of Switch WG.
		(cyprodinil + fludioxonil)					
	11 & 3	Quadris Top	14 fl oz	55.3 fl oz	14	0.5	Make no more than 2 consecutive applications; Adding adjuvant may enhance the efficacy.
		(azoxystrobin + difenoconazole)					
Pythium damping-off	4	Allegiance FL	0.75 fl oz/100 lb. seed	-	-	1	Seed treatment
		(metalaxyl)					
	4	Apron XL	0.64 fl. oz/ 100 lb seed	-	-	2	Seed treatment
		(mefenoxam)					
Pythium	4	Ridomil Gold EC or SL	2 pt			2	Apply in water or liquid fertilizer & incorporate into top 2 inches of soil.
		(mefenoxam)					
Rhizopus rot	11	Cabrio EG	0.6 qt/100 gal for spray and root dip	-	-	0.5	
		(pyraclostrobin)					
Rust	11	Quadris	15.5 fl oz	123 fl oz	14	4 h	Do not make more than 1 application before alternating with a different mode of action.
		(azoxystrobin)					
	11 & 3	Quadris Top	14 fl oz	55.3 fl oz	14	0.5	Make no more than 2 consecutive applications; Adding adjuvant may enhance the efficacy
		(azoxystrobin + difenoconazole)					
Sclerotinia white mold	7	Endura	10 oz	20 oz	10	0.5	
		(boscalid)					
	11	Reason 500SC	8.2 fl oz	16.4 fl oz	14	0	Do not make more than 1 application before alternating with a different mode of action.
		(fenamidone)					

Table 7.37. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Sclerotinia white mold Continued	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	55.3 fl oz	14	0.5	Make no more than 2 consecutive applications; Adding adjuvant may enhance the efficacy
Septoria leaf spot	M2	Micro Sulf	5 lb	-	0	1	Do not use within 2 weeks of an oil spray treatment
		Microthiol Disperss (sulfur)	10 lb	-	0	1	
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	55.3 fl oz	14	0.5	Make no more than 2 consecutive applications; Adding adjuvant may enhance the efficacy
Various (See label)	11	Headline (pyraclostrobin)	12 oz	1.18 lb	3	0.5	
Various soil-borne diseases	11	Quadris (azoxystrobin)	SEE LABEL		14	4 h	
White rust (<i>Albugo spp.</i>)	11	Cabrio EG (pyraclostrobin)	16 oz	48 oz	0	0.5	Alternate with other labeled fungicides after each application
	11	Quadris (azoxystrobin)	15.5 fl oz	123 fl oz	14	4 h	Do not make more than 1 application before alternating with a different mode of action.
	11	Reason 500SC (fenamidone)	8.2 fl oz	16.4 fl oz	14	0	Do not make more than 1 application before alternating with a different mode of action.
Post-harvest rot caused by <i>Rhizopus stolonifer</i>	12	Scholar Fungicide Scholar SC (fludioxonil)	SEE INDIVIDUAL LABELS		0	0.5	Post-harvest treatment; Do not make more than 1 post-harvest application
Seed decay, damping-off, seedling blight caused by soil pathogens	12	Maxim 4FS (fludioxonil)	0.16 fl oz/100 lb seed		0	0.5	Not effective against <i>Pythium spp.</i> ; Tank mix with others for <i>Pythium</i> control

¹FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

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Chapter 8. Pepper Production

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Botany and Planting

Bell pepper - *Capsicum annuum*, Solanaceae.

Habanero pepper - *Capsicum chinense*.

Table 8.1. Planting information for pepper.

Planting dates	
North Florida	Aug 15/Feb-Mar
Central Florida	Aug-Sept/Jan-Mar
South Florida	Aug-Feb
Planting information	
Distance between rows (in)	36 - 48
Distance between plants (in)	10 - 24
Seed per acre in transplant (lb)	0.25 - 0.5
Days to maturity from transplant	65 - 75
Plant population (acre)	17,500

Cultivars

1. SWEET BELL

Allegiance. Vigorous, medium to tall plant with good leaf cover. High yielding with extended harvest. Fruits highly uniform, dark green, blocky 4-lobed thick walled fruit. R to Xcv 1-5, PVY, TM.

Aristotle (with X3R®) is a green to red blocky bell with great yield potential. Extra-large, thick walled. Very vigorous plant that produces dark green, anthocyaninless fruit. R to Xcv 1-3, PVY, Tobamo Po (R).

Blitz. Early-maturing, extra-large blocky green-to-red bell with great yield potential at first harvest. Fruit are high quality with thick walls and a uniformly blocky shape. HR: TMV: 0 / Xcv: 0-5, 7-9 and IR: TE.

Crusader. Plant erect with good cover. Extra-large fruit that are firm at mature red stage. R to Xcv 1-3, PVY, S, PeMo, TM.

Early Summer. Early to mid-early maturing, extra-large, dark green-to-yellow bell pepper with strong plants providing good fruit cover. The fruit are firm, smooth, glossy and high quality, with thick walls. HR: TMV: 0 / Xcv: 0-5, 7-9 and IR: TSW.

Excursion II. Medium size, blocky green to red fruit. R to Xcv 1-3, PVY, TM.

Gridiron. Early to mid-maturing, extra-large blocky dark green-to-red bell with impressive yield potential. The fruit are smooth, glossy and high quality, with thick walls and a uniform blocky shape. HR: TM: (0/?) Xcv: 0-5, 7-9 and IR: TE.

HM 2641. Tall erect vigorous plant with good leaf coverage suited for warm weather production. Glossy dark green large to extra-large sized fruit over an extended production period R to, Xcv 1-4 and TM.

Hunter. Early maturity. Medium size plant produces smooth, four-lobed, blocky dark green glossy fruit. Produces a large percentage of extra-large fruit. R to Xcv 1-5, TE, TM.

Intruder. Mid-season, medium tall plant with smooth, firm fruit. Good disease package. R to Xcv 1-3 TE, TM and IR to Pc.

Myakka. Vigorous plant with good leaf cover. Large, high quality, dark green fruits. R to Xcv 1-4.

Polaris. Uniform blocky green to red fruit. R to Xcv 1-3.

PS 09942815 (with X10R™) is a green-to-red blocky sweet pepper. Fruits are large and slightly elongated with 3-4 lobes. It offers an excellent disease package, including intermediate resistance to bacterial spot races 1-10 (X10R™). TM Tobamo Po (HR); Xcv 1-10, TSW Tobamo Po (IR).

PS 9927141 (with X5R®) is an early, green to red blocky bell pepper with large, dark-green, smooth fruit. It produces a large robust plant with a continuous fruit set. Xcv 1-5, Tobamo Po (HR).

PS 9928302 (with X5R®) has high resistance to bacterial spot races 1-5 (X5R®) and combines a large robust plant with large, dark green to firm red fruits. In trials, 8302 has been very adaptable with good size, shape, uniformity and color. Fruit are anthocyaninless. Xcv 1-5, Tobamo Po (HR).

PS 09954288 (with X10R™) has a medium plant, compact fruit set with smooth and firm fruit. Fruit are anthocyaninless. Xcv 1-10, TSW and Tobamo Po.

PS 9915776 (with X5R®) is an early, blocky sweet pepper with large, smooth, high quality anthocyaninless fruit that remains firm even at the mature red stage. It has a robust plant that sets well. Xcv 1-5, Tobamo Po (HR).

PS 997 9325 (with X10R™) is a main-season hybrid that develops a mid-sized plant that produces green maturing to red fruit targeted to the south east US. The plants produce a high, concentrated set of firm, dark green, smooth, blocky fruit 74 days after transplant. The hybrid is resistant to Tobamo Po and bacterial leaf spot races 0 to 10 (X10R™).

Revolution. Cold tolerance, concentrated early set, firm, uniform, extra-large green to red fruits. R to Xcv 1-3 and 5 and IR to CM and Pc.

Tom Cat. Mid-season. Medium plant size and a concentrated set that yields a high percentage of large size fruit. Blocky dark green color that turns a deep red upon maturity. R to Xcv 1-5, TE, and ToM.

Touchdown. Strong prolific plant with continuous setting ability and excellent cover. This variety has high yield potential of large to extra-large blocky fruit that mature from green to red. HR: TMV: 0 and Xcv: 0-5, 7-9.

Vanguard. Medium plant with good foliage. Fruit are dark green, blocky, 4-lobed, extra-large with thick firm walls. Early maturity with concentrated harvest. R to Xcv 1-5, PepMo and ToM.

2. MINI SWEET

Orange You Sweet, Right On Red, and Yes To Yellow. Hungarian cheese types, very early maturing, has a mid to strong plant vigor, with continuous setting ability. The fruit are flat round in shape and smooth with mid thick walls well suited for stuffing and pickling.

Yellow Sparkler. Sweet snacking pepper type, that turns from green to bright, rich yellow. Fruit have a great sweet flavor.

3. CUBANELLE

Aruba. Early-maturing, erect plant, 3-4 lobed, elongated fruit, matures from a pale lime green to a bright red.

Grenada. Early maturing from pale green to red with very smooth and attractive fruit. HR: Xcv: 0-3, 7, 8.

4. HOT ANCHO POBLANO

Ardo. Ancho poblano type, plant produces high yields of 6 inches long by 3 inches wide fruit, turn from green to red when mature. R to Xcv 1-3, PVY, PM, Tobamo Po.

Tiburón. Ancho poblano type, plant yields large 5 to 6 inch fruit for stuffing or drying. Fruit are shiny, dark green maturing to red and are mildly pungent. Large plant with continuous fruit setting for extended harvest.

5. HOT CAYENNE

Cheyenne. Cayenne type with early maturity on a medium sized plant. Produces long (8-9 inch), medium-high pungent fruit with great flavor and aroma.

El Hombre. Cayenne type, mainly two lobed, early concentrated yield.

Mesilla. Long hot type produces very long (23-28 by 3.8 cm) fruit that can be used green or red. Pods grow pendant from a large plant, maturing at mid-season. R to Tobamo Po and PVY, and IR to TE.

6. HOT JALAPENO

51050015. Large, thick wall, dark green jalapeno. R to Xcv 1-3.

Capsico. Large, vigorous plants with very heavy sets of extra-large fruit. Extra-large with mild checking. Very pungent. HR: PVY: 0.1.2 / Xcv: 0-3, 7, 8.

Centella. Excellent plant cover. Large, dark green glossy fruit. R to Xcv 1-3, TM:0, PVY:0, PepMo.

Colima. Mid season plant. Extra-large, long, tapered, dark green fruit. R to Xcv 1-3, PVY and TM.

Compadre. Medium to late fruiting. Vigorous plant with good tolerance to extreme temperatures. Continuous picking. Uniform, smooth, large fruit. No purpling. R to PVY, TM and Xcv 2,5.

Don Pedro. Large fruit with dark green color. Thick walled, excellent shelf-life. R to Xcv 1-3.

El Jefe. Large plant type jalapeño. Large to extra-large, very dark green, glossy fruit. Minimal cracking and purpling. HR: PVY: 0.1.2 / Xcv: 0-3, 7, 8 and IR: TE.

El Rey. Widely-adapted jalapeño suited for fresh market or processing. High yielder of pungent, large, thick-walled fruit on a compact plant. Dark green color with a minimum of stress purpling. HR: PVY: 0.1.2 / Xcv: 0-3, 7, 8 and IR: TE.

Grande. Large fruit that mature from green to red. Fruit have thick walls and medium pungency. Vigorous plant that produces well, even under stressful growing conditions. Suitable for both fresh market and processing. R to PVY 0 and TE.

Ixtapa. Extra-large thick walled fruit. R 1-3, PVY.

Jalafuego. Extremely pungent. Large vigorous plant. Extra-large, smooth, very dark green fruit. HR: PVY: 0.1.2 / Xcv: 0-3, 7, 8

Magno. Vigorous plants. Mostly jumbo and extra-large, smooth, very dark green fruit. HR: PVY: 0.1.2 / Xcv: 0-3, 7, 8

Sayula. Vigorous plant and with prolific set. Bullet shaped and maturing from green to red. Well suited for both fresh market and processing. R to Xcv 1-3.

Taos. Medium plant. Early with concentrated fruit set. Large to extra large fruit. Performs well under low night time temperatures. No purpling. R to PVY and TM.

Telica. Mid-season fruiting, smooth large dark green fruit with blunt ends. R to cracking and purpling, and Xcv 1-3, PVY and TM.

Tormenta. Vigorous plant. Large, thick wall, dark green fruit does not purple and resists cracking. R to Xcv 1-3.

7. OTHER HOT PEPPERS

Balada. Finger hot Asian type pepper, fruit maturing from green to red, fruit slightly curved, tapers to point, highly pungent.

Camino Real. Serrano type, medium maturity, large green fruit size. R to PVY and IR to TE.

Chile G76. Anaheim type, medium maturity, large to extra large fruit sizes, early concentrated yield, 500-600 units in the Scoville's scale. R to TM.

Habanero. Habanero type, ready for harvest 90-100 days from transplant, extremely pungent, both fresh and processing markets. The wrinkled fruit taper to a point and measure approximately 5 by 2.5 cm. The thin flesh is light-green to orange-pink at full maturity.

Infierno. This Hungarian hot wax hybrid produces high yields of uniform fruit. The thick-walled pods are pendant, large, smooth and tapered, matures from yellow to red, well-suited for fresh market and pickling.

Pesticides for Weed, Arthropod and Disease Management for Pepper

Table 8.2. Selected herbicides approved for managing weeds in pepper.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREPLANT / PREEMERGENCE ***		
Bensulide 5.0 - 6.0	(Prefar) 4 E 5 - 5 qt.	Broadleaf and grass weeds. Incorporate mechanically 1 - 2 in. deep or with irrigation 2 - 4 in. deep.
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides.
Flumioxazin up to 0.128	(Chateau) 51 WDG up to 4 oz.	Annual broadleaf and grass weeds. Apply to row middles of raised plastic mulched beds that are at least 4 in. higher than the treated row middles and 24 in. bed width. Label is a Third-Party registration (TPR, Inc.). Use without a signed authorization and waiver of liability is a misuse of the product. Tank mix with a burn down herbicide to control emerged weeds.
Fomesafen 0.25 - 0.38	(Reflex) 2 EC 1.0 - 1.5 pt.	Broadleaf and grass control and nutsedge. Label is a 24(C) local indemnified label and a waiver of liability must be signed for use. Transplanted crop only. May be applied to bareground production 7 days before transplanting or to a formed bed but before laying plastic. If applying to row middles only prevent the spray from contacting the herbicide.

Table 8.2. Continued.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREPLANT / PREEMERGENCE ***		
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burndown. Allow 3 days between application and planting. Consult label for individual product directions.
Halosulfuron 0.024 - 0.05	(Sanda, Profine) 75 DF 0.5 - 1.0 oz.	Broadleaf control and yellow/purple nutsedge suppression. Apply to row middles only. Do not exceed 2 oz./acre per 12 month period.
Lactofen 0.25 - 0.5	(Cobra) 2 EC 16 - 32 fl. oz.	Broadleaf weeds. Label is a Third-Party registration (TPR, Inc.). Use without a signed authorization and waiver of liability is a misuse of the product. Apply to the row middles only with a shielded or hooded sprayer. Cobra contracting green foliage or fruit can cause excessive injury. Drift of Cobra treated soil particles onto plants can cause contact injury. Limit of 1 PRE and 1 POST application per growing season. PHI 30 days.
S-metolachlor 0.64 - 0.95	(Dual Magnum) 7.62 EC 0.67 - 1.0 pt.	Annual broadleaf and grass weeds. Label is a Third-Party registration (TPR, Inc.). Use without a signed authorization and waiver of liability is a misuse of the product. Apply to the finished bed immediately before laying the plastic. Do not exceed 1.68 pt. of Dual Magnum/acre per crop cycle.
Napropamide 1.0 - 2.0	(Devrinol DF XT) 50 DF 2 - 4 lb.	Annual broadleaf weeds. Apply to bed tops after forming beds, but before plastic application. Rainfall or overhead irrigate to 1 in. within 24 h. of application. For row middle treatments, do not apply between bloom and harvest and do not exceed 2 lb. a.i./acre per crop cycle.
Oxyfluorfen 0.25 - 0.5	(Goal 2 XL) 2 EC 1 - 2 pt. (GoalTender) 4 E 0.5 - 1.0 pt.	Must have a 90 day treatment-planting interval for transplanted pepper. Apply as a preemergence broadcast to preformed beds or banded treatment at 0.25 - 0.5 lb. a.i./acre. Mulch may be applied any time during the 90-day interval.
Paraquat 0.5 - 1.0	(Gramoxone) 2 SL 2.0 - 4.0 pt. (Firestorm) 3 SL 1.3 - 2.7 pt.	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment. Use a nonionic surfactant.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with soil residual compounds
Pendimethalin 0.48 - 0.72	(Prowl H20) 3.8 1.0 - 1.5 pt.	Annual broadleaf and grass weeds. May be applied at 1.0-1.5 pt./acre to row middles or under the plastic. Do not exceed 3.0 pt./acre per year. PHI 70 days.
Pyraflufen 0.001 - 0.003	(ET Herbicide) 0.208 EC 0.5 - 2.0 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burndown treatment.
Trifluralin 0.5 - 0.75	(Treflan, Trifluralin) 4 EC 1.0 - 1.5 pt. (Treflan) 10 G 5.0 - 7.5 lb.	Annual broadleaf and grass weeds. Incorporate 4 in. or less within 8 h. of application. Results in Florida are erratic on soils with low organic matter and clay contents. Note label precautions against planting noncrops within 5 months. Do not apply after transplanting. PHI 60 days.
*** POSTEMERGENCE / POSTTRANSPLANT ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as hooded application to row middles only. Use a COC or NIS at recommended rates. May be tank mixed with other herbicides. Do not exceed 6.1 fl. oz. per cropping season. PHI 0 days.
Clethodim 0.09 - 0.13	(Arrow, Select) 2 EC 6 - 8 fl. oz. (Select Max) 1 EC 9 - 16 fl. oz.	Perennial and annual grass weeds. In fields with heavy grass pressure or larger grass weeds, use higher rates or repeat application 14 days apart. Read the label for the required adjuvant. PHI 20 days.
Diquat 0.5	(Reglone Dessiccant) 1 qt.	Broadleaf and grass weeds. Apply to row middles only. Maximum of 2 applications per season. Include a NIS. Prevent drift to crop. PHI 30 days.
Halosulfuron 0.024 - 0.05	(Sanda, Profine) 75 DF 0.5 - 1.0 oz.	Small seeded broadleaf and nutsedge. Apply to row middles only. Include a nonionic surfactant. Do not exceed 2 oz./acre per 12 month period. PHI 30 days.
Imazosulfuron 0.19 - 0.30	(League) 75 DF 4.0 - 6.4 oz.	Broadleaf weeds and nutsedge. Pepper must be well established and 10 in. tall. Do not exceed 6.4 oz./acre per crop season. It is important to observe crop rotation restrictions. PHI 21 days.
S-metolachlor 0.95	(Dual Magnum) 7.62 EC 1.0 pt.	Annual broadleaf and grass weeds and nutsedge. Label is a Third-Party registration (TPR, Inc.). Use without a signed authorization and waiver of liability is a misuse of the product. Direct spray solution to row middles only with minimal contact to plants and plastic. Do not exceed 1.68 pt. Dual Magnum/acre per crop. PHI 60 days.
Paraquat 0.5	(Gramoxone) 2 SL 2 pt. (Firestorm) 3 SL 1.3 pt.	Emerged broadleaf and grass weeds. Direct spray over emerged weeds 1 to 6 in. tall in the row middles between mulched beds. Use a nonionic surfactant. Use low pressure and shields to control drift. Do not apply more than 3 times per season.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Direct spray to row middles. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with several soil residual compounds.
*** POSTEMERGENCE / POSTTRANSPLANT ***		
Sethoxydim 0.19 - 0.28	(Poast) 1.5 EC 1.0 - 1.5 pt.	Controls growing grass weeds. A total of 4.5 pt./acre applied in one season. Include a crop oil concentrate. Unsatisfactory results may occur if applied to grasses under stress. PHI 20 days.
*** POSTHARVEST ***		
Diquat 0.5	(Reglone Dessiccant) 2.0 pt.	Minimum of 35 gal./acre. Include a NIS. Thorough coverage is required.

Table 8.3. Selected insecticides approved for managing insect pests of peppers.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Acramite-50WS (bifenazate)	0.75-1.0 lb	12	3	twospotted spider mite	un	One application per season.
Actara (thiamethoxam)	2.0-5.5 oz	12	0	aphids, flea beetles, pepper weevil, stink bugs, whitefly	4A	Toxic to bees. Maximum of 11 oz/acre per season.
Admire Pro (imidacloprid) (for rates for other brands, see labels)	7-14.0 fl oz	12	21	aphids, Colorado potato beetle, flea beetles, foliage- feeding thrips, leafhoppers, whitefly	4A	Most effective if applied to soil at transplanting.
Admire Pro (imidacloprid)	0.44 fl oz/10,000 plants	12	21 (soil)	aphids, whitefly	4A	Planthouse: 1 application to transplants. See label.
Agree WG (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	armyworms, hornworms, loopers, tomato fruitworm	11A	Apply when larvae are small for best control. Can be used in greenhouse. OMRI-listed ² .
*Agri-Mek SC (abamectin)	1.7-3.5 fl oz	12	7	broad mite, <i>Liriomyza</i> leafminers, spider mites, <i>Thrips palmi</i>	6	Do not make more than 2 sequential applications. Must be used with a non-ionic activator type wetting, spreading, or penetrating adjuvant.
*Ambush 25W (permethrin)	6.4-12.8 oz	12	3	cabbage looper, flea beetles, pepper weevil, vegetable leafminer	3A	Do not apply more than 1.6 lb ai/acre per season. Bell peppers only.
*Asana XL (0.66EC) (esfenvalerate)	5.8-9.6 fl oz	12	7	Colorado potato beetle, corn earworm, cucumber beetles (adults), European corn borer, flea beetles, loopers, southern armyworm, aids in control of beet armyworm and pepper weevil	3A	Do not apply more than 0.35 lb ai per acre per season, or treat more than 7 times at high rate.
Assail 30SG (acetamiprid)	1.5-4.0 oz	12	7	aphids, pepper weevil, thrips, whitefly	4A	Begin applications for whitefly when first adults are noticed. Do not apply more than 4 times per season or apply more often than every 7 days.
Avaunt (indoxacarb)	2.5-3.5 oz	12	3	beet armyworm, loopers, southern armyworm, tomato fruitworm	22	Minimum spray interval is 5 days. Do not use more than 14 ounces of product per acre per crop.
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, whitefly	un	Antifeedant, repellent, insect growth regulator. OMRI-listed ² .
Azatin XL (azadirachtin)	5-21 fl oz	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, weevils, whitefly	un	Antifeedant, repellent, insect growth regulator. See label for rates for specific pests.
*Baythroid XL (beta-cyfluthrin)	1.6-2.8 fl oz	12	7	beet armyworm (1), cabbage looper, corn earworm, garden webworm, leafhoppers, leafminers (2), pepper weevil (2), stink bugs, thrips (except <i>Thrips palmi</i>)	3A	(1) 1st and 2nd instars only (2) aids in suppression Do not apply more than 0.132 lb ai per acre per season.
Belay 50 WDG (clothianidin)	1.6-3.2 oz	12	7	aphids, Colorado potato beetle, flea beetles, leafhoppers, leafminers (suppression), Lygus, pepper weevil, stink bugs, whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Toxic to bees. Do not release irrigation water from the treated area. Supplemental label (expires 12-30-13) for rates above 2.1 oz per acre.
Belay 50 WDG (clothianidin)	4.8 -6.4 oz (soil application)	12	Apply at planting	aphids, Colorado potato beetle, flea beetles, leafhoppers, leafminers (suppression), Lygus, foliar feeding thrips, whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. See label for application instructions. Do not release irrigation water from the treated area.
Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	0	aphids, plant bugs	9C	Do not apply more than 8.4 oz/acre per season. Begin applications before pests reach damaging levels.
Belt SC (flubendiamide)	1.5 fl oz	12	1	armyworms, cutworms, garden webworm, hornworms, loopers, saltmarsh caterpillar, tomato fruitworm	28	Do not apply more than 4.5 fl oz per acre per season.
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11B	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 qt 100/gal	4	0	aphids, thrips, whitefly	--	May be used in greenhouses. Contact dealer for recommendations if an adjuvant must be used. Not compatible in tank mix with fungicides.
*Brigade 2EC (bifenthrin)	2.1-6.4 fl oz	12	7	armyworms, corn earworm, cucumber beetles, cutworms, leafminers, loopers, mites, pepper weevil, thrips, whitefly	3	Do not make applications less than 7 days apart. Do not apply more than 0.2 lb active ingredient per acre per season.

Table 8.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Confirm 2F (tebufenozide)	6-16 fl oz	4	7	beet armyworm, black cutworm, cabbage looper, fall armyworm, southern armyworm, tobacco hornworm, tomato hornworm, true armyworm, yellowstriped armyworm	18	Do not apply more than 1.0 lb ai per acre per season.
Coragen (rynaxypyr)	3.5-7.5 fl oz.	4	1	beet armyworm, Colorado potato beetle, fall armyworm, hornworms, leafminer larvae, loopers, southern armyworm, tomato fruitworm, tomato pinworm	28	Can be applied by drip chemigation or as a soil application at planting as well as a foliar spray. See label. For hornworms, can use as little as 2.0 fl oz/acre when applied as a foliar spray. Make no more than 4 applications per crop.
Courier 40SC (buprofezin)	9.0-13.6 fl oz	12	1	leafhoppers, mealybugs, planthoppers, whitefly nymphs	16	Product is a slow-acting IGR that will not kill nymphs immediately. No more than 2 applications per season. Allow at least 5 days between applications.
Crymax WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Use high rate for armyworms. Treat when larvae are young.
*Danitol 2.4 EC (fenpropathrin)	10.67 fl oz	24	3	stink bug, tobacco hornworm, tomato fruitworm, twospotted spider mite, yellowstriped armyworm	3A	Maximum of 4 applications (0.8 lb ai/acre) per season.
Deliver (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-1.25 lb	4	0	caterpillars	11	Use higher rates for armyworms. OMRI-listed ² .
*Dibrom 8EC (naled)	1 pt	48	1	aphids, blister beetle, flea beetles, leafminers, mites	1B	Apply no more than 1 pt/acre in Florida. Do not apply when temperatures is over 90°F.
Dimethoate 4EC (dimethoate)	0.5-0.67 pt	48	0 for mechanical harvesting	aphids, leafminers	1B	Highly toxic to bees.
*Dimilin 25 W, *2 L (diflubenzuron)	4-8 oz	12	7	foliage feeding caterpillars, pepper weevil (reduces hatching of eggs produced by adults that have consumed treated foliage)	15	Up to 5 applications per season, but no more than 24 oz per acre per season. IGR - effects not seen for 5-7 days.
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. Good coverage is essential. OMRI-listed ² .
Durivo (thiamethoxam, chlorantraniliprole)	10-13 fl oz	12	30	aphids, beet armyworm, Colorado potato beetle, fall armyworm, flea beetles, hornworms, leafhoppers, loopers, southern armyworm, thrips, tomato fruitworm, tomato pinworm, whitefly, yellowstriped armyworm	5	Several methods of soil application- see label.
Entrust SC (spinosad)	1.5-10 fl oz	4	1	armyworms, flower thrips, hornworms, leafminers, loopers, other caterpillars, <i>Thrips palmi</i> , tomato fruitworm, tomato pinworm	5	Do not use more than 29 oz per acre per crop. Do not apply to seedlings grown for transplant. OMRI-listed ² .
Esteem Ant Bait (pyriproxyfen)	1.5-2.0 lb	12	1	red imported fire ant	7C	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.
Fulfill (pymetrozine)	2.75 oz	12	0	green peach aphid, potato aphid, suppression of whiteflies	9B	Do not make more than two applications.
Grandevo <i>Chromobacterium subtsugae</i> strain PRAA4-1	1-3 lb	4	0	armyworms, hornworms, loopers, saltmarsh caterpillar, tomato fruitworm, tomato pinworm, variegated cutworm	—	Can be used in organic production. OMRI-listed ² .
Intrepid 2F (methoxyfenozide)	4-16 fl oz	4	1	beet armyworm, cabbage looper, fall armyworm, hornworms, southern armyworm, suppression of tomato fruitworm, true armyworm, yellowstriped armyworm	18	Do not apply more than 64 fl oz per acre per season.
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.50 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms)	11	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
Kanemite 15 SC (acequinocyl)	31 fl oz	12	1	twospotted spider mite	20B	Allow a minimum of 21 days between treatments. Do not make more than two applications per year. Do not use an adjuvant.
Knack IGR (pyriproxyfen)	8-10 fl oz	12	1	whitefly (immature)	7C	Do not make more than 2 applications per growing season.

Table 8.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
*Lannate LV, *SP (methomyl)	LV: 0.75-3.0 pt SP: 0.25-1.0 lb	48	3	armyworms, beet armyworm, fall armyworm, green peach aphid, loopers, variegated cutworm	1A	No more than 10 applications per crop or 15 pt LV or 5 lb SP/acre/crop.
Lorsban 75WG (chlorpyrifos) [24(c) label] SLN FL-040005	1.33 lb	24	7	beet armyworm	1B	Do not apply within 10 days of transplanting or to plants under severe heat or drought stress. Do not make more than 8 applications.
Malathion 8F (malathion)	1.5 pt	12	3	aphids	1B	Maximum of 2 applications per year.
Movento (spirotetramat)	4.0-5.0 fl oz	24	1	aphids, psyllids, whitefly	23	Maximum of 10 fl oz per acre per season.
M-Pede 49% EC Soap, insecticidal	1-2% V/V	12	0	aphids, leafhoppers, mites, plant bugs, thrips, whitefly	--	OMRI-listed ² .
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, cabbage looper, Colorado potato beetle, corn earworm, cutworms, hornworms, leafminers, tomato pinworm, tomato fruitworm, weevils, whitefly	un	IGR and feeding repellent. OMRI-listed ² .
Oberon 25C (spiromesifen)	7.0-8.5 fl oz	12	7	broad mite, twospotted spider mite, whiteflies (eggs & nymphs)	23	Maximum amount per crop: 25.5 fl oz/acre. No more than 3 applications.
Orthene 97 (acephate)	0.25-1.00 lb—bell peppers 0.5 lb—non-bell peppers	24	7	cabbage looper, grasshoppers, green peach aphid, tobacco hornworm	1B	Do not apply more than 2 lb ai per acre per season or 1 lb ai per acre per season for non-bell peppers
Platinum Platinum 75 SG (thiamethoxam)	5-11 fl oz 1.66-3.67	12	30	aphids, flea beetles, leafhoppers, thrips, whiteflies	4A	Soil application. See label for rotational restrictions.
Portal (fenpyroximate)	2.0 pt	12	1	mites, including broad mites, whiteflies	21A	Do not make more than two applications per season.
*Pounce 25 W (permethrin)	6.4-12.8 oz	12	3	cabbage looper, corn earworm, cutworms, flea beetles, leafminers, pepper weevil	3A	Do not apply more than 0.8 lb ai per acre per season.
*Proclaim (emamectin benzoate)	2.4-4.8 oz	12	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.
Prokil Cryolite 96 (cryolite)	10-12 lb	12	7 (SLN)	armyworms, cabbage looper, flea beetle, hornworms, pepper weevil	un	Do not exceed 24 lb per acre per crop. Must have supplemental label: FL-200011
Provado 1.6F (imidacloprid)	3.8- 6.2 oz	12	0	aphids, Colorado potato beetle, leafhoppers, pepper weevil, whitefly	4A	Do not apply to crop that has been treated with imidacloprid or thiamethoxam. Do not apply more than 19 ozs per acre as foliar spray.
Pyganic Crop Protection EC 5.0 (pyrethrins)	4.5-18 fl oz	12	0	aphids, beetles, caterpillars, grasshoppers, leafhoppers, leafminers, mites, plant bugs, thrips, whiteflies	3	Pyrethrins degrade rapidly in sunlight. Thorough coverage is important. OMRI-listed ² .
Radiant (spinetoram)	5-10 fl oz	4	1	armyworms (except yellowstriped armyworm), Colorado potato beetle, flower thrips, hornworms, <i>Liriomyza</i> leafminers, loopers, <i>Thrips palmi</i> , tomato fruitworm, tomato pinworm	5	Maximum of 34 fl oz per acre per season.
Requiem 25EC (extract of <i>Chenopodium ambrosioides</i>)	2-4 qts	4	0	chili thrips, Florida flower thrips, eastern flower thrips, green peach aphid, suppression of leafminers, melon thrips, potato aphid, western flower thrips, silverleaf whitefly	un	Begin before pest reach damaging levels.
Rimon 0.83EC (novaluron)	9-12 fl oz	12	1	Armyworms, foliage feeding caterpillars, leafminers, pepper weevil, stink bugs, thrips, whiteflies	15	Do not apply more than 36 fl oz per acre per season. Do not use with an adjuvant.
Scorpion 35SL Insecticide (dinotefuran)	Foliar: 2-7 fl oz Soil: 9-10.5 fl oz	12	foliar - 1, soil - 21	brown stink bug, Colorado potato beetle, cucumber beetles, flea beetles, grasshoppers, green stink bug, leafhoppers, leafminers, pepper weevil, psyllids, southern green stink bug, thrips, whiteflies, suppression of green peach aphid and potato aphid	4A	Do not apply more than 10.5 fl oz per acre per season as foliar sprays or more than 21 fl oz to soil. Use only one application method
Sevin 80S; XLR; 4F (carbaryl)	80S: 0.63-2.5 lb XLR; 4F: 0.5-2.0 qt	12	3	Colorado potato beetle, cutworms, fall armyworm, flea beetles, lace bugs, leafhoppers, stink bugs (suppression), tarnished plant bug, thrips (suppression), tomato fruitworm, tomato hornworm, tomato pinworm	1A	Do not apply more than seven times. Do not apply a total or more than 10 lb or 8 qt per acre per crop. Do not apply to crops or weeds in bloom.
Trigard (cyromazine)	2.66 oz	12	0	leafminers	17	No more than 6 applications per crop.

Table 8.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Trilogy (extract of neem oil)	0.5-1.0% V/V	4	0	aphids, mites, suppression of thrips and whitefly	un	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, Saf-T-Side, others (oil, insecticide)	3-6 qt/100 gal (JMS) 1-2 gal/100 gal	4	0	aphids, beetle larvae, leafhoppers, leafminers, mites, thrips, whiteflies	--	Stylet Oil helps manage aphid-borne viruses but does not kill aphids. Organic Stylet-Oil and Saf-T-Side are OMRI-listed ² .
Venom Insecticide (dinotefuran)	foliar: 1-4 oz soil: 5-6.0 oz	12	foliar: 1 soil: 21	Foliar: brown stink bug, cucumber beetles, grasshopper, green stink bug, southern green stink bug, suppression of green peach aphid and potato aphid Soil: flea beetle, grasshopper, thrips, whiteflies, suppression of aphids	4A	Use only one application method (soil or foliar). No more than 3 applications per season. No more than 6 oz (foliar) or 12 oz (soil) per acre per season.
Vetica (flubendiamide and buprofezin)	12.0-17.0 fl oz	12	1	armyworms, cabbage looper, cutworms, garden webworm, leafhoppers, saltmarsh caterpillar, tobacco budworm, tomato hornworm, tomato fruitworm, tomato pinworm, whiteflies	28, 16	Do not apply more than 3 times per season or apply more than 38 fl oz per acre per season. Use 14 to 17 fl oz per acre to control whiteflies, leafhoppers, and planthoppers.
Voliam Flexi (thiamethoxam, chlorantraniliprole)	4-7 oz	12	1	aphids, beet armyworm, Colorado potato beetle, fall armyworm, flea beetles, hornworms, leafhoppers, loopers, southern armyworm, stink bugs, tobacco budworm, tomato fruitworm, tomato pinworm, whitefly, yellowstriped armyworm, suppression of leafminer	4A, 28	Do not use in greenhouses or on transplants. Do not use if seed has been treated with thiamethoxam or if other Group 4A insecticides will be used. Highly toxic to bees. Do not exceed 14 oz per acre per season, or 0.172 lb ai of thiamethoxam-containing products or 0.2 lb ai of chlorantraniliprole-containing products per acre per season.
*Vydate L (oxamyl)	foliar: 2-4 pt	48	7	green peach aphid, leafminers, pepper weevil, thrips	1A	Do not apply more than 24 pt per acre per season.
*Warrior II (lambda-cyhalothrin)	0.96-1.92 fl oz	24	5	armyworms (1 st & 2 nd instar), cutworms, grasshoppers, hornworms, leafhoppers, loopers, plant bugs, stink bugs, thrips ⁽¹⁾ , tomato fruitworm, vegetable weevil. Suppression of aphids, mites, whitefly	3A	Do not apply more than 0.36 lb ai/acre per season. (1) Does not control western flower thrips.
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.
Zeal Miticide (etoxazole)	2-3 oz	12	7	twospotted spider mite	10B	Do not make more than one application per season. Do not use with an adjuvant or surfactant.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

* Restricted use insecticide.

Table 8.4. Pepper fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Anthracnose	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 50W HB, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, Champion WP, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days	
	M1 & M3	Mankocide (copper hydroxide + mancozeb)	3 lbs	39 lb	7	2	
	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate FL, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		7	1	
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Echo 720	SEE INDIVIDUAL LABELS		3	1	
(suppression)	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	0	0.5	For Disease suppression only. No more than 2 sequential applications before rotating with another effective fungicide from a different FRAC group. See label for additional instructions pertaining to greenhouse useage.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	Limit is 5 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 8 month plant back restriction with off label crops.
	11	Cabrio 2.08 F (pyraclostrobin)	16 fl oz	96 fl oz	0	0.5	No more than 6 appl. of Cabrio or other group 11 fungicides/season.
	11	Heritage (azoxystrobin)	8 oz	2 lbs	0	4 h	Limit is 4 appl/season. No more than 2 sequential appl. Before alternating with a fungicide from a different FRAC group.
(suppression)	11	Flint 50 WGD (trifloxystrobin)	4 oz	16 oz	3	0.5	Maximum of 4 appl/season & alternate with a fungicide from a different FRAC group.
	11	Quadris 2.08 FL (azoxystrobin)	15.4 fl oz	61.5 fl oz	0	4 h	Limit is 6 appl/crop & alternate with a fungicide from a different FRAC group.
			0.8 fl oz per 1,000 row feet		0	4 h	Soil application through drip irrigation.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	55.3 fl oz	0	0.5	Only 4 apps per season; no more than 2 sequential apps; use of a spreading or penetrating type adjuvant may enhance efficacy. Not labeled for transplants. Up to a 1 year plant back restriction for certain off label crops.
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.
	11 & 27	Tanos (famoxadone + cymoxanil)	10 oz	72 oz	3	0.5	Tank mix with contact fungicides. Tank mix or rotate with a fungicide from a different FRAC group.
(suppression)	19	Ph-D WDG (polyoxin D zinc salt)	6.2 oz	31.0 oz	0	4 h	Limit is 5 apps. on 10-14 day interval. Alternate with a fungicide from a different FRAC group.
Bacterial spot	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 50W HB, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, Champion WP, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days	For best possible chemical control of bacterial spot, tank-mix copper with a mancozeb fungicide.

Table 8.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Bacterial spot	M1 & M3	Mankocide (copper hydroxide + mancozeb)	3 lbs	39 lb	7	2	
Continued	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate FL, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		7	1	*Bacterial spot control only when tank mixed with a copper fungicide. Use of 1 lb of mancozeb/acre per app. is sufficient.
(suppression)	11 & 27	Tanos (famoxadone + cymoxanil)	10 oz	72 oz	3	0.5	Tank mix with contact fungicides. Tank mix or rotate with a fungicide from a different FRAC group. Tank mix with copper fungicides for suppression of Phytophthora blight, bacterial spot, and bacterial soft rot
(suppression)	13	Quintec (quinoxifen)	6 fl oz	24 fl oz	3	0.5	Supplemental Section 2(ee) label: Must be alternated with another product effective against bacterial spot. If multiple applications are made, at least one application must be a tank mix with another product effective against bacterial spot.
	25	Agri-mycin 17 Ag Streptomycin Firewall (streptomycin sulfate)	200 ppm	-	-	0.5	For use on transplants only. Initiate when seedling is in 2-leaf stage. Apply at 4-5 day intervals until transplanting.
	P	Actigard* (acibenzolar-S-methyl)	0.75 oz	6 oz	14	0.5	*Labelled for chili pepper only. Begin applications within one week of transplanting or emergence. Make up to 8 weekly, sequential applications.
Bacterial soft rot (suppression)	11 & 27	Tanos (famoxadone + cymoxanil)	10 oz	72 oz	3	0.5	Tank mix with contact fungicides. Tank mix or rotate with a fungicide from a different FRAC group.
Botrytis	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Echo 720	SEE INDIVIDUAL LABELS		3	1	
(suppression)	7	Fontelis (penthioopyrad)	24 fl oz	72 fl oz	0	0.5	For Disease suppression only. No more than 2 sequential applications before rotating with another effective fungicide from a different FRAC group. See label for additional instructions pertaining to greenhouse useage.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	Limit is 5 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 8 month plant back restriction with off label crops.
(suppression)	11	Cabrio 2.08 F (pyraclostrobin)	16 fl oz	96 fl oz	0	0.5	No more than 6 apps. of Cabrio or other group 11 fungicides/season.
(suppression)	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.
	19	Ph-D WDG (polyoxin D zinc salt)	6.2 oz	31.0 oz	0	4 h	Limit is 5 apps. on 10-14 day interval. Alternate with a fungicide from a different FRAC group.
Frogeye leaf spot, Cercospora leaf spot (Cercospora spp.)	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 50W HB, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, Champion WP, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days	For best possible chemical control of bacterial spot, a copper fungicide should be tank-mixed with a mancozeb fungicide.
	M1 & M3	Mankocide (copper hydroxide + mancozeb)	3 lb	39 lb	7	2	

Table 8.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Frogeye leaf spot, Cercospora leaf spot (Cercospora spp.) Continued	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate FL, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		7	1	
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Echo 720	SEE INDIVIDUAL LABELS		3	1	
	3	Indar 75WSP (fenbuconazole)	4 oz	16 oz	7	0.5	No more than 2 sequential appl. before alternating with a fungicide from a different FRAC group. A 35 to 210 day plantback interval exists for non-labeled crops. See supplemental label.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	55.3 fl oz	0	0.5	Only 4 apps per season; no more than 2 sequential apps; use of a spreading or penetrating type adjuvant may enhance efficacy. Not labeled for transplants. Up to a 1 year plant back restriction for certain off label crops.
Gray leaf spot	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	Limit is 5 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 8 month plant back restriction with off label crops.
	11	Flint 50 WGD (trifloxystrobin)	4 oz	16 oz	3	0.5	Maximum of 4 appl/season & alternate with a fungicide from a different FRAC group
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	55.3 fl oz	0	0.5	Only 4 apps per season; no more than 2 sequential apps; use of a spreading or penetrating type adjuvant may enhance efficacy. Not labeled for transplants. Up to a 1 year plant back restriction for certain off label crops.
Powdery mildew	M2	(sulfur) Many brands available: Cosavet DF, Kumulus DF, Micro Sulf, Microfine Sulfur, Microthiol Disperss, Sulfur 6L, Sulfur 90W, Super Six, That Flowable Sulfur, Tiolux Jet, Thiosperse 80%, Wetttable Sulfur, Wetttable Sulfur 92, Yellow Jacket Dusting Sulfur, Yellow Jacket Wetttable Sulfur	SEE INDIVIDUAL LABELS		1	1	Follow label closely, it may cause phytotoxicity.
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Echo 720	SEE INDIVIDUAL LABELS		3	1	
	3	Indar 75WSP (fenbuconazole)	4 oz	16 oz	7	0.5	No more than 2 sequential appl. before alternating with a fungicide from a different FRAC group. A 35 to 210 day plantback interval exists for non-labeled crops.
	3	Rally Sonoma 40WSP (myclobutanil)	5 oz	20 oz	0	1	No more than 4 applications per season on a 10 – 14 day treatment interval. Should be alternated or tank mixed with a fungicide from a different FRAC group.
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	0	0.5	For Disease suppression only. No more than 2 sequential applications before rotating with another effective fungicide from a different FRAC group. See label for additional instructions pertaining to greenhouse useage.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	Limit is 5 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 8 month plant back restriction with off label crops.
	11	Cabrio 2.08 F (pyraclostrobin)	16 fl oz	96 fl oz	0	0.5	No more than 6 apps. of Cabrio or other group 11 fungicide/season.
	11	Heritage (azoxystrobin)	8 oz	2 lbs	0	4 h	Limit is 4 appl/season. No more than 2 sequential apps. before alternating with a fungicide from a different FRAC group.
	11	Flint 50 WGD (trifloxystrobin)	4 oz	16 oz	3	0.5	Maximum of 4 appl/season & alternate with a fungicide from a different FRAC group

Table 8.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Powdery mildew Continued	11	Quadris 2.08 FL (azoxystrobin)	15.4 fl oz	61.5 fl oz	0	4 h	Limit is 6 appl/crop & alternate with a fungicide from a different FRAC group.
			0.8 fl oz per 1,000 row feet		0	4 h	Soil application through drip irrigation.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	55.3 fl oz	0	0.5	Only 4 apps per season; no more than 2 sequential apps; use of a spreading or penetrating type adjuvant may enhance efficacy. Not labeled for transplants. Up to a 1 year plant back restriction for certain off label crops.
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.
	13	Quintec (quinoxifen)	6 fl oz	24 fl oz	3	0.5	Will not control latent or established infections. Must alternate or tank mix with an effective fungicide from a different FRAC group.
	19	Ph-D WDG (polyoxin D zinc salt)	6.2 oz	31.0 oz	0	4 h	Limit is 5 apps. on 10-14 day interval. Alternate with a fungicide from a different FRAC group.
Phytophthora blight, Phytophthora root rot, Phytophthora crown rot (<i>Phytophthora</i> spp.)	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 50W HB, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, Champion WP, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days	
(suppression)	M1 & M3	Mankocide (copper hydroxide + mancozeb)	3 lb	39 lb	7	2	
	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate FL, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		7	1	
	4	Ridomil Gold SL Ultra Flourish (mefenoxam)	1 pt 2 pt	3 pt 6 pt	7 7	2* 2*	*There is a reentry interval exemption if material is soil-injected or soil-incorporated.
	4 & M1	Ridomil Gold Copper 64.8 W (mefenoxam + copper hydroxide)	2.5 lb	10 lb	7	2	Use Ridomil Gold EC on soil preplant or at planting. Make up to 2 additional appl. Use 1 pt/acre and apply at a 30 day interval.
(suppression)	11	Reason 500 SC (fenamidone)	8.2 fl oz	24.6 fl oz	14	0.5	Ground application only. Must alternate with a fungicide from a different FRAC group. See supplemental label for restrictions and details.
(suppression)	11 & 27	Tanos (famoxadone + cymoxanil)	10 oz	72 oz	3	0.5	Tank mix with contact fungicides. Tank mix or rotate with a fungicide from a different FRAC group.
	21	Ranman (cyazofamid)	2.75 fl oz	16.5 fl oz	0	0.5	Limit is 6 apps. per crop. Must be rotated with an effective fungicide from a different FRAC group. See label for application instructions, including the recommended use of specific surfactants.
	28	Previcur Flex or Promess (propamocarb hydrochloride)	SEE INDIVIDUAL LABELS		5	0.5	GREENHOUSE APPLICATION: 6 apps./crop cycle. Do not mix with other products. Can cause phytotoxicity if applied in intense sunlight.
			1.2 pt	6 pt	5	0.5	FIELD APPLICATION: Apply prior to infection when conditions are favorable for disease.
	33	Aliette 80 WDG (fosetyl-al)	5 lbs	20lbs	14	0.5	See label for warnings concerning the use of copper compounds.
	40	Forum (dimethomorph)	6 oz	30 oz	0	0.5	Apply with another fungicide from a different FRAC group.

Table 8.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Phytophthora blight, Phytophthora root rot, Phytophthora crown rot (<i>Phytophthora</i> spp.)	40	Revus (mandipropamid)	8 fl oz	32	1	0.5	No more than 2 sequential apps. before rotating with a fungicide from a different FRAC group. A non-ionic surfactant, crop oil concentrate or blend is recommended.
Continued	43	Presidio (fluopicolide)	4 fl oz	12 fl oz	2	0.5	4 apps per season; no more than 2 sequential apps. 10 day spray interval; Tank mix with another labeled non-FRAC code 43 fungicide; 18 month rotation with off label crops.
	45 & 40	Zampro (ametoctradin + dimethomorph)	14 fl oz	42 fl oz	4	0.5	Addition of a spreading or penetrating adjuvant is recommended to improve performance. Limit of 3 applications per season.
Pythium damping-off, Pythium root rot, or Pythium seedling blights (<i>Pythium</i> spp.)	4	Allegiance-FL Acquire (metalaxyl)	0.75 fl oz/100 lbs seed	-	-	-	Seed treatment only
	4	Apron XL (mefanoxam)	0.64 fl oz/100 lbs seed	-	-	-	Seed treatment only
	4	Ridomil Gold SL Ultra Flourish (mefenoxam)	1 pt 2 pt	3 pt 6 pt	7 7	2* 2*	*There is a reentry interval exemption if material is soil-injected or soil-incorporated.
	4 & M1	Ridomil Gold Copper 64.8 W (mefenoxam + copper hydroxide)	2.5 lb	10 lb	7	2	Use Ridomil Gold EC on soil preplant or at planting. Make up to 2 additional appl. Use 1 pt/acre and apply at a 30 day interval.
(suppression)	12	Maxim 4 FS (fludioxonil)	0.16 fl oz/100 lbs seed	-	-	-	Seed treatment only
	28	Previcur Flex or Promess (propamocarb hydrochloride)	1.2 pt	6 pt	5	0.5	Apply prior to infection when conditions are favorable for disease. See label for greenhouse applications.
<i>Rhizoctonia solani</i>	11	Quadris 2.08 FL (azoxystrobin)	15.4 fl oz	61.5 fl oz	0	4 h	Limit is 6 apps/crop & alternate with a fungicide from a different FRAC group.
			0.8 fl oz/1,000 row feet		0	4 h	Soil application through drip irrigation
	14	Par-Flo 4F (PCNB)	12 fl oz/100 gal.	2 apps	Soil drench	0.5	Limited to only container-grown plants in nurseries or greenhouse.
Southern blight (<i>Sclerotium rolfsii</i>)	11	Aftershock Evito 480 SC (fluoxastrobin)	5.7 fl oz	22.8 fl oz	3	0.5	Limit is 4 apps/crop. Must alternate or tank mix with a fungicide from a different FRAC group.
(suppression)	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.
	14	Blocker 4F Terraclor 75 WP (PCNB)	SEE INDIVIDUAL LABELS		Soil treatment at planting	0.5	See label for application type and restrictions.
White mold (<i>Sclerotinia sclerotiorum</i>)	11	Cabrio 2.08 F (pyraclostrobin)	16 fl oz	96 fl oz	0	0.5	No more than 6 apps. of Cabrio or other group 11 fungicide/season.
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants. White mold suppression only.

¹ FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <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.

Chapter 9. Potato Production

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Botany and Planting

Potato – *Solanum tuberosum*, Solanaceae.

Table 9.1. Planting information for potato.

Planting dates	
North Florida	Jan-Feb
Central Florida	Nov-Feb
South Florida	Oct-Jan
Planting information	
Distance between rows (inch)	36 - 42
Distance between plants (inch)	5 - 10
Planting depth (inch)	3 - 4
Average seed piece size (oz)	2.5 - 3.0
Average seed per planted acre (lb)	2000 - 3000
Days from planting to tuber maturity	85 - 110

Cultivars

1. CHIPPING TYPES

Atlantic. With high yield potential, high specific gravity and uniform tuber size and shape, Atlantic is the standard variety for chipping from the field or from very short-term storage. The cultivar is tolerant to scab and Verticillium wilt; resistant to pinkeye; and highly resistant to Race A of golden nematode, virus X and tuber net necrosis. Tubers are susceptible to internal heat necrosis, particularly in sandy soils in warm, dry seasons. Hollow heart in the larger diameter tubers (> 3 in) can be serious in some growing areas when growing conditions over the season fluctuate.

Elkton. Elkton is a medium to medium-late maturing potato variety with netted-skinned, round-oblong tubers, and white-flesh. Chip color processed directly from the field. Elkton is resistant to internal heat necrosis and moderately resistant to common scab, early blight, and Verticillium wilt; intermediate to moderately susceptible to late blight; moderately susceptible to powdery scab; and, susceptible to potato virus Y and potato virus S.

Harley Blackwell. Harley Blackwell is a round, white-fleshed, tan, netted-skin variety, resistant to internal heat necrosis, for chipping directly from the field in the mid-Atlantic states. Harley Blackwell is resistant to Race A of golden nematode, Verticillium wilt, and late blight. It is moderately susceptible to early blight with intermediate resistance to common scab and some tolerance to powdery scab.

2. FRESH MARKET/TABLE TYPES

Red LaSoda. Red LaSoda is an early to medium season, red-skinned variety that is primarily grown in the southeastern U.S. It is harvested in the winter months as a fresh market variety. Red LaSoda has a high yield potential of tubers with a pink to red color. Tubers size early. Tuber eye depth and off-shape tubers are limitations. The cultivar is susceptible to early and late blights, scab, corky ringspot,

and bacterial wilt. Red LaSoda is the top planted red-skinned potato variety in Florida.

LaRouge. LaRouge is a early to medium maturing, red-skinned variety that has a high tuber yield potential with tubers sizing early. Primary growing areas are in the southeastern U.S. The variety is grown for the fresh market and is generally not stored. LaRouge has good scab resistance but is susceptible to early and late blights, corky ringspot, and bacterial wilt. The deep eyes and irregular tuber shape are the major limitations. When harvested in southern states the relatively high yield, bright color, and good boiling qualities make it popular for markets in the late winter.

LaChipper. LaChipper is an early to midseason variety with moderate to high tuber yield and moderate specific gravity. It is the top planted fresh market white-skinned variety in Florida. Tubers are more elongated than round, somewhat flattened. Skin is smooth and white with medium to deep, cream colored eyes that are fairly evenly distributed. Tuber flesh is very white. LaChipper possesses some resistance to late blight. It is moderately susceptible to common scab. Exposure to air pollution can result in defoliation and reduction in tuber yield. Deep eyes and irregular shape are disadvantages on the tablestock market.

Yukon Gold. Yukon Gold has early-medium maturity, moderate yields, moderate specific gravity and relatively attractive tuber type. Tubers slightly oval, may be somewhat flattened with yellow-white skin and light yellow tuber flesh. Its shallow, pink eyes distinguish Yukon Gold from other yellow-skinned, yellow-fleshed cultivars. Yukon Gold is resistant to mild mosaic, moderately resistant to leafroll virus and susceptible to virus Y, common scab and air pollution. In some growing areas, hollow heart and internal heat necrosis may be a problem. Yukon Gold retains the yellow flesh color when baked, boiled or french-fried.

Goldrush. Goldrush is a medium maturing russet cultivar grown primarily for the fresh market. Russet-skinned tubers are oblong to long and average approximately 6-10 tubers per plant. Eyes are very shallow and well distributed; under some conditions they may show a reddish blush. Tuber flesh is very white and tuber dormancy is medium in duration. Goldrush has been observed to have moderate resistance to Verticillium wilt, good resistance to scab, moderate resistance to blackspot and some resistance to silver scurf. It is considered susceptible to most common potato viruses and other potato diseases, such as early blight, late blight, soft rot and Fusarium dry rot.

Pesticides for Weed, Arthropod and Disease Management for Potato.

Table 9.2. Selected herbicides approved for managing weeds in potato.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREPLANT / PREEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides.
Dimethenamid-p 0.56 - 0.84	(Outlook) 6 L 12 - 18 fl. oz.	Apply after planting or drag-off. Consult label for exact rates based on soil texture. In cold wet conditions, delayed crop emergence or stunting may occur. PHI 40 days.
EPTC 1	(Eptam) 20 G 15 lb.	Broadleaf and grass weeds and nutsedge. Apply preplant or after drag-off. Incorporate mechanically or with irrigation 2-4 in. deep. Do not apply the emulsifiable formulation preemergence in winter and early spring potatoes.
Flumioxazin 0.05	(Chateau) 51 WDG 1.5 oz.	Annual broadleaf weeds. Apply after hilling with a minimum of 2 in. of soil covering the vegetative portion of the potato plant. Should be tank mixed with other herbicides, especially for grass control.
Fomesafen 0.25	(Reflex, Ringside) 2 EC 1.0 pt.	Annual broadleaf and grass weeds. Effectiveness reduced if later cultural practices expose untreated soil. Can be applied after drag off and before crop emergence. Variety tolerance may vary, test on a small sample before application to the entire field. PHI 7 days.
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burndown. Consult label for individual product directions.
Linuron 0.75 - 1.25	(Lorox DF) 50 DF 1.5 - 2.5 lb.	Apply after final drag-off. If weeds are present include a NIS. Best results are obtained in moist fields at application followed by rain or irrigation with 2 wk.
S-metolachlor 0.95 - 1.9	(Dual Magnum) 7.62 EC 1.0 - 2.0 pt.	Annual broadleaf and grass weeds. Apply after drag-off before crop and weed emergence. If cool, wet soil conditions occur after application, a delay in maturity and/or reduced yield may occur. PHI 60 days.
Metribuzin 0.25 - 1.0	(Tricor DF) 75 DF 0.3 - 1.3 lb.	Annual broadleaf weeds. Apply after drag-off but before crop emergence. Do not incorporate. Use lower rates on sandy soil.
Metribuzin + S-metolachlor	(Boundry) 6.5 EC 1.5 - 2.0 pt.	Broadleaf and grass weeds. Apply before potato emergence. This includes drag-off. Do not incorporate.
Paraquat 0.25 - 0.5	(Gramoxone) 2 SL 1.0 - 2.0 pt. (Firestorm) 3 SL 0.7 - 1.3 pt.	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment. Apply up to ground cracking before potatoes have emerged. Use a nonionic surfactant.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with soil residual compounds.
Pendimethalin 0.75	(Prowl H20) 3.8 1.5 pt.	Annual broadleaf and grass weeds. Apply after planting but before potatoes and weeds emerge or after drag-off. Incorporate with rainfall or mechanically into the top 1-2 in. of soil within 7 days. Do not use on peat or muck soils.
Pyraflufen 0.001 - 0.003	(ET Herbicide) 0.208 EC 0.5 - 2.0 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burndown treatment.
Rimsulfuron 0.016 - 0.023	(Matrix) 25 DF 1.0 - 1.5 oz.	Apply immediately after drag-off. Rainfall or sprinkler irrigation 0.3-1.0 in. required with 5 days after application. Do not exceed 2.0 oz./acre per year.
*** POSTEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as hooded application to row middles only. Use a COC or NIS at recommended rates. May be tank mixed with other herbicides. Do not exceed 6.1 fl. oz. per cropping season. PHI 7 days.
Clethodim 0.09 - 0.25	(Arrow, Select) 2 EC 6 - 16 fl. oz. (Select Max) 1 EC 9 - 32 fl. oz.	Perennial and annual grass weeds. In fields with heavy grass pressure or larger grass weeds, use higher rates or repeat application 14 days apart. Use a crop oil concentrate at 1% v/v in the finished spray volume. Nonionic surfactant with Select Max. PHI 30 days.
EPTC	(Eptam) 20 G 15 lb.	Annual broadleaf and grass weeds and nutsedge. Apply at layby to a clean cultivated soil. Incorporate mechanically or with irrigation. PHI 45 days.
Metribuzin 0.23 - 0.5	(Tricor) 75 DF 0.3 - 0.6 lb.	Broadleaf and grass weeds. Do not apply to early smooth skinned, red skinned, and other specified varieties on the label. Do not exceed 1.3 lb. of product /acre. PHI 60 days.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Direct spray to row middles. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with several soil residual compounds.
Rimsulfuron 0.016 - 0.023	(Matrix) 25 DF 1.0 - 1.5 oz.	Apply immediately after drag-off. Rainfall or sprinkler irrigation 0.3-1.0 in. required within 5 days after application. Apply as a sequential treatment 14 to 28 days after the first application. Do not exceed 2.0 oz./acre per year.
Sethoxydim 0.28 - 0.47	(Poast) 1.5 EC 1.5 - 2.5 pt.	Control growing grass weeds. A total of 5.0 pt./acre applied in one season. Include a crop oil concentrate. Unsatisfactory results may occur if applied to grass under stress. PHI 30 days.

Table 9.3. Selected insecticides approved for managing insect pests of potato.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Actara (thiamethoxam)	1.5-3.0 oz	12	14	aphids (higher rate), Colorado potato beetle, flea beetles, potato leafhopper	4A	Toxic to bees. Do not use following soil application of Platinum. Maximum 6 oz/acre per season.
Admire Pro (imidacloprid)	5.7-8.7 fl oz as soil treatment or as seed piece treatment: 3.5-7.0 fl oz/100 lb seed	12	at planting, see label for options	aphids, Colorado potato beetle, flea beetles, potato leafhopper, wireworms (seed-piece protection only)	4A	Do not apply more than, 0.31 lb ai per acre per season. Seed piece rate is based on seeding rate of 2000 lb/acre.
Agree WG (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	1.0-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11A	Apply when larvae are small for best control. OMRI-listed ² .
*Agri-Mek SC (abamectin)	1.75-3.5 fl oz	12	14	Colorado potato beetle, <i>Liriomyza</i> leafminers, potato psyllid, spider mites	6	No more than 2 sequential applications. Must be applied with non-ionic activator type wetting, spreading, or penetrating adjuvant. See label for resistance management.
*Ambush 25W (permethrin)	3.2-12.8 oz	12	14	cabbage looper, Colorado potato beetle, potato aphid, potato flea beetle, potato leafhopper, potato tuberworm	3A	Do not apply more than 1.6 lb active ingredient per season (102.4 oz).
*Asana XL (0.66 EC) (esfenvalerate)	2.9-9.6 fl oz	12	7	beet armyworm (aids in control), cabbage looper, Colorado potato beetle, cucumber beetles (adults), cutworms, flea beetles, grasshoppers, potato aphid, potato leafhopper, potato tuberworm, tarnished plant bug	3A	Do not apply more than 0.35 lb ai/acre per season (7 applications at highest rate).
Assail 30SG (acetamiprid)	1.5-4.0 oz	12	7	aphids, Colorado potato beetle, cucumber beetle, flea beetle, leafhoppers	4A	Do not make more than 4 applications per season. Do not exceed a total of 0.3 lb ai per acre per season.
Avaunt (indoxacarb)	2.5-6.0 oz	12	7	cabbage looper, Colorado potato beetle	22	Do not apply more than 24 oz/acre per crop.
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	un	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	un	Antifeedant, repellent, insect growth regulator.
*Baythroid XL (beta-cyfluthrin)	0.8-2.8 fl oz	12	0	cabbage looper, Colorado potato beetle, cutworms, flea beetles, potato leafhopper, potato psyllid, potato tuberworm, tarnished plant bug	3A	Allow at least 5 days between applications. A maximum of 16.8 fl oz may be applied per acre per season.
Belay Insecticide (clothianidin)	9-12 fl oz (soil application)	12	Foliar: 14, or at planting or sidedress or spray at ground crack over row at hilling	Soil: aphids, Colorado potato beetle, corn wireworm, flea beetle, leafhoppers, southern potato wireworm, white grubs, suppression of other wireworms	4A	See label for in-furrow or side dress applications.
	2-3 fl oz (foliar)			Foliar: aphids, Colorado potato beetle, flea beetles, leafhoppers		
Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	7	aphids, plant bugs	9C	Begin applications before pest populations reach damaging levels. Do not apply more than 8.4 oz/acre per season.
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11	Treat when larvae are young. Good coverage is essential. Can be used in the greenhouse. For organic production.
BotaniGard 22 WP, ES (<i>Beauveria bassiana</i>)	WP: 0.5-2 lb/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.
	ES: 0.5-2 qt/100 gal					
*Brigade 2 EC (bifenthrin)	9.6-19.2 oz at-plant (soil); 3.2-9.6 oz at lay-by (soil); 2.1-6.4 oz (foliar)	12	21	cucumber beetles, flea beetles, sweetpotato weevil adults (foliar), whitefringed beetle adults, white grub adults, white grubs (lay-by), wireworm adults, wireworms (at-plant and lay-by)	3A	No more than 2 foliar applications, at least 21 days apart. Do not apply more than 0.5 lb active ingredient per acre per season, including soil applications.
Clinch (abamectin)	1 lb	12	0	fire ants	6	Apply when ants are actively foraging. Apply after dew or rainfall has dried for maximum effectiveness. Do not apply if rainfall is anticipated within 4-6 hours. No more than 4 applications per year.
Coragen (rynaxypyr)	3.5-5.0 fl oz	4	14	cabbage looper, Colorado potato beetle	28	Do not apply more than 15.4 fl oz per acre per crop per season. Foliar or overhead sprinkler irrigation systems only.
Crymax WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Use high rate for armyworms. Treat when larvae are young. Not for organic production.
Deliver (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11A	Use higher rates for armyworms. OMRI-listed ² .

Table 9.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Dimethoate 4 EC (dimethoate)	0.5-1.0 pt	48	0 if mechanically harvested, 14 otherwise	aphids, grasshoppers, leafhoppers, leafminers	1B	Highly toxic to bees.
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. Good coverage is essential. OMRI-listed ² .
*Endigo ZC (lambda-cyhalothrin, thiamethoxam)	3.5-4.5 fl oz	24	14	armyworms, blister beetles, Colorado potato beetle, corn earworm, crickets, cucumber beetles, cutworms, flea beetles, grasshoppers, leafhoppers, loopers, plant bugs, saltmarsh caterpillar, stink bugs, thrips, webworms, whiteflies	3A, 4A	Do not exceed a total of 10 fl oz of product per acre per growing season. Do not use with other Group 4A insecticides.
Entrust SC (spinosad)	3-10 fl oz	4	7	armyworms, Colorado potato beetle, dipteran leafminers, loopers, thrips	5	Do not apply to consecutive generations of Colorado potato beetle. Do not apply more than 21 fl oz per acre per season or more than 4 times/crop. OMRI-listed ² .
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.
Fulfill (pymetrozine)	2.75-5.5 oz	12	14	green peach aphid, potato aphid, potato psyllid	9B	Apply when aphids first appear. Do not exceed 11.0 oz/acre/season.
Grandevo (<i>Chromobacterium</i> <i>subtsugae</i> strain PRAA4-1)	1-3 lb	4	0	aphids, armyworms, loopers, potato leafhopper, potato psyllid, whiteflies	—	OMRI-listed ² .
Imidan 70 W (phosmet)	1.3 lb	5 days	7	Colorado potato beetle, flea beetles, potato leafhopper	1B	Use only on potatoes to be harvested by machine.
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.5 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms)	11A	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
Kryocide (cryolite)	10-12 lb	12	0	Colorado potato beetle	--	Application to exposed tubers may result in excess residues.
*Lannate LV; *SP (methomyl)	LV: 1.5-3.0 pt SP: 0.5-1.0 lb	48	6	aphids, beet armyworm, fall armyworm, flea beetles, leafhoppers, loopers, potato tuberworm, variegated cutworm	1A	Do not make more than 10 applications per crop or apply more than 15 pt (LV) or 5 lb (SP) per acre per crop.
Malathion 8F (malathion)	1-1.5 pt	12	0	aphids, false chinch bugs, grasshoppers, mealybugs, leafhoppers	1B	Maximum of two applications per year.
*Mocap 15 G, *EC (ethoprop)	See labels	48	preplant or at planting	symphylans, wireworms	1B	Use broadcast application for moderate to heavy infestations of wireworms.
*Monitor 4 EC (methamidophos)	1.5-2 pts	4 days	14	aphids, armyworms, cabbage looper, Colorado potato beetle, cutworms, flea beetles, <i>Lygus</i> bug, potato leafhopper, potato tuberworm	1B	
Movento (spirotetramat)	4.0-5.0 fl oz	24	7	aphids, psyllids, whiteflies	23	Maximum of 10 fl oz/acre per season.
M-Pede 49% EC Soap, insecticidal	1-2% V/V	12	0	aphids, Colorado potato beetle, leafhoppers, plant bugs, thrips, whiteflies, mites	--	OMRI-listed ² .
*Mustang (zeta-cypermethrin)	1.4-4.3 oz	12	1	cabbage looper, cucumber beetles, cutworms, flea beetles, grasshoppers, leafhoppers, tarnished plant bug, vegetable weevil, white-fringed beetle (adult), yellowstriped armyworm; aids in control of aphids and beet armyworm	3A	A maximum of 0.3 lb ai/acre per season may be applied.
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	Aphids, armyworms, caterpillars and loopers, grasshoppers, Colorado potato beetle, whiteflies	un	Insect growth regulator and anti-feedant. OMRI-listed ² .
Oberon 25C (spiromesifen)	8-16 fl oz	12	7	potato psyllid, twospotted spider mite, whiteflies	23	Maximum amount per crop: 32.0 fl oz/acre. Maximum applications: 2.
*PennCap-M (methyl parathion)	2-6 pt	12 days	5	aphids, Colorado potato beetle, cutworms, flea beetles, grasshoppers, potato leafhopper, tarnished plant bug	1B	Do not apply more than 24 pt per acre per year.
Platinum Platinum 75SG (thiamethoxam)	5-8 fl oz 1.66-2.67 oz	12	applied at planting or at plant emergence	aphids, Colorado potato beetles, flea beetles, potato leafhoppers, wireworms (seed-piece only)	4A	For many crops that are not on the label, a 120-day plant-back interval must be observed. To manage resistance, avoid using Actara or Provado in conjunction with Platinum.
*Pounce 25 WP (permethrin)	6.4-12.8 oz	12	14	aphids, aster leafhopper, beet armyworm, cabbage looper, Colorado potato beetle, cutworms, flea beetles, leafhoppers, potato tuberworm, tarnished plant bug	3A	Do not apply more than 0.8 lb ai/acre per season.

Table 9.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Provado 1.6 F (imidacloprid)	3.8 oz	12	7	aphids, Colorado potato beetle, flea beetles, leafhoppers	4A	Do not use if other 4A insecticides have been used at planting.
Pyganic Crop Protection EC 5.0 (pyrethrins)	4.5-18.0 fl oz	12	0	most insects—see label.	3A	Harmful to bees. Degrades rapidly in sunlight. Good coverage essential. OMRI-listed ²
Radiant SC (spinetoram)	4.5-8 fl oz	4	7	armyworms, Colorado potato beetle, <i>Liriomyza</i> leafminers, loopers, thrips	5	No more than 4 applications per year.
*Regent 4SC (fipronil)	3.2 fl oz	0	90	wireworms		Many plant-back restrictions. One in-furrow application at time of planting only. Must be incorporated and covered with soil.
Requiem (extract of <i>Chenopodium ambrosioides</i>)	2-3 qt	4	0	green peach aphid	un	Treat when threshold reached.
Rimon 0.83EC (novaluron)	6-12 fl oz	12	14	armyworms, Colorado potato beetle, loopers, other foliage feeding caterpillars, potato tuberworm, sweetpotato leafminer, whiteflies	15	Do not apply more than 24 oz per acre per season.
Scorpion 35SL (dinotefuran)	foliar: 2-2.75 fl oz soil: 11-13 fl oz	12	foliar - 7 soil - at planting	Colorado potato beetle, flea beetle, potato leafhopper, suppression of green peach aphid and potato aphid	4A	Apply as foliar or soil application, but not both.
Sevin XLR, 4 F; 80 S (carbaryl)	XLR, 4F: 0.5-2.0 qt 80S: 0.63-2.5 lb	12	7	Colorado potato beetle, corn earworm, cutworms, fall armyworm, flea beetles, leafhoppers, stink bugs, tarnished plant bug	1A	Do not apply more than a total of 6 qt (4F, XLR) or 7.5 lb (80S).
Sun Spray 98.8%, JMS Stylet-Oil, others (oil, insecticidal)	3-6 qt/100 gal (JMS)	4	0	leafhoppers, leafminers, thrips, whiteflies, mites	--	See label for tank mix cautions. Organic Stylet-Oil is OMRI-listed ² .
*Thimet 20 G (phorate)	See label - varies with soil type and time of application.	48	90	aphids, Colorado potato beetle (early season), flea beetles (larvae), leafhoppers, leafminers, wireworms	1B	One application per season.
*Thionex 50W (endosulfan)	1-2 lb	12 days	12	aphids, armyworms, Colorado potato beetle, false chinch bugs, flea beetles, leafhoppers, plant bugs, potato tuberworm, stink bugs, three-lined potato beetle, whiteflies	2	No more than 4 applications per year. Do not exceed 2 lb ai/acre per year. It will not be legal to use this product in Florida after Dec. 31, 2014.
Trigard (cyromazine)	2.66-5.32 oz	12	7	Colorado potato beetle larvae, leafminers	17	Most effective for control of 1 st and 2 nd instar larvae. Does not control adult CPB. Use lower rate for leafminers.
Trilogy (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .
Venom Insecticide (dinotefuran)	foliar: 1-1.5 oz soil: 6.5-7.5 oz	12	foliar - 7 soil - at planting	Foliar: Colorado potato beetle, flea beetle, potato leafhopper, psyllid, suppression of green peach aphid and potato aphid Soil: Colorado potato beetle, flea beetle, potato leafhopper, suppression of green peach aphid, potato aphid, and psyllids	4A	Do not apply more than 4.5 oz per acre per season to foliage. One soil application, either preplant, preemergence, or at ground crack. Do not use with other Group 4A insecticides.
Voliam Flexi (thiamethoxam, chlorantraniliprole)	4 oz	12	14	aphids, beet armyworm, cabbage looper, Colorado potato beetle, flea beetles, potato leafhopper	4A, 28	No more than two applications.
*Voliam Xpress (lambda-cyhalothrin, chlorantraniliprole)	5-9 oz	24	14	aphids, armyworms, Colorado potato beetle adults, crickets, cutworms, flea beetle adults, grasshoppers, leafhoppers, loopers, saltmarsh caterpillar, stink bugs, webworms, others	3A, 28	Do not apply more than 27.0 fl. oz of product per acre per season. Supplemental label.
*Vydate L (oxamyl)	foliar: 1-4 pt	48	7	aphids, Colorado potato beetle, flea beetles, potato leafhopper, tarnished plant bug	1A	No more than 8 foliar applications per crop.
*Warrior II (lambda-cyhalothrin)	0.96-1.92 fl oz	24	7	cutworms, leafhoppers, saltmarsh caterpillar, aphids, armyworms, Colorado potato beetle, flea beetles, loopers, potato tuberworm, stink bugs, thrips, webworms	3A	Only exposed insects can be controlled. Do not apply more than 7.68 fl oz of product per acre per season.
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

* Restricted use insecticide.

Table 9.4. Potato fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Botrytis gray mold	M3	(mancozeb) Many brands available: Dithane M45, Dithane DF Rainshield, Dithane F45 Rainshield, Mancozeb Flowable, Manzate Pro-Stick, Nubark Mancozeb, Penncozeb 4FL, Penncozeb 80WP, Penncozeb 75DF	SEE INDIVIDUAL LABELS		3	1	
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo ZN, Bravo Weather Stik 6L, Chloronil 720, Chlorothalonil 720SC, Echo 90DF, Echo 720, Echo ZN, Equus DF, Equus 500 ZN, Equus 720SST, Initiate 720, Initate ZN	SEE INDIVIDUAL LABELS		7	0.5	
	7	Vertisan (penthiopyrad)	24 fl oz	72 fl oz	7	0.5	Do not make more than 2 sequential applications
	7	Endura 70WP (boscalid)	10 oz	20 oz	10	0.5	Do not make more than 4 apps at low rate or 2 apps at high rate
	7 & 9	Luna Tranquility (fluopyram + pyrimethanil)	11.2 fl oz	43.6	7	0.5	Do not make more than 2 sequential applications
	7 & 11	Priaxor	8 fl oz	24	7	0.5	Do not make more than 2 sequential applications
	9	Scala SC (pyrimethanil)	7 fl. oz	35 fl. oz	7	0.5	Use only in a tank mix with labeled fungicide for early blight
	11 & 4	Quadris Ridomil Gold (azoxystrobin + mefenoxam)	0.82 fl oz./1000 ft. of row	See label		0	Apply at planting
	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, COC DF, COC WP, COCS WDG, Champ DP Dry Prill, Champ 2 FL, Champ WG, Champion WP, Cuprofix Ultra 40 Disperss, Copper-Count-N, Cuprofix MZ Disperss, Copper sulfate crystals, Copper-Z 4/4, , Cueva, Kentan DF, Kocide 2000, Kocide DF, Kocide 3000, Nordox 75WG, Nu Cop 50WP, Nu-Cop 3L, Nu-Cop 50DF, Nu-Cop HB, Quimag Copper Sulfate Crystal	SEE INDIVIDUAL LABELS		Varies by product from 0 to 1 day	Varies by product from 4 h to 2 days	
	M1 & M3	ManKocide 61.1DF (copper hydroxide + mancozeb)	5 lb	74.66 lb	3	2	
Early blight (<i>Alternaria solani</i>)	M3	(mancozeb) Many brands available: Dithane M45, Dithane DF Rainshield, Dithane F45 Rainshield, Mancozeb Flowable, Manzate Pro-Stick, Nubark Mancozeb, Penncozeb 4FL, Penncozeb 80WP, Penncozeb 75DF	SEE INDIVIDUAL LABELS		3	1	Limit is 11.2 lb of active ingredient per a crop.
	M3	Polyram 80DF (metiram)	2 lb	14 lb	3	1	Limit is 7 appl./season
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo ZN, Bravo Weather Stik 6L, Chloronil 720, Chlorothalonil 720SC, Echo 90DF, Echo 720, Echo ZN, Equus DF, Equus 500 ZN, Equus 720SST, Initiate 720, Initate ZN	SEE INDIVIDUAL LABELS		7	0.5	Read label for application directions
	2	Enclosure 4 Iprodione 4L Nevada 4F Rovral 4F (iprodione)	2 pt	8 pt	14	1	Limit is 4 appl./crop. See individual label for additional information.
	4 & M3	Ridomil Gold MZ (mancozeb + mefenoxam)	2.5 lb	See label	3	2	Also labeled for storage rots (Pink Rot and Leak)
	4 & M5	Ridomil Gold Bravo SC (chlorothalonil + mefenoxam)	2.5 pt	See label	14	2	Limit is 4 appl./crop. Also labeled for storage rots (Pink Rot and Leak)
	7	Endura 70WP (boscalid)	10 oz	20 oz	10	0.5	Do not make more than 4 apps at low rate or 2 apps at high rate

Table 9.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Early blight (<i>Alternaria solani</i>) Continued	7	Vertisan (penthiopyrad)	24 fl oz	72 fl oz	7	0.5	Do not make more than 2 sequential applications
	7 & 9	Luna Tranquility (Fluopyram; pyrimethanil) (fluopyram + pyrimethanil)	11.2 fl oz	43.6	7	0.5	Do not make more than 2 sequential applications
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	24	7	0.5	Do not make more than 2 sequential applications
	9	Scala SC (pyrimethanil)	7 fl. oz	35 fl. oz	7	0.5	Use only in a tank mix with labeled fungicide for early blight
	11	Evito 480SC Aftershock (fluoxastrobin)	3.8 fl oz	22.8 fl oz	7	0.5	Limit is 6 application per crop and alternate with non-group 11 chemistry
	11	Gem 500SC (trifloxystrobin)	3.8 fl oz	23 fl. oz	7	0.5	Limit is 6 application per crop and alternate with non-group 11 chemistry
	11	Headline 2.09F (pyraclostrobin)	12 fl oz	72 fl oz	3	0.5	Alternate with non-group 11 chemistry between applications.
	11	Heritage (azoxystrobin)	10.5 oz	4.0 lb	14	4 h	Alternate with non-group 11 chemistry between applications. Use 3.2 oz product/acre rate for early and late blight at 7 day intervals on preventative schedule. See label for specifics.
	11	Reason 500SC (fenamidone)	8.2 fl oz	24.6 fl oz	14	0.5	Alternate with non-group 11 chemistry between applications
	11	Quadris 2.08FL (azoxystrobin)	15.5 fl oz	123 fl oz	14	4 h	Alternate with non-group 11 chemistry between applications. See label for soilborne disease applications
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	1.6 pt	See label	14	0.5	Alternate with non-group 11 chemistry between applications
	11 & M3	Cabrio plus (pyraclostrobin + metiram)	2.9 lb	17.4 lb	3	1	Do not make more than two sequential applications
	11 & M3	Quadris Top (azoxystrobin & difenoconazole)	14 fl oz.	55.3 fl oz	14	0.5	Do not make more than 2 consecutive applications before switching to another effective fungicide with a different mode of action
	19	Ph-D (polyoxin D zinc salt)	6.2 oz	31 oz	0	0	Limit is 5 appl./season. Use in alternation with fungicides that have different modes of action.
	22 & M3	Gavel 75DF (mancozeb + zoxamide)	2.0 lb	12 lb	3	2	This product contains 66.7% mancozeb so do not exceed maximum allowed for mancozeb considering this and other mancozeb-containing products.
	27 & 11	Tanos (cymoxanil + famoxadone)	8 oz	48 oz	14	0.5	Do not make consecutive applications. Rotate to material with different mode of action
	28	Previcur Flex (propamocarb hydrochloride)	1.2 pt	6.0 pt	14	0.5	Use with a tank mix. See label for seed piece treatment
	30	Agri-tin (triphenyltin hydroxide)	3.75 oz	11.5	7	2	
	30	Super-Tin 80WP (triphenyltin hydroxide)	6 fl oz	18	7	2	For use with closed tractor cabs only. Super Tin should be tank-mixed with another fungicide
	30	Super-Tin 80WP (triphenyltin hydroxide)	3.75 oz	11.25 oz	7	2	For use with closed tractor cabs only. Super Tin should be tank-mixed with another fungicide
	40 & 3	Revus Top (mandipropamid + difenoconazole)	7 fl. oz	28 fl oz.	14	0.5	Do not make more than 2 consecutive applications
Fusarium tuber rot	M3	(mancozeb) Many brands available: Dithane M45, Dithane DF Rainshield, Dithane F45 Rainshield, Mancozeb Flowable, Manzate Pro-Stick, Nubark Mancozeb, Penncozeb 4FL, Penncozeb 80WP, Penncozeb 75DF	SEE INDIVIDUAL LABELS		3	1	See label for seed piece treatment.
	1	Mertect 340-F (thiabendazole)	0.42 fl oz per 2,000 lb of tuber			0.5	

Table 9.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Fusarium tuber rot Continued	M3 & 25	Nubark Macozeb AS (mancozeb & streptomycin)	1 lb/100 seed pieces			1	Seed treatment
	27, M3 & 1	Evolve (cymoxanil + mancozeb + thiophanate-methyl)	0.75 lb/100 lb cut seed-pieces			1	Potato seed piece treatment
Late blight (<i>Phytophthora infestans</i>)	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 53, COC DF, COC WP, COCS WDG, Champ DP Dry Prill, Champ 2 FL, Champ WG, Champion WP, Cuprofix Ultra 40 Disperss, Copper-Count-N, Cuprofix MZ Disperss, Copper sulfate crystals, Copper-Z 4/4, , Cueva, Kentan DF, Kocide 2000, Kocide DF, Kocide 3000, Nordox 75WG, Nu Cop 50WP, Nu-Cop 3L, Nu-Cop 50DF, Nu-Cop HB, Quimag Copper Sulfate Crystal	SEE INDIVIDUAL LABELS		Varies by product from 0 to 1 day	Varies by product from 4 h to 2 days	
	M1 & M3	ManKocide 61.1DF (copper hydroxide + mancozeb)	5 lb	74.66 lb	3	2	
	M3	(mancozeb) Many brands available: Dithane M45, Dithane DF Rainshield, Dithane F45 Rainshield, Mancozeb Flowable, Manzate Pro-Stick, Nubark Mancozeb, Penncozeb 4FL, Penncozeb 80WP, Penncozeb 75DF	SEE INDIVIDUAL LABELS		3	1	Limit is 11.2 lb of active ingredient per a crop.
	M3	Polyram 80DF (metiram)	2 lb	14 lb	3	1	Limit is 7 appl./season
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo ZN, Bravo Weather Stik 6L, Chloronil 720, Chlorothalonil 720SC, Echo 90DF, Echo 720, Echo ZN, Equus DF, Equus 500 ZN, Equus 720SST, Initiate 720, Initate ZN	SEE INDIVIDUAL LABELS		7	0.5	Read label for application directions
	4 & M1	Ridomil Gold Copper 64.8W (mefenoxam + copper hydroxide)	SEE INDIVIDUAL LABELS		14	2	Limit is 3 appl./crop of this product & other Ridomil products Add protectant fungicide, see label. Also for storage rots (Pythium leak Pink Rot)
	4 & M3	Ridomil Gold MZ (mancozeb + mefenoxam)	2.5 lb	See label	3	2	Also labeled for storage rots (Pink Rot and Leak)
	4 & M5	Ridomil Gold Bravo SC (chlorothalonil + mefenoxam)	2.5 pt	See label	14	2	Limit is 4 appl./crop. Also labeled for storage rots (Pink Rot and Leak)
	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	24	7	0.5	Do not make more than 2 sequential applications
	11	Evito 480SC Aftershock (fluoxastrobin)	3.8 fl oz	22.8 fl oz	7	0.5	Limit is 6 application per crop and alternate with non-group 11 chemistry
	11	Gem 500SC (trifloxystrobin)	3.8 fl oz	23 fl. oz	7	0.5	Limit is 6 application per crop and alternate with non-group 11 chemistry
	11	Headline 2.09F (pyraclostrobin)	12 fl oz	72 fl oz	3	0.5	Alternate with non-group 11 chemistry between applications.
	11	Heritage (azoxystrobin)	10.5 oz	4.0 lb	14	4 h	Alternate with non-group 11 chemistry between applications. Use 3.2 oz product/acre rate for early and late blight at 7 day intervals on preventate schedule. See label for specifics.
	11	Reason 500SC (fenamidone)	8.2 fl oz	24.6 fl oz	14	0.5	Alternate with non-group 11 chemistry between applications
	11	Quadris 2.08FL (azoxystrobin)	15.5 fl oz	123 fl oz	14	4	Alternate with non-group 11 chemistry between applications. See label for soilborne disease applications
	11 & M3	Cabrio plus (pyraclostrobin & metiram)	2.9 lb	17.4 lb	3	1	Do not make more than two sequential applications
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	1.6 pt	See label	14	0.5	Alternate with non-group 11 chemistry between applications

Table 9.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Late blight (<i>Phytophthora infestans</i>) Continued	21	Ranman (cyazofamid)	2.75 fl oz	27.5 fl oz	7	0.5	
	22 & M3	Gavel 75DF (mancozeb + zoxamide)	2.0 lb	12 lb	3	2	This product contains 66.7% mancozeb so do not exceed maximum allowed for mancozeb considering this and other mancozeb-containing products.
	27	Curzate 60DF (cymoxanil)	3.2 oz	22.4 oz	14	0.5	Limit is 7 apps/year. Use in combination with a protectant fungicide. It is best to alternate Curzate with other fungicides such as mancozeb or chlorothalonil. Also labeled for seed treatment
	27 & 11	Tanos (cymoxanil + famoxadone)	8 oz	48 oz	14	0.5	Do not make consecutive applications. Rotate to material with different mode of action
	27, M3 & 1	Evolve (cymoxanil + mancozeb + thiophanate-methyl)	0.75 lb/100 lb cut seed-pieces			1	Potato seed piece treatment
	28	Previcur Flex (propamocarb hydrochloride)	1.2 pt	6.0 pt	14	0.5	Use with a tank mix. See label for seed piece treatment
	29	Omega 500F (fluazinam)	5.5 fl oz	3.5 pt	14	2	Rate is higher for white mold.
	30	Agri-tin (triphenyltin hydroxide)	3.75 oz	11.5	7	2	
	30	Super-Tin 80WP (triphenyltin hydroxide)	6 fl oz	18	7	2	For use with closed tractor cabs only. Super Tin should be tank-mixed with another fungicide
	40	Forum (dimethomorph)	6 oz	30 oz	4	0.5	Tank mix with another chemistry. Do not make more than two sequential applications before alternating to a non-group 40 fungicide
	40	Revus (mandipropamid)	8 fl. oz	32 fl oz	14	4 h	Do not make more than 2 consecutive applications
	40 & 3	Revus Top (mandipropamid + difenoconazole)	7 fl. oz	28 fl oz	14	0.5	Do not make more than 2 consecutive applications
(suppression)	43	Presido (fluopicolide)	4 fl oz	12 fl oz	7	0.5	Must be tank mixed
Pythium, Pink Rot, and Phytophthora seed decays	4	Ridomil Gold SL Ultra Flourish (mefenoxam)	SEE INDIVIDUAL LABELS			2	At planting
	4	MetaStar 2E AG (metalaxyl)	8 pt			2	See label for banding applications; for use at planting
	4 & M1	Ridomil Gold Copper 64.8W (mefenoxam + copper hydroxide)	2 lb	6 lb	14	2	Limit is 3 appl./crop of this product & other Ridomil products Add protectant fungicide, see label. Also for storage rots (Pythium leak, Pink Rot)
	4 & M3	Ridomil Gold MZ (mancozeb + mefenoxam)	2.5 lb	See label	3	2	Also labeled for storage rots (Pink Rot and Leak)
	4 & M5	Ridomil Gold Bravo SC (chlorothalonil + mefenoxam)	2.5 pt	See label	14	2	Limit is 4 appl./crop. Also labeled for storage rots (Pink Rot and Leak)
	14	Botran 75W (DCNA cicloran)	6 lb	10 lb	20	0.5	Subsequent applications are made at 2 lb/acre
	14	Terraclor F (PCNB)	10.4 fl oz 1000 linear ft	15 pt	45	0.5	At planting or see label for white mold
	21	Ranman (cyazofamid)	2.75 fl oz	27.5 fl oz	7	0.5	Alternate with non-group 11 chemistry between applications
	27	Curzate 60DF (cymoxanil)	3.2 oz	22.4 oz	14	0.5	Limit is 7 apps/year. Use in combination with a protectant fungicide. It is best to alternate Curzate with other fungicides such as mancozeb or chlorothalonil. Also labeled for seed treatment

Table 9.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Rhizoctonia, Black Scurf & Stem Canker (<i>Rhizoctonia solani</i>)	M3	(mancozeb) Many brands available: Dithane M45, Dithane DF Rainshield, Dithane F45 Rainshield, Mancozeb Flowable, Manzate Pro-Stick, Nubark Mancozeb, Penncozeb 4FL, Penncozeb 80WP, Penncozeb 75DF	SEE INDIVIDUAL LABELS		3	1	See label for seed piece treatment.
	7	Moncut 70DF (flutolanil)	1.1 lb			0.5	In-furrow use only
	7	Vertisan (penthiopyrad)	24 fl oz	72 fl oz	7	0.5	Do not make more than 2 sequential applications
	7 & M3	Moncoat MZ (flutolanil & mancozeb)	1.0 lb/100 lb seed			1	Seed treatment
	11	Dynasty (azoxystrobin)	0.38 fl oz/100 lb seed			4 h	Seed treatment
	11	Headline (pyraclostrobin)	0.8 fl oz/1000 linear ft			0.5	In-furrow use only
	12	Maxim (fludioxonil)	0.8 fl oz/100 lb seed			0.5	Seed treatment
	12 + M3	Maxim MZ (fludioxonil + mancozeb)	0.5 lb/100 lb seed			1	Seed treatment
	14	Terraclor 75WP (PCNB)	6.66 lb	20 lb in one season		0.5	At planting
	14	Terraclor F (PCNB)	10.4 fl oz 1000 linear ft	15 pt	45	0.5	At planting or see label for white mold
	27, M3 & 1	Evolve (cymoxanil + mancozeb + thiophanate-methyl)	0.75 lb/100 lb cut seed-pieces			1	Potato seed piece treatment
	25	Agri-Mycin 17 Ag Streptomycin Firewall (streptomycin)	100 ppm			0.5	Seed treatment. Check individual labels for specific rates and instructions
	M2	(mancozeb) Many brands available: Dithane M45, Dithane DF Rainshield, Dithane F45 Rainshield, Mancozeb Flowable, Manzate Pro-Stick, Nubark Mancozeb, Penncozeb 4FL, Penncozeb 80WP, Penncozeb 75DF	SEE INDIVIDUAL LABELS		3	1	See label for seed piece treatment.
Soilborne pathogens	11	Dynasty (azoxystrobin)	3.75 fl oz/100 lb seed			4 h	For suppression of black scurf and stem canker and seed-borne black dot and for protection against silver scurf
	12	Maxim 4FS (fludioxonil)	0.16 oz/100 lb seed			0.5	Seed treatment. Must be made using specific equipment.
	12	Maxim Potato Seed Protectant Maxim PSP (fludioxonil)	0.5 lb/100 lb seed			0.5	Seed treatment
	12 & M3	Maxim MZ (fludioxonil + mancozeb)	0.5 lb/100 lb seed			1	Seed treatment
White mold (<i>Sclerotinia sclerotiorum</i>)	1	Topsin M WSB T-Methyl Thiophanate Methyl Incognito 4.5F (thiophanate-methyl)	SEE INDIVIDUAL LABELS		21	2	

Table 9.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
White mold (<i>Sclerotinia sclerotiorum</i>) Continued	2	Enclosure 4 Iprodione 4L Nevado 4F Rovral 4F (iprodione)	2 pt	8 pt	14	1	Limit is 4 appl./crop. See individual label for additional information.
(suppression)	7	Endura 70WP (boscalid)	10 oz	20 oz	10	0.5	Do not make more than 4 apps at low rate or 2 apps at high rate
	7	Vertisan (penthiopyrad)	24 fl oz	72 fl oz	7	0.5	Do not make more than 2 sequential applications
(suppression)	7 & 9	Luna Tranquility (fluopyram + pyrimethanil)	11.2 fl oz	43.6	7	0.5	Do not make more than 2 sequential applications
(suppression)	7 & 11	Priaxor (fluxapyroxad + pyraclostrobin)	8 fl oz	24	7	0.5	Do not make more than 2 sequential applications
	11	Headline 2.09F (pyraclostrobin)	12 fl oz	72 fl oz	3	0.5	Alternate with non-group 11 chemistry between applications.
(suppression)	11 & M3	Cabrio plus (pyraclostrobin & metiram)	2.9 lb	17.4 lb	3	1	Do not make more than two sequential applications

¹FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

²Information 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.

Table 9.5. THIS ONE DID NOT HAVE A LABEL.

Active Ingredient	Trade name	Manufacturer	Product / A	PHI ¹	Relative Desc. Rate ²
Carfentrazone	Aim	FMC	3.2 - 5.8 fl. oz.	7 days	Fast
Diquat	Reglone	Syngenta	1.0 - 2.0 pt.	7 days	Fast
Glufosinate	Rely 280	Bayer	21 fl. oz.	9 days	Slow
Pelargonic acid	Scythe	Dow	7 - 10% v/v	1 day	Fast
Pyraflufen	ET herbicide	Nichino	2.75 - 5.5 fl.oz.	14 days	Slow

¹ PHI = Preharvest Interval is the minimum time between application and harvest. It is not necessarily the time required to achieve tuber maturity and good skin-set.

² Relative dessication rate for each herbicide

Chapter 10. Strawberry Production

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Botany and Planting

Strawberry - *Fragaria x ananassa*, Rosaceae.

Table 10.1. Planting information for strawberries.

Planting dates	
North Florida	Sept 15 - Oct 15
Central Florida	Sept 15 - Oct 25
South Florida	Oct 1 - Dec 1
Planting information	
2-row beds	
Distance between beds (in)	48 - 60
Distance between plants (in)	12-16
Distance between rows (in)	12 - 14
Days to first ripe fruit	40 - 100
Plant populations (acre)	16,000-22,000

Cultivars

1. MAIN CULTIVARS

Strawberry Festival. Medium-size, uniform broad-conic fruit that fit well in a 1lb plastic container; deep red external color and medium to dark red internal color; moderately acidic but balanced flavor; very firm with excellent shipping quality; flexible skin that is extremely resistant to rain damage. Moderately vigorous plant; long fruit stems allow efficient picking. Resistant to *Phytophthora cactorum* root rot (caused by *Phytophthora cactorum*); moderately resistant to anthracnose fruit rot (caused by *Colletotrichum acutatum*) and Botrytis fruit rot (caused by *Botrytis cinerea*; susceptible to angular leaf spot (caused by *Xanthomonas* spp.) and Colletotrichum crown rot (caused by *Colletotrichum gloeosporoides*). ‘Strawberry Festival’ produces ample runners in the nursery and is a robust plant that is not prone to damage during handling; due to its susceptibility to Colletotrichum crown rot, care should be taken to control this disease in the nursery by using disease-free foundation stock.

Florida Radiance. Large, uniform, conic fruit with glossy appearance; deep-red external color and medium red internal color; moderately acidic but balanced flavor; moderately firm with good shipping quality; flexible skin that is moderately resistant to rain damage. Low to medium plant vigor with very open canopy; very long fruit stems giving excellent picking efficiency. Moderately resistant to anthracnose fruit rot, Botrytis fruit rot, and Colletotrichum crown rot; moderately susceptible to angular leaf spot, with symptoms particularly noticeable on the calyx; highly susceptible to *Phytophthora* root rot. Metalaxyl, the active ingredient in Ridomil Gold®, is highly effective against *Phytophthora* and should be injected through the drip tape as soon as plants are established. Two applications may be needed to treat an infected crop. Products containing potassium phosphite or potassium salts of phosphorus acid and the related aluminum deriva-

tives are alternatives that should generally be applied as foliar sprays, although some are also labeled for drip application. ‘Florida Radiance’ produces many runners in the nursery but must be handled very carefully since the petioles and root system are not robust and are prone to damage; it is recommended that water and nitrogen applications be reduced at the end of the season to allow the plants to “harden off”; due to the susceptibility of this cultivar to *Phytophthora* root rot, poorly-drained areas of the nursery should be avoided.

Winterstar (‘FL 05-107’). Large, very uniform, conic to broad-conic fruit with glossy appearance; bright-red external color that does not become overly dark at the end of the season and medium to light red internal color; low-acid flavor gives enhanced sweetness perception; firm with shipping quality nearly comparable to ‘Strawberry Festival’; skin particularly tough late in the season; moderately resistant to rain damage. Moderately vigorous plant that is also compact allowing higher density plantings; medium-long fruit stems. High early yield comparable to ‘Florida Radiance’ and moderate to high late-season yields. Moderately resistant to anthracnose fruit rot and Botrytis fruit rot; moderately susceptible to angular leaf spot; susceptible to *Phytophthora* root rot though not quite as severe as for ‘Florida Radiance’; take precautions against *Phytophthora* as recommended for ‘Florida Radiance’. ‘Winterstar’ strawberry produces runners in the nursery at rates similar to ‘Florida Radiance’. The foliage is more robust, however, and less prone to breakage. Nursery growers are highly encouraged to take precautions against *Phytophthora cactorum* infestation as they would for ‘Florida Radiance’.

2. MINOR CULTIVARS

Camarosa. Released in 1990, Camarosa is an early-season short day variety. Fruit is large to very large, very flat conic, productive, has good appearance, is very firm and has good flavor. It is widely adapted producing fruit over an extended period. Used for fresh-market (local sales) and u-pick operations in north Florida.

Sweet Charlie. Released in 1992, ‘Sweet Charlie’ was grown on a large commercial scale at one time. Due to its soft fruit it did not remain a commercial cultivar, but its low-acid flavor and high early yields make it a local favorite for U-pick operations.

Winter Dawn. Released in 2005, ‘Winter Dawn’ is known for its incredibly early yields. However, suboptimal flavor and decreasing fruit size over the course of the season have caused this cultivar to decline in favor of ‘Florida Radiance’ which has comparable early yields.

Florida Elyana. Released in 2008, ‘Florida Elyana’ has extremely large and firm fruit with high sugar content. Its compact plant can be spaced tightly. This cultivar is also very resistant to Colletotrichum root rot, anthracnose fruit rot, and Botrytis fruit rot. This cultivar is susceptible to rain damage and is recommended for production under protective structures such as greenhouses or high tunnels.

Pesticides for Weed, Arthropod and Disease Management for Strawberry.

Table 10.2. Selected herbicides approved for managing weeds in strawberry.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PRETRANSPLANT ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides.
Flumioxazin 0.1	(Chateau) 51 WDG 3 oz.	Broadleaf weeds. May be applied under the plastic mulch or a shielded or hooded spray directed to row middles before weed emergence. If applied under the plastic mulch, minimum of 30 days between applications and planting. Do not apply after fruit set.
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burndown. Consult label for individual product directions.
Napropamide 4	(Devrinol) 2 EC 8 qt. (Devrinol DF XT) 50 DF 8 lb.	Do not apply between bloom and harvest. May be applied under the plastic and in the row middles. Mechanically incorporate or irrigate 1-2 in. within 24 h. of application
Oxyfluorfen 0.25 - 0.5	(Galigan H ₂ O, GoalTender) 4 EC 0.5 - 1.0 pt. (Galigan, Goal 2XL) 2 EC 1 - 2 pt.	Certain broadleaf weeds. Minimum 30 day application to planting interval. Apply to a preformed bed. Plastic can be laid anytime during the 30 day interval.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment. Scythe is a contact, nonresidual and can be tank mixed with residual preemergence herbicides to lengthen control.
Pendimethalin 0.72	(Prowl H ₂ O) 3.8 1.5 pt.	Broadleaf and grass control in the row middles. Do not apply under the plastic. In systems that use irrigation at planting, delay application until after irrigation regime. PHI 35 days.
Terbacil 0.2	(Sinbar WDG) 80 WDG 4 oz.	Once-per-crop application of 4 oz./acre after bedding but prior to transplanting. Rainfall or irrigation required. Do not apply to soils with less than 0.5% organic matter. PHI 110 days.
*** POSTTRANSPLANT ***		
Clpyralid 0.125 - 0.25	(Stinger) 3 EC 0.33 - 0.66 pt.	Broadleaf weeds. Do not exceed 2/3 pt./acre per year. Do not include a surfactant. PHI 7 days.
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply directed to the row middles. Injury has been observed from translocation from daughter plants in the row middle to the mother plants. PHI 14 days. Spot treatment has PHI 7 days.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Direct spray to row middles. Do not allow spray to contact plants. May be tank mixed with several soil residual compounds.
Paraquat 0.5	(Gramoxone) 2 SL 2 pt. (Firestorm) 3 SL 1.3 pt.	Emerged broadleaf and grass weeds. Apply as a directed spray to row middles only. Do not allow spray to contact plants. Do not apply more than 3 times per season. PHI 21 days.
Sethoxydim 0.28 - 0.47	(Poast) 1.5 EC 1.5 - 2.5 pt.	Emerged grass weeds. A maximum of 2.5 pt./acre applied in one season. Include a COC at required rate. Unsatisfactory results may occur if applied to grasses under stress. PHI 7 days.
*** POSTHARVEST ***		
Paraquat 0.49	(Gramoxone) 2 SL 1.95 pt.	Do not apply more than 3 applications. Include a COC or NIS in the spray solution.

Table 10.3. Selected insecticides approved for managing insect pests of strawberry.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹
Agri-Mek 0.15 E (Abamectin)	16 oz/acre	12	3	twospotted spider mites	6
Kanenite 15 SC (Acequinocyl)	21-31 fl oz./acre	12	1	twospotted spider mites	20B
Assail 70 WP Assail 30SG (Acetamiprid)	see label	12	1	aphids, flea beetles, obliquebanded leafroller, plant bugs (Lygus spp.), sap beetles, spittlebug, thrips, whiteflies	4A
Neemix 4.5% EC (Azadirachtin)	See label	12	0	armyworms, caterpillars, loopers, thrips	un
Azatin XL (Azadirachtin)	See label	4	0	aphids, armyworms, beetles, caterpillars and loopers, thrips	un
Aza-Direct (Azadirachtin)	See label	4	0	aphids, armyworms, flies, mites, thrips, whiteflies	un

Table 10.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹
Javelin WG (Bacillus thuringiensis kurstaki)	0.25-1.5 lbs/acre	4	0	armyworms, loopers, omnivorous leaf tier, armyworm, loopers	11A
Biobit HP (Bacillus thuringiensis kurstaki)	See label	4	0	armyworms, loopers,	11A
DiPel ES (Bacillus thuringiensis kurstaki)	See label	4	0	armyworm, caterpillar, looper	11A
DiPel DF (Bacillus thuringiensis kurstaki)	See label	4	0	armyworm,	11A
Deliver (Bacillus thuringiensis kurstaki)	See label	4	0	armyworm, looper	11A
Agree WG Bacillus thuringiensis aizawai	0.5-2 lbs/acre	4	0	armyworms	11A
Xentari (Bacillus thuringiensis aizawai)	see label	4	0	armyworms, loopers,	11A
Botanigard ES (Beauveria bassiana)	See label	4	0	aphids, thrips	un
Mycotrol O (Beauveria bassiana)	See label	4	0	aphids, thrips	un
Naturalis L (Beauveria bassiana)	10-15 fl oz/acre	4	0	ants, aphids, armyworms, loopers, lygus bug, tarnished plant bug, thrips	un
Acramite 50 WS (Bifenazate)	0.75-1 lb/acre	12	1	twospotted spider mite	un
Brigade WSB (Bifenthrin)	See label	12	0	aphids, armyworms, plant bugs, stink bugs, spider mites	3A
Athena (Bifenthrin & Avermectin B1)	See label	12	3	aphids, armyworms, corn earworm, cutworms, cyclamen mite, flea beetles, leafrollers, leafhoppers, loopers, lygus, spittlebugs, stink bugs, strawberry sap beetle, twospotted spider mite, whitefly adult	3A + 6
Brigadier (Bifenthrin & Imidacloprid)	5.1-6.14 fl oz/acre	12	7	aphids, armyworms, corn earworm, flea beetle, leafhopper, lygus, spittlebug, whitefly	3A + 4A
Courier 40SC (Buprofezin)	9-12 oz/acre	12	2	whiteflies	16
Sevin 4F (Carbaryl)	See label	12	7	cutworms, omnivorous leaf tiers, tarnished plant bug	1A
Cutworm & Cricket Bait (Carbaryl)	See label	12	7	armyworms, crickets, ants, grasshoppers	1A
Sevin 80 Solupak (Carbaryl)	See label	12	7	armyworms, omnivorous leaf tier, tarnished plant bug	1A
Carbaryl 4 L	See label	12	7	omnivorous leaf tier, tarnished plant bug	1A
Grandevo (Chromobacterium subtsugae strain PRAA4-1)	1-3 lbs/acre	4	0		un
Coragen (Chlorantraniliprole)	3.5-5 fl oz/acre	4	1	Beet armyworm, cabbage looper, corn earworm, spider mites	28
Govern 4E (Chlorpyrifos)	see label	24	21	grubs	
Lorsban 75WG (Chlorpyrifos)	see label	24	21	grubs	1B
Diazinon 50W	See label	3 days	5	aphids, cyclamen mites	1B
Diazinon AG 600	See label	3 days	5	aphids, cyclamen mites	1B
Diazinon AG 500 (Diazinon)	See label	3 days	5	aphids, cyclamen mites	1B
Zeal (Etoxazole)	See label	12	1	twospotted spider mite, lygus, spittlebug, tarnished plant bug	10B
Danitol 2.4 EC (Fenpropathrin)	See label	24	2	lygus, tarnished plant bug, twospotted spider mites	3A
Vendex 50 WP (Fenbutatin oxide)	1.5-2 lbs/acre	48	1	twospotted spider mites	12B
Portal 5% EC (Fenpyroximate)	2 pt/acre	12	1	twospotted spider mites, cyclamen mites, whiteflies	21A
Beleaf 50 SG (Flonicamid)	2.8 oz/acre	12	0	Aphids and plant bugs	9C
Savey 50 DF (Hexythiazox)	6 oz/acre	12	3	twospotted spider mite	10A
Admire Pro (Imidacloprid)	10.5-14 fl oz/acre	12	14	aphids, whiteflies	4A
Malathion 5EC	See label	12	3	aphids, field cricket, lygus bugs, thrips	1B
Malathion 8F (Malathion)	1.5-2.0 pt/acre	12	3	aphids, field crickets, leafhopper, lygus bugs	1B
Intrepid 2F (Methoxyfenozide)	6-12 fl oz	4	3	armyworms, corn earworm	18
DiBrom 8-E (Naled)	1 pt/acre	48	1	leafrollers, spider mites, omnivorous leaf tiers, aphids, thrips, lygus	1B
Trilogy (Neem oil)	See label	4	0	aphids, mites, whiteflies, thrips ¹	un
Rimon 0.83EC (Novaluron)	See label	12	1	sap beetle (Nitidulidae), Asian cockroach, armyworms, loopers, corn earworm	15
PFR-97 20%WDG (Isaria fumosoroseus Apopka Strain 97)	1-2 lbs/acre	4	0	whiteflies, aphids, thrips, spider mites, Liriomyza leafminers, plant bugs, caterpillars	un
M-Pede (Potassium salts of acids (insecticidal))	See label	12	0	aphids, leafhoppers, twospotted mites	un
PyGanic EC 5.0 (Pyrethrins)	See label	12	0	aphids, armyworms, beet armyworm, fruit flies, lygus, tarnished plant bugs, thrips, whiteflies	3A
Evergreen EC 60-6 (Pyrethrins & Piperonyl Butoxide)	2-16 fl oz/acre	12	0	aphids, armyworms, beet armyworm, fruit flies, lygus, tarnished plant bugs, thrips, whiteflies	3A

Table 10.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹
Esteem 0.86 EC (Pyriproxyfen)	10 fl oz/acre	12	2	banded wing whitefly, silverleaf whitefly	7C
Esteem Ant Bait (Pyriproxyfen)	1.5-2 lbs/acre	12	1	red imported fire ant	7C
Extinguish fire ant bait ((S) methoprene)	See label	4	0	fire ants	7A
Radiant SC (Spinetoram)	6-10 fl oz/acre	4	1	armyworms, leafrollers, thrips	5
Entrust (Spinosad)	1.25-1.5 oz/acre	4	1	armyworms including beet armyworm, thrips, leaf rollers, omnivorous leaf tiers,	5
GF-120 NF Fruit Fly Bait (Spinosad)	See label	4	1	Tephritid flies	5
Oberon 2SC (Spiromesifen)	12-16 fl. oz/acre	12	3	Twospotted spider mite, whiteflies	23
Actara 25 WG (Thiamethoxam)	See label	12	3	aphids, whiteflies	4A
Voliam Flexi (Thiamethoxam & chlorantraniliprole)	See label	12	3	Aphids, beet armyworm, cabbage looper, corn earworm, leafhoppers, whiteflies	4A + 28

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

* **Restricted use insecticide.**

Table 10.4. Strawberry fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Angular leaf spot	M1	(copper compounds) Many brands available: Badge SC, Basic Copper 53, Badge X2, Champ DP Dry Prill, Champ Formula 2 Flowable, Champ WG, COC DF, COC WP, C-O-C-S WDG, Copper Count-N, Cueva, Cuprofix Ultra 40 Disperss, Kentan DF, Kocide 2000, Kocide 3000, Kocide DF, Mastercop, Nordox, Nordox 75WG, Nu Cop 3L, Nu Cop 50 DF, Nu Cop 50 WP, Nu Cop HB	SEE INDIVIDUAL LABELS		1-2	Varies by product from 4 h to 2 day	Frequent use of copper fungicides may cause foliar burn
	21	Actigard 50 WG (acibenzolar-s-methyl)	0.75 oz	6 oz	0	0.5	Do not apply to plants that are stressed due to drought, excessive moisture, cold weather, herbicide injury, etc.
Anthracnose	M4	Captan 50W, Captan 50 WP, Captan 80 WDG, Captec 4L (captan)	SEE INDIVIDUAL LABELS		1	1	Rate per treated acre. Special label for FL allows up to 24 applications per season
	M4 + 17	Captevat 68 WDG (captan + fenhexamid)	5.25 lb	21 lb	0	1	Do not make more than 2 consecutive applications
	3	(propiconazole) Many brands available: Amtide Propiconazole EC, Bumper 41.8 EC, Orbit, Propi-Star EC, Shar-Shield PPZ, Tilt	4 fl oz	16 fl oz	0	0.5	Do not make more than 2 consecutive applications
	3 + 11	Quadris Top (difenoconazole + azoxystrobin)	14 fl oz	56 fl oz	0	0.5	Do not make more than 2 sequential applications before alternating to another fungicide group and no more than 4 appl/ crop per year.
	3 + 11	Quilt Xcel (azoxystrobin + propiconazole)	14 oz	56 oz	0	0.5	Do not make more than 2 consecutive applications and no more than 4 appl/crop
	9 + 12	Switch 62.5 WG (cyprodinil + fludioxonil)	14 oz	56 oz	0	0.5	Do not make more than 2 consecutive appl. Do not plant crops not on the label for 30 days after last appl. See special label for instructions on dipping transplants

Table 10.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Anthrachnose Continued	11	Abound (azoxystrobin)	15.4 fl oz	1.92 qt	0	4 h	Do not make more than 2 sequential appl. and no more than 4 appl/crop year. See label for instructions on dipping transplants
	11	Cabrio EG (pyraclostrobin)	14 fl oz	70 fl oz	0	0.5	Do not make more than 2 sequential applications and no more than 5 appl/ crop year
	11	Flint (trifloxystrobin)	3.2 oz.	19.2 oz.	0	0.5	Do not apply more than 2 sequential applications of Flint of other Group 11 fungicides. Do not exceed more than 6 total applications of Group 11 fungicides per season
	11	Aftershock Evito (fluoxastrobin)	5.7 fl oz	22.8 fl oz	1	0.5	Do not make more than 2 sequential applications and no more than 4 applications per season, and a minimum interval of 14 days between applications
	11 + 7	Pristine (pyraclostrobin + boscalid)	23 oz	115 oz	0	0.5	Do not make more than 2 consecutive appl. and no more than 5 appl/ crop
Botrytis fruit rot	M3	Thiram Granuflo (thiram)	4.4 lb	22 lb	3	1	Do not rotate treated crops with other crops for which Thiram is not registered
	M4	(captan) Many brands available: Captan 50W, Captan 50 WP, Captan 80 WDG, Captec 4L	SEE INDIVIDUAL LABELS		1	1	Rate per treated acre. Special label for FL allows up to 24 applications per season
	M4 + 17	Captevat 68 WDG (captan + fenhexamid)	5.25 lb	21 lb	0	1	Do not make more than 2 consecutive applications
	1	(thiophanate-methyl) Many brands available: Thiophanate-methyl 85 WDG, Topsin 4.5 FL, Topsin 70 WDG, Topsin M 70 WP, Topsin M WSB, Incognito 4.5F	SEE INDIVIDUAL LABELS		1	1	Fungicides from different chemical groups should be used in spray program for disease resistance management
	2	(iprodione) Many brands available: Enclosure 4, Iprodione 4L AG, Meteor, Nevada 4F, Rovral 4 Flowable	2 pt	2 pt	N/A	1	Do not make more than 1 application per season. Do not apply after first fruiting flower
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	0	0.5	Do not make more than 2 sequential applications before alternating to a fungicide from a different group
	9	Scala SC (pyrimethanil)	18 fl oz	54 fl oz	1	0.5	Do not make more than 2 consecutive applications. Do not use more than 2 of 6 appl. in any one season
	9 + 12	Switch 62.5 WG (cyprodinil + fludioxonil)	14 oz	56 oz	0	0.5	Do not make more than 2 consecutive appl. Do not plant crops not on the label for 30 days after last appl. See special label for instructions on dipping transplants
	11 + 7	Pristine (pyraclostrobin + boscalid)	23 oz	115 oz	0	0.5	Do not make more than 2 consecutive appl. and no more than 5 appl/ crop
	17	Elevate 50 WDG (fenhexamid)	1.5 lb	6 lb	0	0.5	Do not make more than 2 consecutive applications
Botrytis (suppression only)	3	Mettle 125 ME (tetraconazole)	5 fl oz	20 fl oz	0	0.5	Do not apply same product within 14 days. Do not apply more than 4 applications per season.
	11	Abound (azoxystrobin)	15.4 fl oz	1.92 qt	0	4 h	Do not make more than 2 sequential appl. and no more than 4 appl/crop year. See label for instructions on dipping transplants
	11	Cabrio EG (pyraclostrobin)	14 fl oz	70 fl oz	0	0.5	Do not make more than 2 sequential applications and no more than 5 appl/ crop year
	11	Flint (trifloxystrobin)	3.2 oz.	19.2 oz.	0	0.5	Do not apply more than 2 sequential applications of Flint of other Group 11 fungicides. Do not exceed more than 6 total applications of Group 11 fungicides per season
	11	Aftershock Evito (fluoxastrobin)	5.7 fl oz	22.8 fl oz	1	0.5	Do not make more than 2 sequential applications and no more than 4 applications per season, and a minimum interval of 14 days between applications
Colletotrichum Crown rot	1	(thiophanate-methyl) Many brands available: Thiophanate-methyl 85 WDG, Topsin 4.5 FL, Topsin 70 WDG, Topsin M 70 WP, Topsin M WSB, Incognito 4.5F	SEE INDIVIDUAL LABELS		1	1	Fungicides from different chemical groups should be used in spray program for disease resistance management

Table 10.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Leaf blight	1	(thiophanate-methyl)	SEE INDIVIDUAL LABELS		1	1	Fungicides from different chemical groups should be used in spray program for disease resistance management
Leaf Scorch		Many brands available: Thiophanate-methyl 85 WDG, Topsin 4.5 FL, Topsin 70 WDG, Topsin M 70 WP, Topsin M WSB, Incognito 4.5F					
	3	Nova 40W Rally 40WSP, Sonoma 40 WSP (myclobutanil)	5 oz	30 oz	0	1	
	3	Mettle 125 ME (tetraconazole)	5 fl oz	20 fl oz	0	0.5	Do not apply same product within 14 days. Do not apply more than 4 applications per season.
Leaf spot	M4	(captan) Many brands available: Captan 50W, Captan 50 WP, Captan 80 WDG, Captec 4L	SEE INDIVIDUAL LABELS		1	1	Rate per treated acre. Special label for FL allows up to 24 applications per season
	2	(iprodione) Many brands available: Enclosure 4, Iprodione 4L AG, Meteor, Nevada 4F, Rovral 4 Flowable	2 pt	2 pt	N/A	1	Do not make more than 1 application per season. Do not apply after first fruiting flower
	3	(propiconazole) Many brands available: Amtide Propiconazole EC, Bumper 41.8 EC, Orbit, Propi-Star EC, Shar-Shield PPZ, Tilt	4 fl oz	16 fl oz	0	0.5	Do not make more than 2 consecutive applications
	3	Nova 40W Rally 40WSP, Sonoma 40 WSP (myclobutanil)	5 oz	30 oz	0	1	Do not plant rotational crops until 30 days after last application
	3	Mettle 125 ME (tetraconazole)	5 fl oz	20 fl oz	0	0.5	Do not apply same product within 14 days. Do not apply more than 4 applications per season.
	3 + 11	Quadris Top (difenoconazole + azoxystrobin)	14 fl oz	56 fl oz	0	0.5	Do not make more than 2 sequential applications before alternating to another fungicide group and no more than 4 appl/ crop per year.
	3 + 11	Quilt Xcel (azoxystrobin + propiconazole)	14 oz	56 oz	0	0.5	Do not make more than 2 consecutive applications and no more than 4 appl/crop
	11	Cabrio EG (pyraclostrobin)	14 fl oz	70 fl oz	0	0.5	Do not make more than 2 sequential applications and no more than 5 appl/ crop year
	11 + 7	Pristine (pyraclostrobin + boscalid)	23 oz	115 oz	0	0.5	Do not make more than 2 consecutive appl. and no more than 5 appl/ crop
Leather rot	11	Abound (azoxystrobin)	15.4 fl oz	1.92 qt	0	4 h	Do not make more than 2 sequential appl. and no more than 4 appl/crop year. See label for instructions on dipping transplants
Phomopsis leaf blight & soft rot	11	Flint (trifloxystrobin)	3.2 oz	19.2 oz	0	0.5	Do not apply more than 2 sequential applications of Flint of other Group 11 fungicides. Do not exceed more than 6 total applications of Group 11 fungicides per season
Phomopsis soft rot	2	(iprodione) Many brands available: Enclosure 4, Iprodione 4L AG, Meteor, Nevada 4F, Rovral 4 Flowable	2 pt	2 pt	N/A	1	Do not make more than 1 application per season. Do not apply after first fruiting flower
Phytophthora diseases	4	MetaStar 2E AG (metalaxyl)	2 qt	6 qt	0	2	See label for use in drip irrigation
	4	Ridomil Gold EC, Ridomil Gold SL Ultra Flourish (mefenoxam)	1 pt/trtd acre	1 ½ qt/trtd acre	0	2	See label for use in drip irrigation
	33	Aliette WDG, Legion 80WDG, Linebacker WDG (fosetyl-Al)	5 lb	30 lb	12 h	0.5	Do not tank mix with copper fungicides, adjuvants or foliar fertilizers

Table 10.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Powdery mildew	M2	(sulfur) Many brands available: Kumulus DF, Micro Sulf, Microfine Sulfur, Microthiol Disperss, Sulfur 90W, Wettable Sulfur, Wetttable Sulfur 92, Yellow Jacket Dusting Sulfur, Yellow Jacket Wetttable Sulfur	SEE INDIVIDUAL LABELS		1	1	Do not use during hot weather
	M2 + 33	Sanction (potassium phosphate + sulfur)	6 pt	24 pt	N/A	1	Do not apply during hot weather. May cause injury during certain climatic conditions
	1	(thiophanate-methyl) Many brands available: Thiophanate-methyl 85 WDG, Topsin 4.5 FL, Topsin 70 WDG, Topsin M 70 WP, Topsin M WSB, Incognito 4.5F	SEE INDIVIDUAL LABELS		1	1	Fungicides from different chemical groups should be used in spray program for disease resistance management
	3	(propiconazole) Many brands available: Amtide Propiconazole EC, Bumper 41.8 EC, Orbit, Propi-Star EC, Shar-Shield PPZ, Tilt	4 fl oz	16 fl oz	0	0.5	Do not make more than 2 consecutive applications
	3	Nova 40W Rally 40WSP, Sonoma 40 WSP (myclobutanil)	5 oz	30 oz	0	1	Do not plant rotational crops until 30 days after last application
	3	Procure 480 SC (triflumizole)	8 oz	32 oz	1	0.5	Do not plant leafy vegetables within 30 days or root vegetables within 60 days or rotational crops not on label for one year after application
	3	Mettle 125 ME (tetraconazole)	5 fl oz	20 fl oz	0	0.5	Do not apply same product within 14 days. Do not apply more than 4 applications per season.
	3 + 11	Quadris Top (difenoconazole + azoxystrobin)	14 fl oz	56 fl oz	0	0.5	Do not make more than 2 sequential applications before alternating to another fungicide group and no more than 4 appl/crop per year.
	3 + 11	Quilt Xcel (azoxystrobin + propiconazole)	14 oz	56 oz	0	0.5	Do not make more than 2 consecutive applications and no more than 4 appl/crop
	7	Fontelis (penthioopyrad)	24 fl oz	72 fl oz	0	0.5	Do not make more than 2 sequential applications before alternating to a fungicide from a different group
	7	Luna Privilege (fluopyram)	6.84 fl oz	13.7 fl oz	0	0.5	Apply through drip irrigation system preventatively. Do not make more than 2 sequential applications before alternating to a fungicide from a different group
	11	Abound (azoxystrobin)	15.4 fl oz	1.92 qt	0	4 h	Do not make more than 2 sequential appl. and no more than 4 appl/crop year. See label for instructions on dipping transplants
	11	Cabrio EG (pyraclostrobin)	14 fl oz	70 fl oz	0	0.5	Do not make more than 2 sequential applications and no more than 5 appl/crop year
	11	Flint (trifloxystrobin)	3.2 oz.	19.2 oz.	0	0.5	Do not apply more than 2 sequential applications of Flint of other Group 11 fungicides. Do not exceed more than 6 total applications of Group 11 fungicides per season
	11	Aftershock Evito (fluoxastrobin)	5.7 fl oz	22.8 fl oz	1	0.5	Do not make more than 2 sequential applications and no more than 4 applications per season, and a minimum interval of 14 days between applications

¹FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

²Information 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.

Chapter 11. Sweet Corn Production

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Botany and Planting

Sweet corn - *Zea mays* var. *rugosa*, Poaceae (Gramineae).

Table 11.1. Planting information for sweet corn.

Planting dates	
North Florida	Feb - Apr
Central Florida	Jan - Apr
South Florida	Oct - Mar
Planting information	
Distance between rows (in)	28 - 36
Distance between plants (in)	6 - 81
Seeding depth (in)	1.0 - 1.5
Seed per acre (lb)	6 - 15
Days to maturity from seed	64 - 90
Plant population (acre)	24,000 - 32,000

Cultivars

Table 11.2. Description of major sweet corn cultivars currently available.

Type	Genes controlling sweetness	Storage life (days)	Relative sugar content
Sugary	Full complement of sugary	1 to 3	Normal
Sugary Enhanced, also "Modified" and "EH"	Full complement of sugary (su) and half or full complement of sugary enhancer (se)	3 to 5	Slight to moderate or even high levels
Supersweet, also "Ultra", "Extra" sweet	No sugary (su); full complement of shrunken-2 (sh2)	5 to 10	High
Synergistic, also "Sweet-Gene Hybrid"	Full complement of sugary (su); and half complement of shrunken-2 (sh2)	3 to 5	Moderate
Improved Supersweet	Half complement of sugary (su); and full complement of shrunken-2 (sh2)	5 to 10	Very high
ADX	No sugary (su) or shrunken-2 (sh2) genes; full complement of ae, du, and wx genes.	5 to 10	Moderate to high

Table 11.3. Supersweet (shrunken-2) sweet corn cultivars arranged by kernel color.

Yellow		White		Bicolor	
ACcentuate	Summer Sweet 6800R	Crookham 433	Summer Sweet 7311	Big Time	Pickett
Beyond Multisweet	Summer Sweet 7900R	Devotion	Summer Sweet 7811	Beyond BC	Summer Sweet 7922
Crookham 382	Summer Sweet 7640R	Munition	Summer Sweet 8101R	Crookham 423	Summer Sweet 8102R
Garrison	Summer Sweet 7640	Summer Sweet 7111	Summer Sweet 844-W	Crookham 426	Summer Sweet 7932
Passion				Legion	Summer Sweet 8102 R Plus
				Obsession	

Pesticides for Weed, Arthropod and Disease Management for Sweet Corn.

Table 11.4. Selected herbicides approved for managing weeds in sweet corn.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREEMERGENCE ***		
Atrazine Mineral 1.0 - 2.0 Muck 2.0 - 3.0	(AAtrex) 4 L Mineral 2 - 4 pt. Muck 4 - 6 pt. (Aatrex Nine-0) 90 WDG Mineral 1.1 - 2.2 lb. Muck 2.2 - 3.3 lb.	Germinating broadleaf and grass weeds. Apply to moist soil. Do not exceed 2.5 lb. a.i./acre per calendar year. Consult labels for plant back restrictions on rotational crops.
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burndown. Use a crop oil or nonionic surfactant at recommended rates. Do not apply more than 2.0 fl. oz./acre per season including preplant burndown and crop application.
Dimethanamid-P 0.56 - 0.84	(Outlook, Slider) 6 EC 12 - 18 fl. oz.	Annual broadleaf and grass weeds. After application incorporate into soil by rainfall, sprinkler irrigation, or mechanical tillage. Consult label for rate based on soil texture.
EPTC 4.0 - 6.0	(Eradicane) 6.7 E 4.75 - 7.33 pt.	Annual broadleaf and grass weeds and nutsedge. Use lower rates on lighter soils (sand). Control of perennial weeds such as bermudagrass or nutsedge is increased thorough incorporation.
Flufenacet 0.49 - 0.68	(Define DF) 60 DF 13 - 18 oz. (Define SC) 4 SC 15 - 19 fl. oz.	Annual broadleaf and grass weeds. Rainfall, irrigation, or light cultivation is required within 7 to 10 days of application. Consult label for rate based on soil texture.
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burndown. Tank mix with a residual herbicide to broaden spectrum of weed control. Consult label for individual product directions.
Mesotrione 0.188 - 0.24	(Callisto) 4 L 6.0 - 7.7 fl. oz.	Annual broadleaf weeds. Tank mix with a preemergence grass herbicide for grass control. Do not exceed 7.7 fl. oz./acre per season.
S-metolachlor 1.0 - 1.6	(Brawl, Dual Magnum) 7.62 EC 1.0 - 1.67 pt. (Cinch, Dual II Magnum) 7.64 EC 1.0 - 1.67 pt.	Annual broadleaf and grass weeds. Use a lower rate on lighter soils. Weed control is increased with 0.5 to 1 in. of rainfall or irrigation. Do not exceed 3.9 pt./acre per crop year depending on soil texture.
Paraquat 0.5 - 1.0	(Gramoxone) 2 SL 2.0 - 4.0 pt. (Firestorm) 3 SL 1.3 - 2.7 pt.	Emerged broadleaf and grass weeds. Apply as a preplant burndown. No more than 3 applications per year. Tank mix with a residual preemergence herbicide to broaden the spectrm of weed control.
Pendimethalin Mineral 0.75 - 1.0 Muck 1.0 - 2.0	(Acumen, Prowl) 3.3 EC Mineral 1.8 - 2.4 pt. Muck 2.4 - 4.8 pt. (Prowl H20) 3.8 Mineral 2.0 - 3.0 pt. Muck 2.0 - 4.0 pt.	Broadleaf and grass weeds. Overhead irrigation or rainfall is required within 7 days of application.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with soil residual compounds.
Pyraflufen 0.001 - 0.003	(ET Herbicide) 0.208 EC 0.5 - 2.0 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burndown treatment.
*** PREEMERGENCE ***		
Simazine 2.0	(Princep, Simazine) 4 L 2.0 qt. (Princep, Simazine) 90 WDG 2.2 lb.	Broadleaf and grass weeds. If a second application is required do no exceed 2.5 lb. a.i./acre per calendar year. Simazine 4 L and Simazine 90 DF can be applied to muck soils at 2.5 lb. a.i./acre. PHI 45 days.
*** POSTEMERGENCE ***		
Atrazine Mineral 1.0 - 2.0 Muck 2.0 - 3.0	(AAtrex) 4 L Mineral 2 - 4 pt. Muck 4 - 6 pt. (Aatrex Nine-0) 90 WDG Mineral 1.1 - 2.2 lb. Muck 2.2 - 3.3 lb.	Broadleaf and some grass weeds. Apply before weeds exceed 1.5 in. tall and before corn exceeds 12 in. in height. Do not exceed 2.5 lb. a.i./acre per calendar year. Consult label for plant back restrictions on rotational crops.
Bentazon 0.75 - 1.0	(Basagran) 4 L 1.5 - 2.0 pt.	Certain broadleaf and sedge weeds. Consult label for weeds controlled/weed size table. Do not apply more than 4 pt./acre per season.

Table 11.4. Continued.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** POSTEMERGENCE ***		
Carfentrazone 0.008 - 0.016	(Aim) 1.9 EW 0.5 - 1.0 fl. oz. (Aim) 2 EC 0.5 - 1.0 fl. oz.	Emerged broadleaf weeds. Apply up to the 14-leaf stage of corn growth. After the V8 stage of growth, apply as a directed application. Do not apply more than 2.0 fl. oz./acre per season including preplant burndown and crop application. PHI 3 days.
Clopyralid 0.15 - 0.23	(Clopyr Ag) 3 EC 0.3 - 0.6 pt.	Emerged broadleaf weeds. Apply after emergence and before corn is 18 in. tall. Consult labels for plant back restrictions on rotational crops. PHI 30 days
Halosulfuron 0.03 - 0.05	(Sandeal) 75 DF 0.6 - 1.0 oz.	Broadleaf and nutsedge weeds. Apply over-the-top or with drop nozzles from the spike to the layby stage of corn. A sequential application of 0.66 oz./acre may be with drop nozzles to avoid application to the plant whorl. No more than 2 applications per year.
Mesotrione 0.094	(Callisto) 4 L 3 fl. oz.	Broadleaf weeds. Treat up to 30 in. tall or up to the 8-leaf stage. Include a crop oil concentrate or nonionic surfactant in the spray solution. Slight leaf bleaching may occur. Do not exceed 7.7 fl. oz./acre per season.
S-metolachlor up to 1.9	(Brawl, Dual Magnum) 7.62 EC up to 2.0 pt. (Cinch, Dual II Magnum) 7.64 EC up to 2.0 pt.	Annual broadleaf and grass weeds. Apply after crop emergence up to 40 in. in height. Direct spray to the base of the plants when plants are taller than 5 in. Use a lower rate on lighter soils. Weed control is increased with 0.5 to 1 in. of rainfall or irrigation. DO not exceed 3.9 pt./acre per crop year depending on soil texture. PHI 30 days.
Nicosulfuron 0.03 - 0.06	(Accent) 75 WDG 0.6 - 1.3 oz. (Accent Q) 54.5 WDG 0.9 - 1.8 oz.	Broadleaf and grass weeds. Sensitivity to sweet corn varieties is variable. Do not apply to 'Merit' sweet corn. Do not apply to corn that has previously been treated with 'Counter', 'Lorsban', or 'Thimet' insecticides for this may result in injury. Consult label for acceptable insecticides. Apply broadcast to corn plants less than 12 in. tall. Apply with drop nozzles to direct spray to corn plants 12 - 18 in. tall.
Pendimethalin Mineral 0.75 - 1.0 Muck 1.0 - 2.0	(Acumen, Prowl) 3.3 EC Mineral 1.8 - 2.4 pt. Muck 2.4 - 4.8 pt. (Prowl H20) 3.8 Mineral 2.0 - 3.0 pt. Muck 2.0 - 4.0 pt.	Broadleaf and grass weeds. Apply after 4 in. tall until corn is 20 to 24 in. tall or the V8 growth stage. Direct the spray to the base of the plants.
Tembotrione 0.08	(Laudis) 3.5 EC 3 fl. oz.	Annual broadleaf and grass weeds. Crop tolerance is dependent on variety so apply to a small area if tolerance is unknown. Do not use on Merit or Shogun varieties. May be applied from corn emergence through the V7 stage of growth. Do not exceed 3 fl. oz./acre per season.
Topramezone 0.02 - 0.022	(Armezon, Impact) 2.8 0.75 - 1.0 fl. oz.	Broadleaf and grass weeds. Consult label for maximum size of certain weed species for control. PHI 45 days.

Table 11.5. Selected insecticides approved for managing insect pests of sweet corn.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Agree WG (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	1.0-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11A	Apply when larvae are small for best control. OMRI-listed ² .
*Ambush 25W (permethrin)	6.4-16.0 oz	12	1	aster leafhopper, corn earworm, corn rootworm (adults), cutworms, fall armyworm, flea beetles, southern armyworm	3A	Do not apply more than 2.0 lb ai/acre per season. Rates above 12.8 oz are for Florida only.
*Asana XL (0.66EC) (esfenvalerate)	5.8-9.6 fl oz	12	1	aphids, armyworms, banded cucumber beetle, beet armyworm (aids in control), chinch bugs, corn borer, corn earworm, corn rootworm, corn silk fly, cutworms, flea beetles, grasshoppers, sap beetle (adults), stalk borers, tarnished plant bug	3A	Do not apply more than 0.5 lb ai/acre per season (10 applications at highest rate).
Avaunt (indoxacarb)	2.5-3.5 oz	12, (14 days for hand harvest-ing)	3, (35 for fod- der & stover)	corn earworm, fall armyworm	22	Whorl application (before silking) only. No more than 4 applications per season.
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	un	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	un	Antifeedant, repellent, insect growth regulator.

Table 11.5. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
*Baythroid XL (beta-cyfluthrin)	0.8-2.8 fl oz	12	0	Foliar: chinch bugs, common stalk borers, corn earworm, corn rootworm adult, corn silk fly, cutworms, fall armyworm (1st and 2nd instars only), grasshoppers, true armyworm Soil (at planting): seedcorn maggot, wireworms	3A	Maximum number of applications: 10. Maximum amount allowed per season: 28 fl oz/acre.
Belt SC (flubendiamide)	2.0-3.0 fl oz	12	1	beet armyworm, black cutworm, common stalk borer, corn earworm, fall armyworm, green cloverworm, yellowstriped armyworm	28	Do not apply more than 12 fl oz/acre per season (or four applications). Use in rotation with products with a different mode of action.
*Besiege (lambda-cyhalothrin, chlorantraniliprole)	6-9 fl oz	24	1	armyworms, aster leafhopper, chinch bug, corn earworm, corn rootworm beetle adults, cutworms, flea beetles, grasshoppers, sap beetles, stink bugs, tarnished plant bug, webworms, suppression of aphids, spider mites, corn silkfly	3A, 28	Do not exceed 31 fl oz of Besiege per acre per year.
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11A	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.
*Brigade 2EC (bifenthrin)	2.1-6.4 fl oz	12	1	aphids, beet armyworm, chinch bug, common stalk borer, corn earworm, corn rootworm adults, cucumber beetle adults, cutworms, fall armyworm, flea beetles, grasshoppers, sap beetles, southern armyworm, stink bugs, tarnish plant bugs, true armyworm, webworms, yellowstriped armyworm, spider mites	3A	Use of Brigade is prohibited in coastal counties. Do not apply more than 12.8 fl oz per acre per season. See label for soil application at planting. Many other brands available with same active ingredient.
*Capture LFR (bifenthrin)	at planting: 3.4-8.5 oz, post-plant, incorporated: 4-5.3 fl oz, pre-emergence: 3.4 fl oz	12	see label	corn rootworm larvae, wireworm, grubs, seedcorn maggot, root aphids, cutworms, true armyworm, stalkborer	3A	See label for application methods and restrictions. For mixing with liquid fertilizer. Do not apply more than 0.2 lb active ingredient per acre per season of all bifenthrin products.
*Cobalt (chlorpyrifos, gamma-cyhalothrin)	13-42 fl oz	24	21	aphids, armyworms, beetles, billbugs, chinch bugs, grasshoppers, green cloverworm, lesser cornstalk borer, stalk borer, stink bugs	1B, 3A	See label for application methods and restrictions.
Coragen (rynaxypyr)	3.5-5.0 fl oz	4	1	beet armyworm, corn earworm, fall armyworm	28	Foliar only. No more than 4 applications per crop. Do not apply more than 15.4 fl oz per acre per crop.
*Counter 15G Lock 'n Load (terbufos)	6.0-8.0 oz per 1000 ft of row, banded or in furrow post emergence incorporated, 8 oz per 1000 ft of row at cultivation	48	60	billbugs, chinch bugs ⁽¹⁾ , corn rootworm, cutworms (suppression), flea beetles, lesser corn stalk borer (suppression), maize billbug, seedcorn beetle, seedcorn maggot, symphylans, thrips, white grubs, wireworms	1B	⁽¹⁾ Early season control of light to moderate infestations. Only one application (at-planting, post-emergence incorporated, or cultivation time treatment) per season. Do not exceed 8.7 lb/acre. 20G formulation also available.
Crymax WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Use high rate for armyworms. Treat when larvae are young. Not for organic production.
Deliver (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11A	Use higher rates for armyworms. OMRI-listed ² .
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. Good coverage is essential. For organic production.
Entrust SC (spinosad)	1.5-6.0 fl oz	4	1 day - ears 7 day - forage	armyworms, beet armyworm, corn earworm	5	Do not apply more than 29 oz per acre per year or six applications. OMRI-listed ² .
Extinguish ((S)-methoprene)	1-1.5 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 11.5. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
*Force 3G Insecticide (tefluthrin)	depends on row spacing	0	at planting or cultivation within 30 days of seeding emergence	billbugs ⁽¹⁾ , chinch bugs ⁽¹⁾ , corn rootworm, cutworms, lesser cornstalk borer, red imported fire ant ⁽²⁾ , seedcorn beetle, seedcorn maggot, white grubs, wireworms	3A	Only one application per crop. Granules must be incorporated. ⁽¹⁾ suppression only ⁽²⁾ suppression for 28 days
Grandevo <i>Chromobacterium subtsug-ae</i> strain PRAA4-1	1-3 lb	4	0	armyworms, chinch bugs, common stalk borer, corn earworm, corn leaf aphid, corn rootworm beetles, lesser cornstalk borer, mites, thrips, webworms	—	OMRI-listed ² .
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.50 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms)	11A	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
*Lannate LV, *Lannate SP (methomyl)	0.75-1.5 pt 0.25-0.50 lb	48	0 - ears 3 - forage 21 - stover	aphids, armyworm, beet armyworm, corn earworm, corn rootworm adults, fall armyworm, flea beetles, picnic beetles, variegated cutworm	1A	Certain hybrid varieties are susceptible to methomyl injury. Treat a small area to determine safety first.
*Larvin 3.2 (thiodicarb)	20-30 fl oz	48	0	armyworms, corn earworm	1A	Do not allow livestock to graze treated field. Do not feed treated corn silage or fodder to livestock. See label for special instructions for cutworms.
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)	11A	Treat when larvae are small. Thorough coverage is essential.
Lorsban 75WG *Lorsban Advanced (chlorpyrifos)	0.33-1.33 lb 0.5-2.0 pt	24	21 (grain or ears)	aphids, beet armyworm, chinch bugs, corn earworm, corn rootworm adult, cutworms, fall armyworm, grasshoppers	1B	Do not feed treated corn silage, forage, or fodder, or allow livestock to graze. Do not make more than 3 applications of any product containing chlorpyrifos per season. See label for application methods and pest-specific instructions.
Lorsban 15G (chlorpyrifos)	8 oz per 1000 ft of row	24	at planting	billbugs, corn rootworm larvae, cutworms, lesser corn stalk borer, seed corn maggot, symphylans, wireworms	1B	See label.
*Mocap 15G (ethoprop)	See label.	48	at planting	corn rootworms, cutworms, symphylans, wireworms, (suppression of white grubs)	1B	One application per growing season.
*Mustang (zeta-cypermethrin)	2.4-4.3 oz	12	3	aphids, armyworms, chinch bug, corn borers, corn earworm, corn silk fly, cutworms, flea beetles, grasshoppers, leafhoppers, sap beetle adults	3A	Maximum of 0.3 lb ai/acre per season.
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, corn earworm	un	OMRI-listed ² .
Oberon 2 SC (spiromesifen)	5.7-16 fl oz	12	5 for fresh, green forage or silage, grain or stover, 30	twospotted spider mite	23	No more than two applications or a total of 17 fl oz per acre per season.
Oil, insecticidal	1-2 gal/100 gal, depending on brand	4	0	aphids, armyworms, corn earworms, corn rootworms, mites, thrips	--	
*PennCap-M (methyl parathion)	1-3 pt	9 days if for corn silk fly, 31 days for all others	12	aphids, corn earworm, corn rootworm adult, cutworms, flea beetles, grasshoppers, sap beetles, silk fly, stink bugs, true armyworm	1B	See restrictions on label. Mechanical harvesting must be used. Do not apply during pollen shed if bees are foraging.
*Pounce 1.5 G (permethrin)	8 oz/1000 ft	12	at planting	armyworms, cutworms	3A	
*Pounce 1.5 G (permethrin)	6.7-13.3 lb	12	pre-emergence	armyworms, cutworms, stalk borers	3A	
*Pounce 1.5 G *Pounce 25 WP (permethrin)	6.7-13.3 lb 6.4-16.0 oz	12	1	armyworms, corn borers, cutworms, stalk borers	3A	Do not apply more than 2.0 lb ai/acre per season.
*Proaxis Insecticide (gamma-cyhalothrin)	2.56-3.84 fl oz	24	1 - ears 21 - forage or fodder	beet armyworm, chinch bug, corn earworm, cutworms, fall armyworm ⁽¹⁾ , flea beetles, grasshoppers, sap beetles, southern armyworm, sting bugs, yellowstriped armyworm	3A	⁽¹⁾ 1 st or 2 nd instars See label for soil application rates.
PyGanic Crop Protection EC 5.0 (pyrethrins)	4.5-18 fl oz	12	0	Aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, whiteflies, others	3A	Thorough coverage is essential. Breaks down rapidly in sunlight. OMRI-listed ² .
Radiant SC (spinetoram)	3-6 fl oz	4	1 - ear harvest 3 - forage or fodder	armyworms, corn earworm	5	No more than 6 applications per year.

Table 11.5. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Rimon 0.83EC (novaluron)	9-12 fl oz	12	1	Armyworms, corn earworm, other foliage-feeding caterpillars, grasshopper nymphs	15	Do not use surfactants or other adjuvants. Do not apply more than 60 fl oz per acre per season.
Sevin 80S; 4F; XLR (carbaryl)	80S: 1.25-2.5 lb 4F; XLR: 1-2 qt	12	2 – ears 14 – forage 48 – fodder	armyworms, chinch bugs, corn earworms, corn rootworm adult, cutworms, fall armyworm, flea beetles, leafhoppers, sap beetles	1A	Highly toxic to bees.
*Thimet 20-G (phorate)	See label. 4.5-6.0 oz per 1000 ft of row	48	at planting, see label	corn rootworms, flea beetles, mites, seed-corn beetle, seed corn maggot, white grubs, wireworms	1B	One application per season, no more than 6.5 lb/acre per season.
*Thionex 3EC (endosulfan)	1.33-2.0 qt	17 days	1	corn earworm, corn leaf aphid, whiteflies	2	Fresh vegetable use, only. Do not apply to sweet corn to be processed or used to feed livestock. Do not make more than 1 application per season. Only mechanical harvesting is permitted. Cannot be used after Dec. 31, 2014.
Trilogy (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .
*Warrior II (lambda-cyhalothrin)	0.33 fl oz per 1000 ft of row (at plant) 1.28-1.92 fl oz (foliar)	24	1 (21 for feeding livestock)	aphids ⁽¹⁾ , aster leafhopper, beet armyworm, chinch bugs, corn earworm, corn rootworm, cutworms, fall armyworm, flea beetles, grasshoppers, mites ⁽¹⁾ (see label for more details), southern armyworm, stink bugs, tarnished plant bug, yellowstriped armyworm	3A	⁽¹⁾ suppression only. Many other brands with same active ingredient are available.
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

*** Restricted use insecticide.**

Table 11.6. Sweet corn fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Bacterial stalk rot	M1	(copper compounds) Many brands available: Badge X2, Copper Count N, Cueva, Kocide 2000, Kocide 3000, Mastercop, Nu-Cop DF, Top Cop w/ Sulfur	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days	
Powdery mildew Rust	M2	(sulfur) Many brands available: Kumulus DF, Microfine Sulfur, Sulfur 90W, Top Cop w/ Sulfur, Yellow Jacket Wettable Sulfur	SEE INDIVIDUAL LABELS		1	1	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
Northern blight Southern blight Common rust	M3	(mancozeb) Many brands available: Dithane DF Rainshield, Dithane F-45 Rainshield, Dithane M45, Koverall, Manzate DF, Manzate Flowable, Manzate Pro-Stick, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	1.5 lb	24 lb	7	1	Start applications at the first sign of disease.
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Chloronil 720, Chlorothalonil 720 SC, Echo 720, Echo 90DF, Echo ZN, Equus 500 ZN, Equus 720, Equus DF, Initiate 720, Initiate ZN	SEE INDIVIDUAL LABELS		7	0.5	

Table 11.6. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Northern blight	3	(propiconazole)	4 fl oz	16 fl oz	14	0.5	Do not exceed 4 total appls.
Southern blight							
Common rust							
Continued							
	3	(tebuconazole) Many brands available: Amcide propiconazole 41.8, Bumper 41.8EC, Fitness, Propiconazole E-AG 41.8EC, Propimax EC, Propi-Star EC, Shar-Shield PPZ, Tilt 3.6EC, Topaz	6 fl oz	24 fl oz	7	0.5	Restricted-entry time is 19 days.
	3	Prosaro (tebuconazole + prothioconazole)	8.2 fl oz	26 fl oz	7	0.5	See label for adjuvant information and rotational restrictions
	7	Vertisan (penthioopyrad)	24 fl oz	48 fl oz	0	0.5	Soil and foliar treatments.
	11	Aftershock (fluoxastrobin)	0.24 fl oz per 1000' of row in soil, 3.8 fl oz foliarly	22.8 fl oz in-furrow or 7.6 fl oz foliarly		0.5	Soil and foliar treatments.
	11	Evito 480SC (fluoxastrobin)	3.8 fl oz	15.2 fl oz	7	0.5	Do not exceed 2 sequential and 4 total appls.
	11	Headline EC (pyraclostrobin)	12 fl oz	72 fl oz	0	0.5	Do not exceed 2 sequential and 6 total appls. of Headline or other Qol fungicides.
	11	Headline SC (pyraclostrobin)	12 fl oz	72 fl oz	0	0.5	Do not exceed 2 sequential and 6 total appls. of Headline or other Qol fungicides.
	11	Quadris (azoxystrobin)	15.4 fl oz or 0.8 fl oz / 1000 row ft	2.88 qt	0	4 h	Do not exceed 1 sequential and 4 total appl. of Quadris or other Qol fungicides. See label for soil applications.
	11 & 3	Evito T (fluoxastrobin + tebuconazole)	9 fl oz	36 fl oz	7	19	Do not exceed 2 sequential and 4 total appls.
	11 & 3	Headline AMP (pyraclostrobin + metconazole)	14.4 fl oz	57.6 fl oz		0.5	Do not exceed 2 sequential and 4 total appls. of Headline AMP.
	11 & 3	Quilt (azoxystrobin + propiconazole)	14 fl oz	56 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11 & 3	Quilt XCEL (azoxystrobin + propiconazole)	14 fl oz	56 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11 & 3	Avaris (azoxystrobin + propiconazole)	14 fl oz	28 fl oz	14	0.5	See label for details.
	11 & 3	Stratego 250EC (trifloxystrobin + propiconazole)	12 fl oz	24 fl oz	14	0.5	Do not apply more than 2 sequential applications.
	11 & 3	Stratego YLD (trifloxystrobin + propiconazole)	5 fl oz	20 fl oz	14	0.5	Do not apply more than 2 sequential applications.
	11 & 7	Priaxor SC (pyraclostrobin + fluxapyroxad)	8 fl oz	16 fl oz	7	0.5	See label for details.
Gray leaf spot	3	(tebuconazole) Many brands available: Folicur 3.6F, Monsoon 3.6F, Orius 3.6F, Tebustar 3.6L, Tebuzol 3.6F, Toledo 3.6F	6 fl oz	24 fl oz	7	0.5	Restricted-entry time is 19 days.
Gray leaf spot	3	(propiconazole)	4 fl oz	16 fl oz	14	0.5	Do not exceed 4 total appls.
Eye spot							
	7	Vertisan (penthioopyrad)	24 fl oz	48 fl oz	0	0.5	Soil and foliar treatments. See label for details.
	11	Aftershock (fluoxastrobin)	0.24 fl oz per 1000' of row in soil, 3.8 fl oz foliarly	22.8 fl oz in-furrow or 7.6 fl oz foliarly		0.5	Soil and foliar treatments. See label for details.
	11	Evito 480SC (fluoxastrobin)	3.8 fl oz	15.2 fl oz	7	0.5	Do not exceed 2 sequential and 4 total appls.
	11	Headline EC (pyraclostrobin)	12 fl oz	72 fl oz	0	0.5	Do not exceed 2 sequential and 6 total appls. of Headline or other Qol fungicides.

Table 11.5. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Gray leaf spot Eye spot Continued	11	Headline SC (pyraclostrobin)	12 fl oz	72 fl oz	0	0.5	Do not exceed 2 sequential and 6 total ap- pls. of Headline or other Qol fungicides.
	11	Quadris (azoxystrobin)	15.4 fl oz or 0.8 fl oz / 1000 row ft	2.88 qt	0	4 h	Do not exceed 1 sequential and 4 total appl. of Quadris or other Qol fungicides. See label for soil applications.
	11 & 3	Evito T (fluoxastrobin + tebuconazole)	9 fl oz	36 fl oz	7	19	Do not exceed 2 sequential and 4 total appls.
	11 & 3	Headline AMP (pyraclostrobin + metconazole)	14.4 fl oz	57.6 fl oz		0.5	Do not exceed 2 sequential and 4 total appls. of Headline AMP.
	11 & 3	Quilt (azoxystrobin + propiconazole)	14 fl oz	56 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11 & 3	Quilt XCEL (azoxystrobin + propiconazole)	14 fl oz	56 fl oz	14	0.5	Alternate every other application with a fungicide of dissimilar mode of action.
	11 & 3	Avaris (azoxystrobin + propiconazole)	14 fl oz	28 fl oz	14	0.5	See label for details.
	11 & 3	Stratego 250EC (trifloxystrobin + propiconazole)	12 fl oz	24 fl oz	14	0.5	Do not apply more than 2 sequential applications.
	11 & 3	Stratego YLD (trifloxystrobin + propiconazole)	5 fl oz	20 fl oz	14	0.5	Do not apply more than 2 sequential applications.
	11 & 7	Priaxor SC (pyraclostrobin + fluxapyroxad)	8 fl oz	16 fl oz	7	0.5	See label for details.
Damping-off	M3	Defiant 75WP (thiram)	5.3 oz / 100 lbs of seed			1	Seed treatment only.
Damping-off Seedling blight	3	Vortex (ipconazole)	0.085 fl oz/ 100 lb of seed			0.5	Seed treatment only.
	4 & 3	Dividend Extreme (mefenoxam + difenoconazole)	5 fl oz/ 100 lbs of seed			2	Seed treatment only.
	11	Dynasty (azoxystrobin)	0.153 fl oz/ 100 lbs of seed			4 h	Seed treatment only.
	11	Trilex (trifloxystrobin)	0.96 fl oz/ 100 lb of seed			0.5	Seed treatment only.
Pythium seedling blight Systemic downy mildew	4	Allegiance FL (metalaxyl)	3 fl oz/ 100 lb seed			1	Seed treatment only.
	4	Sebring 2.65ST (metalaxyl)	3 fl oz/ 100 lb of seed			1	Seed treatment only.
	4	Apron XL LS (mefenoxam)	2.2 fl. oz./ 100 lb seed			2	Seed treatment only.
Soil-borne diseases	11	Aftershock (fluoxastrobin)	0.24 fl oz per 1000' of row in soil, 3.8 fl oz foliarly	22.8 fl oz in-furrow or 7.6 fl oz foliarly		0.5	Soil and foliar treatments. See label for details.
Various seedling diseases	4, 14, & NC	System 3 (mefenoxam + PCNB + Bacillus subtilis GB03)	3 oz/bu of seed			1	Seed treatment only.
	11	Stamina (pyraclostrobin)	1.6 fl oz/ 100 lbs seed				Seed treatment only.
	12	Maxim 4FS (fludioxonil)	0.16 fl oz/ 100 lbs seed			0.5	Seed treatment only.

¹ FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <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.

Chapter 12. Tomato Production

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Botany and Planting

Tomato - *Solanum lycopersicum*, Solanaceae

Table 12.1. Planting information for tomato.

Planting dates	
North Florida	July-Aug 15; Feb-Apr 15
West-central Florida	Aug-Sept; Jan-Feb
South Florida	Aug-Feb
Planting information	
Distance between rows (in)	48-72
Distance between plants (in)	12-32
Seed per acre (lb)	0.5-0.75
Days to maturity	70-90
Plant population per acre	3630-4356

Cultivars

1. LARGE FRUITED AND BEEFSTEAK TYPES

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

Bella Rosa. Midseason maturity. Fruit are large to extra-large, deep globe shaped with firm, uniform green fruits well suited for mature green or vine-ripe production. Determinate, medium to tall vine. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1 and 2), gray leaf spot, and Tomato spotted wilt.

BHN 602. Early-midseason maturity. Fruit are globe shaped but larger than BHN 640, and green shouldered. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1, 2, and 3) and Tomato spotted wilt.

BHN 730. Intended for mature green production. Smooth fruit and a strong bush that produces well even on poor soils. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1, 2), Fusarium Crown Rot, bacterial Speck

BHN 871. Midseason maturity. Firm gold to tangerine colored globe shaped fruit with much improved taste and texture. Strong medium tall bush. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1, 2, and 3). Tolerant: Fusarium crown rot.

BHN 1064. Mainseason maturity. Strong vines with firm large to extra-large fruit that size well from bottom to top. In north Florida does well in both spring and fall seasons. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1, 2 and 3) and Tomato spotted wilt.

Biltmore. Strong determinate bush with midseason maturity. High yield potential of uniform, round, firm fruit with a small blossom end scar. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1 and 2), Alternaria stem canker and gray leaf spot.

Charger. Vigorous plant with good vine cover. Large, smooth, deep oblate fruit with excellent firmness and color. Resistance: Fusarium wilt (races 1, 2, and 3), Tomato yellow leaf curl, Verticillium wilt (race 1) and Alternaria stem canker.

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

Crown Jewel. Late midseason determinate. Uniform fruit have a deep oblate shape with good firmness, quality and uniformly-colored shoulders. Determinate with medium-tall bush. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1 and 2) Fusarium crown rot, Alternaria stem canker and gray leaf spot. Tolerant to gray wall.

EX 01420200. Main season fresh market tomato intended for spring planting in south and central Florida where TYLC is a threat to growers. Bears smooth deep oblate shaped, uniform fruit on a vigorous, determinate plant with a high yield potential of high-quality fruit. Resistance: alternaria stem canker, Verticillium race 1, Fusarium races 1 and 2, Stemphylium, Tomato spotted wilt, Tomato yellow leaf curl (TYLC). and Tomato mosaic.

Finishline. Main season fall variety. Tall determinate with good cover. Good fruit quality for vine ripe or mature green production. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1, 2, and 3), Tomato spotted wilt and gray leaf spot.

Fletcher. Midseason maturity. Large, globe to deep oblate shaped fruit with compact plants. Does best with moderate pruning and high fertility. Good flavor, color and shelf-life. For vine ripe use only due to nipple characteristic on green fruit. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1 and 2), Tomato spotted wilt and root-knot nematode.

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

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

HM 8849 CR. Early maturing variety with a strong plant and good leaf cover. Fruit extra-large, smooth and slightly flattened globe shape. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1 and 2), Fusarium crown and root rot 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. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1 and 2), Alternaria stem canker and gray leaf spot.

Quincy. Full season. Large to extra-large, excellent quality, firm, deep oblate shaped fruit and uniformly colored. Very strong determinate plant. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1 and 2), Alternaria stem canker, Tomato spotted wilt and gray leaf spot.

Red Defender. Medium maturity. Vigorous vine with smooth, large deep red fruit with excellent firmness and shelf life. Resistance: Alternaria stem canker, Fusarium wilt (races 1 and 2), gray leaf spot, Tomato spotted wilt and Verticillium wilt (race 1).

Redline. Main season spring variety. Tall determinate with good cover. Good fruit quality for vine ripe or mature green production. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1, 2, and 3), Tomato spotted wilt and gray leaf spot.

Rocky Top. Mid-season. Mostly extra-large and large firm fruit. Great eating quality and is well adapted for vine ripe production as well as high tunnel production. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1, 2, and 3), gray leaf spot.

RFT 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. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1 and 2) and gray leaf spot.

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

Sebring. A main season, determinate, jointed hybrid with smooth, deep oblate shaped, firm, thick walled fruit. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1, 2, and 3) Fusarium crown rot, gray leaf spot.

Security 28. An early season determinate variety with a medium vine and good leaf cover adapted to different growing conditions. Produces extra-large, firm, round fruit. Resistance: Alternaria stem canker, Fusarium wilt (races 1 and 2), gray leaf spot, Tomato yellow leaf curl and Verticillium wilt (race 1).

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

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

Talladega. 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. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1 and 2), Tomato spotted wilt and gray leaf spot.

Tasti-Lee. Targeted at the premium tomato market. A midseason, determinate, jointed hybrid with moderate heat-tolerance. Fruit are uniform green with a high lycopene content and deep red interior color due to the crimson gene. Resistance: Fusarium wilt (races 1, 2, and 3), Verticillium wilt (race 1), and gray leaf spot.

Tribeca. Early midseason. Strong vines with firm large to extra-large fruit. In north Florida does well in both spring and fall seasons. Resistance: Verticillium wilt (race 1), Fusarium wilt (race 1 and 2) Tomato spotted wilt and gray leaf spot.

Tribute. Main season fall variety. Vigorous plant with good cover. Medium large to large, smooth, globed shaped fruit with excellent firmness and color. Resistance: Alternaria stem canker, Fusarium wilt (races 1 and 2), Verticillium wilt (race 1), gray leaf spot, Tomato spotted wilt and Tomato yellow leaf curl.

Tygress. A main season, jointed hybrid producing large, smooth, firm fruit with good pack-outs. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1 and 2), gray leaf spot, Tomato mosaic, Tomato yellow leaf curl, and Alternaria stem canker.

2. PLUM TYPE VARIETIES

BHN 685. Midseason. Large to extra-large, deep blocky fruit. Determinate, vigorous bush with no pruning recommended. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1, 2, and 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. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1 and 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. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1 and 2), bacterial speck (race 0), gray leaf spot, and Alternaria stem canker.

Monticello. Uniform fruit size and a unique blocky shape with an improved disease resistance package. Large firm fruit with good interior quality and small blossom end scar. Resistance to Fusarium wilt (races 1-2, bacterial speck, gray leaf spot, tomato spotted wilt virus, verticillium and root knot nematode

Picus. Main season, widely adapted determinate Roma tomato. Fruits are large, uniform and blocky, maturing to a deep-red color with great firmness at the red stage. Medium to large, vigorous plant that provides good fruit cover and sets well in hot temperatures. Resistance: Alternaria stem canker, Fusarium wilt (races 1 and 2), Tomato spotted wilt, Verticillium wilt (race 1), Alternaria stem canker and Cladosporium leaf mold.

Regidor. Determinate Roma type for open field production. Medium tall plant with short internodes. 6-8 sets with great fruit quality. Resistance: Fusarium wilt (races 1 and 2), Tomato yellow leaf curl and Verticillium wilt (race 1).

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

Tachi. Mid-season variety with classic saladette shape. Determinate mid compact plant. Uniform predominately extra-large fruit. Wide adaptability and suited for concentrated harvests for vine ripe and mature green markets. Resistance: Fusarium wilt (races 1 and 2), Verticillium wilt (race 1), tomato spotted wilt, root-knot nematodes and Alternaria stem canker.

3. CHERRY TYPE VARIETIES

BHN 268. Early to mid-season, determinate, medium to tall bush with high yields. An extra firm cherry tomato that holds, packs and ships well. Resistance: 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. Resistance: Verticillium wilt (race 1), Fusarium wilt (race 1) and tobacco mosaic.

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

4. GRAPE TOMATOES

BHN 785. Midseason determinate grape hybrid with a strong set of very uniform size and shape fruit on a vigorous bush with good cover. Resistance: Fusarium wilt (race 1).

Brixmore. Very early. indeterminate bush. Very uniform in shape and size, deep glossy red color with very high early and total yield. High brix and excellent firm flavor. Resistance: Verticillium wilt (race 1), rootknot nematodes and Tomato mosaic.

Cupid. Early. Vigorous, indeterminate bush. Oval shaped fruit have an excellent red color and a sweet flavor. Resistance: Fusarium wilt (races 1 and 2), bacterial speck (intermediate resistance race 0), Alternaria stem canker, and gray leaf spot.

Jolly Elf. Early season. Determinate plant. Extended market life with firm, flavorful grape shaped fruits. Average 10% brix. Resistance: 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. Resistance: Verticillium wilt (race 1), Fusarium wilt (races 1, 2, and 3), 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.

Sweethearts. Early to mid-season, indeterminate bush with intermediate internodes. Brilliant red, firm, elongated grape-shaped fruit. Matures between 70 and 75 days. Good flavor, crack-resistant and high brix. Resistance: Tobacco mosaic, Cladosporium leaf mold and Fusarium wilt (race 1).

Tami G. Early season. Indeterminate, medium tall bush. Small fruits with nice shape.

Pesticides for Weed, Arthropod and Disease Management for Tomato.

Table 12.2. Selected herbicides approved for managing weeds in tomato.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREPLANT / PREEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burndown for emerged broadleaf weeds. Use a COC or NIS at recommended rates. May be tank mixed with other herbicides.
EPTC 2.6	(Eptam) 7 E 3 pt.	Annual broadleaf, annual grass, and yellow/purple nutsedge. Labeled for transplanted tomatoes grown on low density mulch. Do not use under high density, VIF, or metalized mulches. Do not transplant until 14 days after application. A 24(c) special local needs label in Florida.
Flumioxazin up to 0.128	(Chateau) 51 WDG up to 4 oz.	Annual broadleaf and grass weeds. Apply to row middles of raised plastic mulched beds that are at least 4 in. higher than the treated row middle and 24 in. bed width. Label is a Third-Party registration (TPR, Inc.). Use without a signed authorization and waiver of liability is a misuse of the product. Tank mix with a burndown herbicide to control emerged weeds.
Fomesafen 0.25 - 0.38	(Reflex) 2 EC 1.0 - 1.5 pt.	Broadleaf and grass control and nutsedge. Label is a 24(C) local indemnified label and a waiver of liability must be signed for use. Transplanted crop only. May be applied to bareground production 7 days before transplanting or to a formed bed but before laying plastic. If applying to row middles only prevent the spray from contacting the herbicide.
Glyphosate	(various formulations) consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burndown. Consult label for individual product directions.
Halosulfuron 0.024 - 0.05	(Sandea, Profine) 75 DF 0.5 - 1.0 oz.	Broadleaf control and yellow/purple nutsedge suppression. Total of 2 applications of halosulfuron per season.
Lactofen 0.25 - 0.5	(Cobra) 2 EC 16 - 32 fl. oz.	Broadleaf weeds. Label is a Third-Party registration (TPR, Inc.). Use without a signed authorization and waiver of liability is a misuse of the product. Apply to row middles only with shielded or hooded sprayers. Cobra contacting green foliage or fruit can cause excessive injury. Drift of Cobra treated soil particles onto plant can cause contact injury. Limit of 1 PRE and 1 POST application per growing season. PHI 30 days.
S-metolachlor 1.0 - 1.3	(Brawl, Dual Magnum, Medal) 7.62 EC 1.0 - 1.33 pt.	Annual broadleaf and grass weeds and yellow nutsedge. Apply to row middles. Label rates are 1.0-1.33 pt./acre 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. Use on a trial basis.
Napropamide 1.0 - 2.0	(Devrinol DF XT) 50 DF 2.0 - 4.0 lb.	Annual broadleaf and grass weeds. For direct-seed or transplanted tomatoes. Apply to well worked soil that is dry enough to permit thorough incorporation to a depth of 1 to 2 in. Incorporate same day as applied.
Oxyfluorfen 0.25 - 0.5	(Goal 2 XL) 2 EC 1.0 - 2.0 pt. (GoalTender) 4 E 0.5 - 1.0 pt.	Must have a 30-day treatment-planting interval for transplanted tomatoes. Apply as a preemergence broadcast to preformed beds or banded treatment. Mulch may be applied any time during the 30-day interval.
Paraquat 0.5 - 1.0	(Gramoxone) 2 SL 2.0 - 4.0 pt. (Firestorm) 3 SL 1.3 - 2.7 pt.	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment. Use a nonionic surfactant.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Apply as a preplant burndown treatment. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with soil residual compounds.

Table 12.2. Continued.

Active ingredient lb. a.i./acre	Trade name product/acre	Weeds controlled / remarks
*** PREPLANT / PREEMERGENCE ***		
Pendimethalin 0.48 - 0.72	(Prowl H ₂ O) 3.8 1.0 - 1.5 pt.	May be applied pretransplant. May be applied at 1.0-1.5 pt./acre to row middles. Do not exceed 3.0 pt./acre per year. PHI 70 days.
Pyraflufen 0.001 - 0.003	(ET Herbicide) 0.208 EC 0.5 - 2.0 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burndown treatment.
Rimsulfuron 0.03 - 0.06	(Martix FNV, Matrix SG, Pruvlin) 25 WDG 2.0 - 4.0 oz.	Annual broadleaf weeds. Read labels for specific grass species controlled. Requires 0.5-1 in. of rainfall or irrigation within 5 days of application for activation. May be applied as a sequential treatment with a PRE and POST application not exceeding 0.06 lb. a.i./acre in a single season.
Tifluralin 0.5	(Treflan, Trifluralin) 4 EC 1 pt. (Treflan, Trifluralin) 10 G 5 lb.	Annual broadleaf and grass weeds. Do not apply in Dade County. Incorporate 4 in. or less within 8 h. of application. Results in Florida are erratic on soils with low organic matter and clay contents. Note label precautions against planting noncrop within 5 months. Do not apply after transplanting.
*** POSTTRANSPLANT ***		
Carfentrazone up to 0.031	(Aim) 1.9 EW up to 2 fl. oz. (Aim) 2.0 EC up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a hooded application to row middles only. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides. PHI 0 days.
Clethodim 0.09 - 0.25	(Arrow, Select) 2 EC 6 - 16 fl. oz. (Select Max) 1 EC	Perennial and annual grass weeds. Use higher rates under heavy grass pressure or larger grass weeds. Consult label for required surfactant. PHI 20 days.
0.07 - 0.25	9 - 32 fl. oz.	
DCPA 6.0 - 7.5	(Dacthal) W-75 8 - 10 lb. (Dacthal) 6 F 8 - 10 pt.	Apply to weed-free soil 6-8 wk. after crop is established and growing rapidly or to moist soil in row middles after crop establishment. Note label precautions against replanting non-registered within 8 months.
Diquat 0.5	(Reglone Dessiccant) 1 qt.	Broadleaf and grass weeds. Apply to row middles only. Maximum of 2 applications per season. Include a NIS. Prevent drift to crop. PHI 30 days.
Halosulfuron 0.024 - 0.05	(Sandea, Profine) 75 DF 0.5 - 1.0 oz.	Small seeded broadleaf and nutsedge. One over-the-top application 14 days after transplanting at 0.5-0.75 oz. product and/or POST application(s) of up to 1 oz. product to row middles. Include a nonionic surfactant. PHI 30 days.
Lactofen 0.25 - 0.5	(Cobra) 2 EC 16 - 32 fl. oz.	Broadleaf weeds. Apply to row middles only with shielded or hooded sprayers. Cobra contacting green foliage or fruit can cause excessive injury. Drift of Cobra treated soil particles onto plants can cause contact injury. Limit of 1 PRE and 1 POST application per growing season. PHI 30 days.
S-metolachlor 1.0 - 1.3	(Brawl, Dual Magnum, Medal) 7.62 EC 1.0 - 1.33 pt.	Annual broadleaf and grass weeds and yellow nutsedge. Apply to row middles. Label rates are 1.0-1.33 pt./acre 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. Use on a trial basis. PHI 60 days for rates 1.67 pt. or less/acre. PHI 90 days for rates 1.68-2.0
Metribuzin 0.25 - 0.5	(Sencor DF, TriCor DF) 75 WDG 0.33 - 0.67 lb. (Sencor 4, Metri) 4 F 0.5 - 1.0 pt.	Controls small emerged weeds. Apply after transplants are established or direct-seeded plants reach 5-6 true leaf stage. Apply in single or multiple applications with a minimum of 14 days between treatments. Maximum of 1.0 lb. a.i./acre within a season. Avoid application for 3 days following cool, wet, or cloudy weather to reduce possible crop injury. PHI 7 days.
Paraquat 0.5	(Gramoxone) 2 SL 2 pt. (Firestorm) 3 SL 1.3 pt.	Emerged broadleaf and grass weeds. Direct spray over emerged weeds 1-6 in. tall in row middles between mulched beds. Use a nonionic surfactant. Use low pressure and shields to control drift. Do not apply more than 3 times per season. PHI 30 days.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	Emerged broadleaf and grass weeds. Direct spray to row middles. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with several soil residual compounds. Has a greenhouse and growth structure label.
Rimsulfuron 0.02 - 0.03	(Matrix FNV, Matrix SG, Pruvlin) 25 WDG 1.0 - 2.0 oz.	Broadleaf and grass weeds. May be applied as a sequential treatment with a PRE and POST application not exceeding 0.06 lb. a.i./acre in a single season. Requires 0.5-1.0 in. of rainfall or irrigation within 5 days of application for activation. For POST weed control, include a COC or NIS. PHI 45 days.
Sethoxydim 0.19 - 0.28	(Poast) 1.5 EC 1.0 - 1.5 pt.	Controls growing grass weeds. A total of 4.5 pt./acre applied in one season. Include a COC. Unsatisfactory results may occur if applied to grasses under stress. PHI 20 days.
Trifloxysulfuron 0.005 - 0.009	(Envoke) 75 DG 0.1 - 0.2 oz.	Broadleaf and nutsedge control. Direct spray solution to the base of transplanted tomato plants. Apply at least 14 days after transplanting and before fruit set. Include a nonionic surfactant in the spray mix. PHI 45 days.
*** POSTHARVEST ***		
Diquat 0.5	(Reglone Dessiccant) 2.0 pt.	Minimum of 35 gal./acre. Include a NIS. Thorough coverage is required.
Paraquat 0.62 - 0.94	(Gramoxone) 2 SL 2.4 - 3.75 pt. (Firestorm) 3 SL 1.6 - 2.5 pt.	Broadcast spray over the top of the plants after the last harvest. Use a nonionic surfactant. Thorough coverage is required to ensure maximum herbicide burndown. Do not use treated crop for human or animal consumption.

Table 12.3. Selected insecticides approved for managing insect pests of tomato.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Acramite-50WS (bifenazate)	0.75-1.0 lb	12	3	twospotted spider mite	un	One application per season. Field grown only.
Actara (thiamethoxam)	2.0-5.5 oz	12	0	aphids, Colorado potato beetle, flea beetles, leafhoppers, stinkbugs, whitefly	4A	Maximum of 11 oz/acres per season. Do not use following a soil application of a Group 4A insecticide.
Admire Pro (imidacloprid)	7-10.5 fl oz (for rates for other brands, see labels)	12	21	aphids, Colorado potato beetle, flea beetles, leafhoppers, thrips (foliar feeding thrips only), whitefly	4A	Most effective if applied to soil at transplanting. Admire Pro limited to 10.5 fl oz/acre.
Admire Pro (imidacloprid)	0.6 fl oz per 1000 plants	12	0 (soil)	aphids, whitefly	4A	Greenhouse use: 1 application to mature plants, see label for cautions.
Admire Pro (imidacloprid)	0.44 fl oz per 10,000 plants	12	21	aphids, whitefly	4A	Planthouse: 1 application. See label.
Agree WG (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	armyworms, hornworms, loopers, tomato fruitworm	11	Apply when larvae are small for best control. Can be used in greenhouse. OMRI-listed ² .
*Agri-Mek SC (abamectin)	1.75-3.5 fl oz	12	7	broad mite, Colorado potato beetle, <i>Liriomyza</i> leafminers, spider mite, <i>Thrips palmi</i> , tomato pinworm, tomato russet mite	6	Do not make more than 2 sequential applications. Do not apply more than 10.25 fl oz per acre per season.
*Agri-Mek 0.15 EC	8.0-16.0 fl. oz	12	7	broad mite, Colorado potato beetle, <i>Liriomyza</i> leafminers, spider mite, <i>Thrips palmi</i> , tomato pinworm, tomato russet mite		Do not make more than 2 sequential applications per season. 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 cutworm, hornworms, southern armyworm, tomato fruitworm, tomato pinworm	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, whitefly, 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, whitefly	4A	Do not apply to crop that has been already treated with imidacloprid or thiamethoxam at planting. Begin applications for whitefly 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					
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, whitefly	un	Antifeedant, repellent, insect growth regulator. OMRI-listed ² .
Azatin XL (azadirachtin)	5-21 fl oz	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, weevils, whitefly	un	Antifeedant, repellent, insect growth regulator.
*Baythroid XL (beta-cyfluthrin)	1.6-2.8 fl oz	12	0	beet armyworm ⁽¹⁾ , cabbage looper, Colorado potato beetle, dipterous leafminers ⁽²⁾ , flea beetles, hornworms, potato aphid, southern armyworm ⁽¹⁾ , stink bugs, tomato fruitworm, tomato pinworm, variegated cutworm, thrips (except <i>Thrips palmi</i>), whitefly adults ⁽²⁾	3	⁽¹⁾ 1st and 2nd instars only ⁽²⁾ Suppression Do not apply more than 16.8 fl oz per acre per season.
Belay 50 WDG (clothianidin)	1.6-2.1 oz (foliar application)	12	7	aphids, Colorado potato beetle, flea beetles, leafhoppers, leafminers (suppression), Lygus, stink bugs, whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Toxic to bees. Do not release irrigation water from the treated area.
Belay 50 WDG (clothianidin)	4.8-6.4 oz (soil application)	12	Apply at planting	aphids, Colorado potato beetle, flea beetles, leafhoppers, leafminers (suppression), Lygus, foliar feeding thrips, whiteflies (suppression)	4A	Do not apply more than 6.4 oz per acre per season. See label for application instructions. Do not release irrigation water from the treated area.
Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	0	aphids, plant bugs	9C	Do not apply more than 8.4 oz per acre per season. Begin applications before pests reach damaging levels.
Belt SC (flubendiamide)	1.5 fl oz	12	1	Beet armyworm, cabbage looper, cutworm species, fall armyworm, southern armyworm, tomato fruitworm, tomato hornworm, tomato pinworm, yellow striped armyworm	28	Do not apply more than 1.5 oz per acre per 3 day interval. Do not apply more than 4.5 oz per acre per crop season.

Table 12.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11	Treat when larvae are young. Good coverage is essential. Can be used in the greenhouse. OMRI-listed ² .
BotaniGard ES (Beauveria bassiana)	Greenhouse: up to 3 quarts/100 gal. Field: 0.5-1 quart per acre; see label for water volume	4	0	aphids, thrips, whitefly	--	May be used in greenhouses. Contact dealer for recommendations if an adjuvant must be used. Not compatible in tank mix with fungicides.
*Brigade 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, whitefly	3	Make no more than 4 applications per season. Do not make applications less than 10 days apart.
CheckMate TPW-F (pheromone)	1.2-6.0 fl oz	0	0	tomato pinworm	--	For mating disruption - See label for details.
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 64 fl oz per acre per season.
Coragen (rynaxypyr)	3.5-7.5 fl oz	4	1	beet armyworm, Colorado potato beetle, fall armyworm, hornworms, leafminer larvae, loopers, southern armyworm, tomato fruitworm, tomato pinworm	28	Can be applied by drip chemigation or as a soil application at planting. See label for details. Do not apply more than 15.4 fl oz per acre per crop.
Courier 40SC (buprofezin)	9.0-13.6 fl oz	12	1	leafhoppers, mealybugs, planthoppers, whitefly nymphs	16	Apply when a threshold is reached of 5 whitefly 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 5 days between applications.
Crymax WDG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	armyworms, loopers, tomato fruitworm, tomato hornworm, tomato pinworm	11	Use high rate for armyworms. Treat when larvae are young.
*Danitol 2.4 EC (fenpropathrin)	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, tobacco hornworm, tomato pinworm, twospotted spider mite, yellowstriped armyworm	3	Use alone for control of fruitworms, stink bugs, tobacco hornworm, twospotted spider mites, and yellowstriped armyworms. Tank-mix with Monitor 4 for all others, especially 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	armyworms, cutworms, loopers, tomato fruitworm, tomato pinworm	11	Use higher rates for armyworms. OMRI- listed ² .
*Diazinon AG500; *50 W (diazinon)	AG500: 1-4 qt 50W: 2-8 lb	48	preplant	cutworms, mole crickets, wireworms	1B	Incorporate into soil - see label.
Dimethoate 4 EC (dimethoate)	0.5-1.0 pt	48	7	aphids, leafhoppers, leafminers	1B	Will not control organophosphate- resistant leafminers.
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Good coverage is essential. Can be used for organic production.
Durivo (thiamethoxam, chlorantraniliprole)	10-13 fl oz	12	30	aphids, beet armyworm, Colorado potato beetle, fall armyworm, flea beetles, hornworms, leafhoppers, loopers, southern armyworm, thrips, tomato fruitworm, tomato pinworm, whitefly, yellowstriped armyworm	4A, 28	Several methods of soil application – see label.
*Endigo ZC (lambda- cyhalothrin, thiamethoxam)	4.0-4.5 fl oz	24	5	aphids, blister beetles, cabbage looper, Colorado potato beetle, cucumber beetle adults, cutworms, fall, southern, and yellowstriped armyworm (1 st and 2 nd instars), flea beetles, grasshoppers, hornworms, leafhoppers, plant bugs, stink bugs, tomato fruitworm, vegetable weevil adult	3A, 4A	Do not exceed a total of 19.0 fl oz per acre per season. See label for limits on each active ingredient.
Entrust (spinosad)	0.5-2.5 oz	4	1	armyworms, Colorado potato beetle, flower thrips, hornworms, Liriomyza leafminers, loopers, tomato fruitworm, tomato pinworm	5	Do not apply more than 9 oz per acre per crop. OMRI-listed ² . For thrips, rotate to other class of effective insecticide after 2 applications of a Group 5 insecticide for at least 2 applications.
Esteem Ant Bait (pyriproxyfen)	1.5-2.0 lb	12	1	red imported fire ant	7C	Apply when ants are actively foraging.

Table 12.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
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.
Fulfill (pymetrozine)	2.75 oz	12	0	green peach aphid, potato aphid, suppression of whitefly	9B	Do not apply more than 5.5 oz/acre per crop. (FL-040006) 24(c) label for growing transplants also (FL-03004).
Grandevo (Chromobacterium subtsugae)	1.0-3.0 lb	4	0	Armyworms, hornworms, loopers, tomato fruitworm, tomato pinworm, variegated cutworm, aphids, mites, thrips, whiteflies	un	Thorough coverage is necessary for effective control.
*Hero (Bifenthrin, zeta- cypermethrin)	4.5-11.2 oz	12	1	Armyworms, cabbage looper, Colorado potato beetle, cucumber beetle, cutworms, flea beetles, grasshoppers, hornworms, leafhoppers, stink bugs, tobacco budworm, tomato fruitworm, tomato pinworm, vegetable leafminer, thrips, twospotted spider mite, whiteflies	3	Check label for maximum seasonal totals.
Intrepid 2F (methoxyfenozide)	4-16 fl oz	4	1	beet armyworm, cabbage looper, fall armyworm, hornworms, southern armyworm, true armyworm, yellowstriped armyworm, suppression of tomato fruitworm and tomato pinworm	18	Do not apply more than 64 fl oz per acre per season. Product is a slow-acting IGR that will not kill larvae immediately.
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.5 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms)	11	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
Kanemite 15 SC (acequinocyl)	31 fl oz	12	1	twospotted spider mite	20B	Do not use less than 100 gal per acre. Make no more than 2 applications at least 21 days apart.
Knack IGR (pyriproxyfen)	8-10 fl oz	12	7	immature whitefly	7C	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. Treat whole fields.
Kryocide (cryolite)	8-16 lb	12	14	armyworm, blister beetle, cabbage looper, Colorado potato beetle larvae, flea beetles, hornworms, tomato fruitworm, tomato pinworm	un	Minimum of 7 days between applications. Do not apply more than 64 lbs per acre per season.
*Lannate LV, *SP (methomyl)	LV: 1.5-3.0 pt SP: 0.5-1.0 lb	48	1	aphids, armyworm, beet armyworm, fall armyworm, hornworms, loopers, southern armyworm, tomato fruitworm, tomato pinworm, variegated cutworm	1A	Do not apply more than 21 pt LV/acre/crop (15 for tomatillos) or 7 lb SP /acre/crop (5 lb for tomatillos).
Malathion 5 Malathion 8 F (malathion)	1.0-2.5 pt 1.5 pt	12	1	aphids, <i>Drosophila</i> , spider mites	1B	8F can be used in greenhouse.
*Monitor 4EC (methamidophos)	1.5-2 pts	96	7	aphids, fruitworms, leafminers, tomato pinworm ⁽¹⁾ , whitefly ⁽²⁾	1B	⁽¹⁾ Suppression only ⁽²⁾ Use as tank mix with a pyrethroid for whitefly control.
[24(c) labels] FL-800046 FL-900003						Do not apply more than 8 pts per acre per crop season, nor within 7 days of harvest.
Movento (spirotetramat)	4.0-5.0 fl oz	24	1	aphids, psyllids, whitefly	23	Maximum of 10 fl oz/acre per season.
M-Pede 49% EC (Soap, insecticidal)	1-2% V/V	12	0	aphids, leafhoppers, mites, plant bugs, thrips, whitefly	--	OMRI-listed ² .
*Mustang (zeta- cypermethrin)	2.4-4.3 oz	12	1	beet armyworm, cabbage looper, Colorado potato beetle, cutworms, fall armyworm, flea beetles, grasshoppers, green and brown stink bugs, hornworms, leafminers, leafhoppers, <i>Lygus</i> bugs, plant bugs, southern armyworm, tobacco budworm, tomato fruitworm, tomato pinworm, true armyworm, yellowstriped armyworm. Aids in control of aphids, thrips and whitefly.	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)	4.0-16.0 fl oz	12	0	aphids, armyworms, hornworms, psyllids, Colorado potato beetle, cutworms, leafminers, loopers, tomato fruitworm (corn earworm), tomato pinworm, whitefly	un	IGR, feeding repellent. OMRI-listed ² .
NoMate MEC TPW (pheromone)		0	0	tomato pinworm	--	For mating disruption - See label.

Table 12.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
Oberon 25C (spiromesifen)	7.0-8.5 fl oz	12	1	broad mite, twospotted spider mite, whiteflies (eggs and nymphs)	23	Maximum amount per crop: 25.5 fl oz/acre. No more than 3 applications.
PFR-97 (Isaria fumosorosea Apopka strain 97)	1.0-2.0 lbs	4	0	Aphids, broad mites, rust mites, spider mites, leafminers, thrips, whiteflies	un	Repeat applications at 3-10 days are needed to maintain control. OMRI listed 2.
Platinum	5-11 fl oz	12	30	aphids, Colorado potato beetles, flea beetles, leafhoppers, thrips, tomato pinworm, whitefly	4A	Soil application. See label for rotational restrictions. Do not use with other neonicotinoid insecticides
Platinum 75 SG (thiamethoxam)	1.66-3.67 oz					
Portal (fenpyroximate)	2.0 pt	12	1	mites, including broad mites	21A	Do not make more than two applications per growing season.
*Pounce 25 WP (permethrin)	3.2-12.8 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 0.6 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), whitefly ⁽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	12	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.
Provado 1.6F (imidacloprid)	3.8-6.2 fl oz	12	0	aphids, Colorado potato beetle, leafhoppers, whitefly	4A	Do not apply to crop that has been already treated with imidacloprid or thiamethoxam at planting. Maximum per crop per season 19 fl oz per acre.
Pyganic Crop Protection EC 5.0 (pyrethrins)	4.5-18.0 fl oz	12	0	aphids, beetles, caterpillars, grasshoppers, leafhoppers, leafminers, mites, plant bugs, thrips, whiteflies	3	Pyrethrins degrade rapidly in sunlight. Thorough coverage is important. OMRI-listed ² .
Radiant SC (spinetoram)	5-10 fl oz.	4	1	armyworms (except yellowstriped), Colorado potato beetle, flower thrips, hornworms, <i>Liriomyza</i> leafminers, loopers, <i>Thrips palmi</i> , tomato fruitworm, tomato pinworm	5	Maximum of 34 fl oz per acre per season. For thrips, if additional treatment is needed after two applications, switch to an alternate mode of action (not group 5) for at least two applications.
Requiem 25EC (extract of <i>Chenopodium ambrosioides</i>)	2-4 qt	4	0	chilli thrips, eastern flower thrips, Florida flower thrips, green peach aphid, <i>Liriomyza</i> leafminers, melon thrips, potato aphid, western flower thrips, silverleaf whitefly	un	Begin applications before pests reach damaging levels. Limited to 10 applications per crop cycle.
Rimon 0.83EC (novaluron)	9.0-12.0 fl oz	12	1	armyworms, Colorado potato beetle, foliage feeding caterpillars, loopers, tomato fruitworm, tomato hornworm, tomato pinworm, stink bugs, thrips, whiteflies (immatures only)	15	Do not apply more than 36 fl oz per acre per season. Minimum of 7 days between applications.
Safari 20 SG (dinotefuran)	7.0-14.0 oz	12	1	Aphids, leafminers, whiteflies	4A	For transplant production only. Can be applied as foliar spray or soil drench.
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	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.
10% Sevin Granules (carbaryl)	20 lb	12	3	ants, centipedes, crickets, cutworms, earwigs, grasshoppers, millipedes, sowbugs, springtails	1A	Maximum of 4 applications, not more often than once every 7 days.
Sulfur (many brands)		24		tomato russet mite, twospotted spider mite	--	May burn fruit and foliage when temperature is high. Do not apply within 2 weeks of an oil spray or EC formulation.
Synapse WG (flubendiamide)	2.0-3.0 oz	12	1	armyworms, hornworms, loopers, tomato fruitworm, tobacco budworm	28	Do not apply more than 9 oz/acre per season.

Table 12.3. Continued.

Trade Name (Active Ingredient)	Rate (Product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes ²
*Thionex EC (endosulfan)	0.66-1.33 qt	48	2	aphids, blister beetle, cabbage looper, Colorado potato beetle, flea beetles, hornworms, stink bugs, tomato fruitworm, tomato russet mite, whitefly, yellowstriped armyworm	2	Do not exceed a maximum of 2.0 lb active ingredient per acre per season or apply more than 4 times. Use ends Dec. 31, 2014 for field-grown tomatoes and July 31, 2012 for greenhouse crops (not permitted on current label).
Trigard (cyromazine)	2.66 oz	12	0	Colorado potato beetle (suppression of), leafminers	17	No more than 6 applications per crop. Does not control CPB adults. Most effective against 1 st & 2 nd instar larvae.
Trilogy (extract of neem oil)	0.5-1.0% V/V	4	0	aphids, mites, suppression of thrips and whitefly	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. Do not exceed 2 gal/acre per application. OMRI-listed ² .
Ultra Fine Oil, Saf-T-Side, others	1.0-2.0 gal/100 gal	4	0	aphids, beetle larvae, leafhoppers, leafminers, mites, thrips, whitefly, aphid-transmitted viruses (JMS)	--	Do not exceed four applications per season.
JMS Stylet-Oil (oil, insecticidal) (JMS)	3.0-6.0 qt/100 gal water					Organic Stylet-Oil and Saf-T-Side are OMRI-listed ² .
Venom Insecticide (dinotefuran)	foliar: 1.0-4.0 oz	12	1	cucumber beetles, grasshoppers, stink bugs, suppression of green peach and potato aphids	4A	Use only one application method (soil or foliar). Limited to three applications per season. Toxic to honeybees.
Venom Insecticide (dinotefuran)	soil: 5.0-6.0 oz	12	21	Colorado potato beetle, flea beetles, grasshoppers, leafhoppers, leafminers, thrips, whiteflies, suppression of green peach and potato aphids		Use only one application method (soil or foliar). Must have supplemental label for rates over 6.0 oz/acre.
Vetica (flubendiamide and buprofezin)	12.0-17.0 fl oz	12	1	armyworms, cabbage looper, cutworms, garden webworm, saltmarsh caterpillar, tobacco budworm, tomato hornworm, tomato fruitworm, tomato pinworm, suppression of leafhoppers, mealybugs, and whiteflies	28, 16	Do not apply more than 3 times per season or apply more than 38 fl oz per acre per season. Same classes of active ingredients as Synapse, Coragen, and Courier.
Voliam Flexi (thiamethoxam, chlorantraniliprole)	4.0-7.0 oz	12	1	aphids, beet armyworm, Colorado potato beetle, fall armyworm, flea beetles, hornworms, leafhoppers, loopers, southern armyworm, stink bugs, tobacco budworm, tomato fruitworm, tomato pinworm, whitefly, yellowstriped armyworm, suppression of leafminer	4A, 28	Do not use in greenhouses or on transplants. Do not use if seed has been treated with thiamethoxam or if other Group 4A insecticides will be used. Highly toxic to bees. Do not exceed 14 oz per acre per season, or 0.172 lb ai of thiamethoxam-containing products or 0.2 lb ai of chlorantraniliprole-containing products per acre per season.
*Voliam Xpress (lambda-cyhalothrin, chlorantraniliprole)	5.0-9.0 fl oz	24	5	Aphids, armyworms, Colorado potato beetle, cucumber beetle adults, flea beetles, leafhoppers, leafminers, stink bugs, thrips (suppression - does not include Western flower thrips), tobacco budworm, tomato fruitworm, tomato pinworm, whiteflies (suppression)	3, 28	Do not apply more than 31.0 fl oz Voliam Xpress or equivalent of lambda-cyhalothrin or chlorantraniliprole containing products per acre per season.
*Vydate L (oxamyl)	foliar: 2.0-4.0 pt	48	3	aphids, Colorado potato beetle, Liriomyza leafminers (suppression), whiteflies (suppression)	1A	Do not apply more than 32 pts per acre per season.
*Warrior II (lambda-cyhalothrin)	0.96-1.92 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, whitefly ⁽¹⁾ , vegetable weevil adults, 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 (Bacillus thuringiensis subspecies aizawai)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production. OMRI-listed ² .

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

*** Restricted use insecticide.**

Table 12.4. Tomato fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Anthracnose	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 50W HB, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, Champion WP, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		1	Varies from 4 h to 2 days.	Mancozeb enhances bactericidal effect of fix copper compounds.
	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate FL, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		5	1	
	M3	Ziram 76DF (ziram)	4 lb	23.7 lb	7	2	Do not use on cherry tomatoes.
	M3 & M1	ManKocide (mancozeb + copper hydroxide)	5 lb	112 lb	5	2	
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Echo 720, Echo 90 DF, Echo Zn, Equus 500 Zn, Equus 720 SST, Equus DF, Initiate 720	SEE INDIVIDUAL LABELS		0	0.5	Use higher rates at fruit set and lower rates before fruit set.
(suppression)	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	0	0.5	For Disease suppression only. No more than 2 sequential applications before rotating with another effective fungicide from a different FRAC group. See label for additional instructions pertaining to greenhouse useage.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	Limit is 5 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 8 month plant back restriction with off label crops.
	11	Heritage Quadris FL (azoxystrobin)	3.2 oz 6.2 fl oz	1.6 lb 37 fl oz	0 0	4 h 4 h	Must alternate or tank mix with a fungicide from a different FRAC group; use of an adjuvant or tank mixing with EC products may cause phytotoxicity; avoid applications until 21 days after transplanting or 35 days after seeding, or within +/- 6 days of a postemergence broadcast application of Sencore®.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	1.6 pt	8 pt	0	0.5	Must alternate with a non-FRAC code 11 fungicide; use of an adjuvant may cause phytotoxicity; do not apply until 21 days after transplanting or 35 days after seeding; avoid applications within +/- 6 days of a postemergence broadcast application of Sencore®.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	8 fl oz	47 fl oz	0	0.5	Do not apply until 21 days after transplant or 35 days after seeding. Limit is 4 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group.
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.
	11 & 27	Tanos (famoxadone + cymoxanil)	8 oz	72 oz	3	0.5	Do not alternate or tank mix with other FRAC group 11 fungicides.
(suppression)	19	Ph-D WDG (polyoxin D zinc salt)	6.2 oz	31.0 oz	0	4 h	Limit is 5 apps. on 10-14 day interval. Alternate with a non-FRAC code 19 fungicide.
	40 & 3	Revus Top (mandipropamid + difenoconazole)	7 fl oz	28 fl oz	1	0.5	Limit is 4 apps per season; no more than 2 sequential apps. Not labeled for transplants.

Table 12.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Bacterial canker	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 50W HB, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, Champion WP, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days.	Mancozeb enhances the bactericidal effect of fix copper compounds.
(suppression)	11 & 27	Tanos (famoxadone + cymoxanil)	8 oz	72 oz	3	0.5	Do not alternate or tank mix with other FRAC group 11 fungicides.
Bacterial spot and Bacterial speck	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 50W HB, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, Champion WP, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days.	Mancozeb enhances the bactericidal effect of fix copper compounds.
	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate FL, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		5	1	Bacterial spot control only when tank mixed with a copper fungicide.
	M3 & M1	ManKocide (mancozeb + copper hydroxide)	5 lb	112 lb	5	2	
(suppression)	11 & 27	Tanos (famoxadone + cymoxanil)	8 oz	72 oz	3	0.5	Do not alternate or tank mix with other FRAC group 11 fungicides.
	25	Agri-mycin 17 Ag Streptomycin Bac-Master (streptomycin sulfate)	200 ppm	-	-	0.5	See label for details. For transplant production only. Many isolates are resistant to streptomycin.
	P	Actigard (acibenzolar-S-methyl)	0.75 oz	4.75 oz	14	0.5	Begin applications within one week of transplanting or emergence. Make up to 8 weekly, sequential applications.
Black mold (<i>Alternaria</i> spp.)	7	Endura (boscalid)	12.5 oz	25 oz	0	0.5	Alternate with non-FRAC code 7 fungicides, see label
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	0	0.5	No more than 2 sequential applications before rotating with another effective fungicide from a different FRAC group. See label for additional instructions pertaining to greenhouse useage.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	Limit is 5 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 8 month plant back restriction with off label crops.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	1.6 pt	8 pt	0	0.5	Must alternate with a non-FRAC code 11 fungicide; use of an adjuvant may cause phytotoxicity; do not apply until 21 days after transplanting or 35 days after seeding; avoid applications within +/- 6 days of a postemergence broadcast application of Sencore®.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	8 fl oz	47 fl oz	0	0.5	Do not apply until 21 days after transplant or 35 days after seeding. Limit is 4 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 1 year plant back restriction for certain off label crops.
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.
	40 & 3	Revus Top (mandipropamid + difenoconazole)	7 fl oz	28 fl oz	1	0.5	4 apps per season; no more than 2 sequential apps. Not labeled for transplants.

Table 12.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Botrytis, Gray Mold	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Echo 720, Echo 90 DF, Echo Zn, Equus 500 Zn, Equus 720 SST, Equus DF, Initiate 720	SEE INDIVIDUAL LABELS		0	0.5	Use higher rates at fruit set and lower rates before fruit set.
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	0	0.5	No more than 2 sequential applications before switching to another effective fungicide with a different mode of action. See label for additional instructions pertaining to greenhouse useage.
	7	Endura (boscalid)	12.5 oz	25 oz	0	0.5	Alternate with non-FRAC code 7 fungicides.
	9	Scala SC (pyrimethanil)	7 fl oz	35 fl oz	1	0.5	Use only in a tank mix with another effective non-FRAC code 9 fungicide; Has a 30 day plant back with off label crops.
	9 & 12	Switch 62.5WG (cyprodinil + fludioxonil)	14 oz	56 oz per year	0	0.5	After 2 appl. Alternate with non-FRAC code 9 or 12 fungicides for next 2 applications. Has a 30 day plant back with off label crops.
	(suppression)	11 Cabrio 2.09 F (pyraclostrobin)	16 fl oz	96 fl oz	0	0.5	Only 2 sequential appl. Allowed. Limit is 6 appl/crop. Must alternate or tank mix with a fungicide from a different FRAC group.
	(suppression)	11 & 7 Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.
	14	Botran 75 W (dichloran)	1 lbs per 100 gal.	5.33 lb	10	0.5	<u>Greenhouse use only.</u> Limit is 4 applications. Seedlings or newly set transplants may be injured.
	19	Ph-D WDG (polyoxin D zinc salt)	6.2 oz	31.0 oz	0	4 h	Limit is 5 apps. on 10-14 day interval. Alternate with a non-FRAC code 19 fungicide.
	Buckeye rot	M1 + 4 Ridomil Gold Copper (copper hydroxide + mefenoxam)	2 lb	6 lb	14	2	Limited to 3 apps per season. Tankmix with mancozeb.
Buckeye rot Continued	11	Heritage Quadris FL (azoxystrobin)	3.2 oz 6.2 fl oz	1.6 lb 37 fl oz	0	4 h	Must alternate or tank mix with a fungicide from a different FRAC group; use of an adjuvant or tank mixing with EC products may cause phytotoxicity; avoid applications until 21 days after transplanting or 35 days after seeding, or within +/- 6 days of a postemergence broadcast application of Sencore®.
	11	Cabrio 2.09 F (pyraclostrobin)	16 fl oz	96 fl oz	0	0.5	Only 2 sequential appl. Allowed. Limit is 6 appl/crop. Must alternate or tank mix with a fungicide from a different FRAC group, see label.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	1.6 pt	8 pt	0	0.5	Must alternate with a non-FRAC code 11 fungicide; use of an adjuvant may cause phytotoxicity; do not apply until 21 days after transplanting or 35 days after seeding; avoid applications within +/- 6 days of a postemergence broadcast application of Sencore; see label.
	(suppression)	11 & 27 Tanos (famoxadone + cymoxanil)	8 oz	72 oz	3	0.5	Do not alternate or tank mix with other FRAC group 11 fungicides.
	22 & M3	Gavel 75DF (zoaximide + mancozeb)	2.0 lb	16 lb	5	2	See label
	Early blight	M1 (copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 50W HB, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, Champion WP, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days.	Mancozeb or maneb enhances bactericidal effect of fix copper compounds. See label for details.
	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate FL, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		5	1	

Table 12.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Early blight	M3	Ziram 76DF	4 lbs	23.7 lb	7	2	Do not use on cherry tomatoes.
Continued		(ziram)					
	M3 & M1	ManKocide (mancozeb + copper hydroxide)	5 lb	112 lb	5	2	
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Echo 720, Echo 90 DF, Echo Zn, Equus 500 Zn, Equus 720 SST, Equus DF, Initiate 720	SEE INDIVIDUAL LABELS		0	0.5	Use higher rates at fruit set and lower rates before fruit set.
	4 & M5	Ridomil Gold Bravo 76.4 W (chlorothalonil + mefenoxam)	3 lb	12 lb	14	2	Limit is 4 appl./crop.
	7	Endura (boscalid)	12.5 oz	25 oz	0	0.5	Alternate with non-FRAC code 7 fungicides.
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	0	0.5	No more than 2 sequential applications before switching to another effective fungicide with a different mode of action. See label for additional instructions pertaining to greenhouse useage.
	9	Scala SC (pyrimethanil)	7 fl oz	35 fl oz	1	0.5	Use only in a tank mix with another effective non-FRAC code 9 fungicide ; Has a 30 day plant back with off label crops.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	Limit is 5 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 8 month plant back restriction with off label crops.
	9 & 12	Switch 62.5WG (cyprodinil + fludioxonil)	14 oz	56 oz per year	0	0.5	After 2 apps. alternate with non-FRAC code 9 or 12 fungicides for next 2 applications. Has a 30 day plant back with off label crops.
	11	Heritage Quadris FL (azoxystrobin)	3.2 oz 6.2 fl oz	1.6 lb 37 fl oz	0	4 h	Must alternate or tank mix with a fungicide from a different FRAC group; use of an adjuvant or tank mixing with EC products may cause phytotoxicity; avoid applications until 21 days after transplanting or 35 days after seeding, or within +/- 6 days of a postemergence broadcast application of Sencore®.
	11	Cabrio 2.09 F (pyraclostrobin)	16 fl oz	96 fl oz	0	0.5	Only 2 sequential apps. allowed. Limit is 6 apps/crop. Must alternate or tank mix with a fungicide from a different FRAC group.
	11	Flint (trifloxystrobin)	4 oz	16 oz	3	0.5	Limit is 5 apps/crop. Must alternate or tank mix with a fungicide from a different FRAC group.
	11	Evito Aftershock (fluoxastrobin)	5.7 fl oz	22.8 fl oz	3	0.5	Limit is 4 apps/crop. Must alternate or tank mix with a fungicide from a different FRAC group.
	11	Reason 500 SC (fenamidone)	8.2 oz	24.6 lb	14	0.5	Must alternate with a fungicide from a different FRAC group. See supplemental label for restrictions and details.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	1.6 pt	8 pt	0	0.5	Must alternate with a non-FRAC code 11 fungicide; use of an adjuvant may cause phytotoxicity; do not apply until 21 days after transplanting or 35 days after seeding; avoid applications within +/- 6 days of a postemergence broadcast application of Sencore®.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	8 fl oz	47 fl oz	0	0.5	Do not apply until 21 days after transplant or 35 days after seeding. Limit is 4 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 1 year plant back restriction for certain off label crops.
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.
	11 & 27	Tanos (famoxadone + cymoxanil)	8 oz	72 oz	3	0.5	Do not alternate or tank mix with other FRAC group 11 fungicides.
	19	Ph-D WDG (polyoxin D zinc salt)	6.2 oz	31.0 oz	0	4 h	Limit is 5 apps. on 10-14 day interval. Alternate with a non-FRAC code 19 fungicide.

Table 12.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Early blight	22 & M3	Gavel 75DF	2.0 lb	16 lb	5	2	
Continued		(zoaximide + mancozeb)					
	28	Previcur Flex (propamocarb hydrochloride)	1.5 pt	7.5 pt	5	0.5	Must tank mix with chlorothalonil or mancozeb.
	28	Promess (propamocarb hydrochloride)	1.5 pt	7.5 pt	5	0.5	Must tank mix with chlorothalonil or mancozeb.
	40 & 3	Revus Top (mandipropamid + difenoconazole)	7 fl oz	28 fl oz	1	0.5	Limit is 4 apps per season; no more than 2 sequential apps. Not labeled for transplants.
Late blight	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 50W HB, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, Champion WP, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days.	
	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		5	1	
	M3 & M1	ManKocide (mancozeb + copper hydroxide)	5 lb	112 lb	5	2	
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Echo 720, Echo 90 DF, Echo Zn, Equus 500 Zn, Equus 720 SST, Equus DF, Initiate 720	SEE INDIVIDUAL LABELS		0	0.5	Use higher rates at fruit set and lower rates before fruit set.
	4 & M3	Ridomil MZ 68 WP (mefenoxam + mancozeb)	2.5 lb	7.5 lb	5	2	Limit is 3 apps./crop.
	4 & M1	Ridomil Gold Copper 64.8 W (mefenoxam + copper hydroxide)	2 lb	6 lb	14	2	Limit is 3 apps./crop. Tank mix with mancozeb fungicide.
	4 & M5	Ridomil Gold Bravo 76.4 W (chlorothalonil + mefenoxam)	3 lb	12 lb	14	2	Limit is 4 apps./crop.
	11	Heritage Quadris FL (azoxystrobin)	3.2 oz 6.2 fl oz	1.6 lb 37 fl oz	0	4 h	Must alternate or tank mix with a fungicide from a different FRAC group; use of an adjuvant or tank mixing with EC products may cause phytotoxicity; avoid applications of Heritage/Amistar until 21 days after transplanting or 35 days after seeding, or within +/- 6 days of a post-emergence broadcast application of Sencore®.
	11	Cabrio 2.09 F (pyraclostrobin)	16 fl oz	96 fl oz	0	0.5	Only 2 sequential appl. Allowed. Limit is 6 appl/crop. Must alternate or tank mix with a fungicide from a different FRAC group.
	11	Flint (trifloxystrobin)	4 oz	16 oz	3	0.5	Limit is 5 appl/crop. Must alternate or tank mix with a fungicide from a different FRAC group.
	11	Evito Aftershock (fluoxastrobin)	5.7 fl oz	22.8 fl oz	3	0.5	Limit is 4 appl/crop. Must alternate or tank mix with a fungicide from a different FRAC group.
	11	Reason 500 SC (fenamidone)	8.2 oz	24.6 lb	14	0.5	Must alternate with a fungicide from a different FRAC group.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	1.6 pt	8 pt	0	0.5	Must alternate with a non-FRAC code 11 fungicide; use of an adjuvant may cause phytotoxicity; do not apply until 21 days after transplanting or 35 days after seeding; avoid applications within +/- 6 days of a postemergence broadcast application of Sencore®.
(suppression)	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.

Table 12.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Late blight Continued	11 & 27	Tanos (famoxadone + cymoxanil)	8 oz	72 oz	3	0.5	Do not alternate or tank mix with other FRAC group 11 fungicides.
	21	Ranman (cyazofamid)	2.75 oz	16oz	0	0.5	Limit is 6 apps./crop.
	22 & M3	Gavel 75DF (zoaximide + mancozeb)	2.0 lb	16 lb	5	2	
	27	Curzate 60DF (cymoxanil)	5 oz	30 oz per year	3	0.5	Must tank mix with another effective product.
	28	Previcur Flex (propamocarb hydrochloride)	1.5 pt	7.5 pt	5	0.5	Must tank mix with Chlorothalonil or mancozeb.
	28	Promess (propamocarb hydrochloride)	1.5 pt	7.5 pt	5	0.5	Must tank mix with Chlorothalonil or mancozeb.
	33	Aliette 80 WDG (fosetyl-al)	5 lb	20lb	14	0.5	See label for warnings concerning the use of copper compounds.
	40	Forum (dimethomorph)	6 oz	30 oz	4	0.5	Only 2 sequential appl. See label for details
	40	Revus (mandipropamid)	8 fl oz	32 fl oz	1	4 h	Supplemental label; No more than 2 sequential appl.; See label
	40 & 3	Revus Top (mandipropamid + difenoconazole)	7 fl oz	28 fl oz	1	0.5	4 apps per season; no more than 2 sequential apps; do not use on varieties with mature fruit less than 2 inches in diameter. Not labeled for transplants. See label
	43	Presidio (Fluopicolide)	4 fl oz	12 fl oz/per season	2	0.5	4 apps per season; no more than 2 sequential apps. 10 day spray interval; Tank mix with another labeled non-FRAC code 43 fungicide; 18 month rotation with off label crops; see label.
	45 & 40	Zampro (ametoctradin + dimethomorph)	14 fl oz	42 fl oz	4	0.5	Addition of a spreading or penetrating adjuvant is recommended to improve performance. Limit of 3 applications per season.
Leaf mold	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		5		
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Echo 720, Echo 90 DF, Echo Zn, Equus 500 Zn, Equus 720 SST, Equus DF, Initiate 720	SEE INDIVIDUAL LABELS		0	0.5	Use higher rates at fruit set and lower rates before fruit set, see label
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	Do not use on varieties with mature fruit less than 2 inches (cherry and grape types). Limit is 5 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 8 month plant back restriction with off label crops ; see label.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	8 fl oz	47 fl oz	0	0.5	Do not apply until 21 days after transplant or 35 days after seeding. Limit is 4 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Do not apply to varieties with mature fruit less than 2 inches (cherry and grape types). Has up to a 1 year plant back restriction for certain off label crops ; see label.
	11 & 27	Tanos (famoxadone + cymoxanil)	8 oz	72 oz	3	0.5	Do not alternate or tank mix with other FRAC group 11 fungicides. See label for details
	22 & M3	Gavel 75DF (zoaximide + mancozeb)	2.0 lb	16 lb	5	2	
	40 & 3	Revus Top (mandipropamid + difenoconazole)	7 fl oz	28 fl oz	1	0.5	4 apps per season; no more than 2 sequential apps. Not labeled for transplants.

Table 12.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Grey leaf spot	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 50W HB, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, Champion WP, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days.	Mancozeb or maneb enhances bactericidal effect of fix copper compounds.
	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		5	1	
	M3 & M1	ManKocide (mancozeb + copper hydroxide)	5 lb	112 lb	5	2	
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Echo 720, Echo 90 DF, Echo Zn, Equus 500 Zn, Equus 720 SST, Equus DF, Initiate 720	SEE INDIVIDUAL LABELS		0	0.5	Use higher rates at fruit set and lower rates before fruit set.
	4 & M5	Ridomil Gold Bravo 76.4 W (chlorothalonil + mefenoxam)	3 lb	12 lb	14	2	Limit is 4 apps./crop.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	Do not use on varieties with mature fruit less than 2 inches (cherry and grape types). Limit is 5 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 8 month plant back restriction with off label crops.
	11	Flint (trifloxystrobin)	4 oz	16 oz	3	0.5	Limit is 5 apps/crop. Must alternate or tank mix with a fungicide from a different FRAC group.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	8 fl oz	47 fl oz	0	0.5	Do not apply until 21 days after transplant or 35 days after seeding. Limit is 4 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 1 year plant back restriction for certain off label crops.
	22 & M3	Gavel 75DF (zoaximide + mancozeb)	2.0 lb	16 lb	5	2	
	40 & 3	Revus Top (mandipropamid + difenoconazole)	7 fl oz	28 fl oz	1	0.5	4 apps per season; no more than 2 sequential apps. Not labeled for transplants.
Phytophthora crown rot, Phytophthora root rot (Phytophthora spp.)	4	Ridomil Gold SL	1 pt	3 pt	28	2*	Do not apply more than 6 lb mefenoxam/acre per crop to the soil. *There is a reentry interval exemption if material is soil-injected or soil-incorporated.
		Ultra Flourish (mefenoxam)	2 pt	6 pt	7	2*	
	4	Metastar 2E (metalaxyl)	2 qt	6 qt	2	28	Soil applied by drip injection.
	11	Reason 500 SC (fenamidone)	8.2 oz	24.6 lb	14	0.5	Must alternate with a fungicide from a different FRAC group. (Phytophthora capsici-suppression only)
	14	Terramaster 4EC (etrifidazole)	7 fl oz	27.4 fl oz	3	0.5	<u>Greenhouse use only.</u>
	21	Ranman (cyazofamid)	2.75 fl oz	16.5 fl oz	0		Apply to the base of plant at the time of transplanting. Make additional applications on a 7 to 10 day schedule if conditions are favorable for disease.
	28	Previcur Flex (propamocarb hydrochloride)	SEE LABEL		5	0.5	GREENHOUSE APPLICATION: 6 apps/crop cycle. Do not mix with other products. Can cause phytotoxicity if applied in intense sunlight.
	33	Aliette 80 WDG Linebacker WDG (fosetyl-aluminum)	5 lb	2 lb	14	0.5	See label for warnings concerning the use of copper compounds.

Table 12.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Phytophthora crown rot, Phytophthora root rot (<i>Phytophthora</i> spp.) Continued	43	Presidio (fluopicolide)	4 fl oz	12 fl oz	2	0.5	4 apps per season; no more than 2 sequential apps. 10 day spray interval; Tank mix with another labeled non-FRAC code 43 fungicide; 18 month rotation with off label crops.
	45 & 40	Zampro (ametoctradin + dimethomorph)	14 fl oz	42 fl oz	4	0.5	Addition of a spreading or penetrating adjuvant is recommended to improve performance. Limit of 3 applications per season.
Powdery mildew	M2	(sulfur) Many brands available: Cosavet DF, Kumulus DF, Micro Sulf, Microfine Sulfur, Microthiol Disperss, Sulfur 6L, Sulfur 90W, Super Six, That Flowable Sulfur, Tiolux Jet, Thiosperse 80%, Wettable Sulfur, Wettable Sulfur 92, Yellow Jacket Dusting Sulfur, Yellow Jacket Wettable Sulfur	SEE INDIVIDUAL LABELS		1	1	Follow label closely, may cause leaf burn if applied during high temperatures.
	3	Rally 40WSP Nova 40 W Sonoma 40WSP (myclobutanil)	4 oz	1.25 lb	0	1	Note that a 30 day plant back restriction exists.
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	0	0.5	No more than 2 sequential applications before switching to another effective fungicide with a different mode of action. See label for additional instructions pertaining to greenhouse useage.
		(cyprodinil + difenoconazole)					
	9 & 12	Switch 62.5WG (cyprodinil + fludioxonil)	14 oz	56 oz per year	0	0.5	After 2 apps alternate with non-FRAC code 9 or 12 fungicides for next 2 applications. Has a 30 day plant back with off label crops.
	11	Heritage Quadris FL (azoxystrobin)	3.2 oz 6.2 fl oz	1.6 lb 37 fl oz	0	4 h	Must alternate or tank mix with a fungicide from a different FRAC group; use of an adjuvant or tank mixing with EC products may cause phytotoxicity; avoid applications until 21 days after transplanting or 35 days after seeding, or within +/- 6 days of a postemergence broadcast application of Sencore®.
	11	Cabrio 2.09 F (pyraclostrobin)	16 fl oz	96 fl oz	0	0.5	Only 2 sequential apps. allowed. Limit is 6 appl/crop. Must alternate or tank mix with a fungicide from a different FRAC group.
	11	Flint (trifloxystrobin)	4 oz	16 oz	3	0.5	Limit is 5 apps/crop; must alternate or tank mix with a fungicide from a different FRAC group.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	1.6 pt	8 pt	0	0.5	Must alternate with a non-FRAC code 11 fungicide; use of an adjuvant may cause phytotoxicity; do not apply until 21 days after transplanting or 35 days after seeding; avoid applications within +/- 6 days of a postemergence broadcast application of Sencore®.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	8 fl oz	47 fl oz	0	0.5	Do not apply until 21 days after transplant or 35 days after seeding. Limit is 4 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 1 year plant back restriction for certain off label crops.
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.
	19	Ph-D WDG (polyoxin D zinc salt)	6.2 oz	31.0 oz	0	4 h	Limit is 5 apps. on 10-14 day interval. Alternate with a non-FRAC code 19 fungicide.
	40 & 3	Revus Top (mandipropamid + difenoconazole)	7 fl oz	28 fl oz	1	0.5	4 apps per season; no more than 2 sequential apps. Not labeled for transplants.
Pythium diseases (<i>Pythium</i> spp.)	4	Ridomil Gold GR Ridomil Gold SL Ultra Flourish (mefenoxam)	20 lb 2 pt 2 pt	40 lb 3 pt 6 pt	28 7 7	2* 2* 2	*There is a reentry interval exemption if material is soil-injected or soil-incorporated.
	4	Metastar 2E (metalaxyl)	2 qt	6 qt	28	2	Soil applied by drip injection.

Table 12.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Pythium diseases (<i>Pythium spp.</i>)	14	Terramaster 4EC (etridiazole)	7 fl oz	27.4 fl oz	3	0.5	<u>Greenhouse use only.</u>
	21	Ranman (cyazofamid)	3 fl oz/ 100 gal	-	0	-	For greenhouse transplant production; make a single application to the seedling tray 1 week prior up to the time of transplanting. Do not use any surfactant.
	28	Previcur Flex (propamocarb hydrochloride)	SEE INDIVIDUAL LABELS		5	0.5	GREENHOUSE APPLICATION: 6 apps/crop cycle. Do not mix with other products. Can cause phytotoxicity if applied in intense sunlight.
	28	Previcur Flex (propamocarb hydrochloride)	1.5 pts/ treated acre	7.5 pt/ treated acre	5	0.5	(Root rots and seedling diseases) Applied to lower portion of plant and soil, or as a soil drench or drip irrigation.
	28	Promess (propamocarb hydrochloride)	1.5 pt	7.5 pt	5	0.5	Must tank mix with chlorothalonil or mancozeb.
Rhizoctonia root rot, Rhizoctonia fruit rot (<i>Rhizoctonia solani</i>)	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Echo 720, Echo 90 DF, Echo Zn, Equus 500 Zn, Equus 720 SST, Equus DF, Initiate 720	SEE INDIVIDUAL LABELS		0	0.5	Use higher rates at fruit set and lower rates before fruit set.
(suppression)	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.
	14	Blocker 4F Terraclor 75 WP (PCNB)	SEE INDIVIDUAL LABELS		Soil treatment at planting	0.5	See label for application type and restrictions
	14	Par-Flo 4F (PCNB)	12 fl oz per 100 gal.	2 app.	Soil drench	0.5	Limited to only container-grown plants in nurseries or greenhouse.
Target spot	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Echo 720, Echo 90 DF, Echo Zn, Equus 500 Zn, Equus 720 SST, Equus DF, Initiate 720	SEE INDIVIDUAL LABELS		0	0.5	Use higher rates at fruit set and lower rates before fruit set.
	4 & M5	Ridomil Gold Bravo 76.4 W (chlorothalonil + mefenoxam)	3 lb	12 lb	14	2	Limit is 4 appl./crop.
	7	Endura (boscalid)	12.5 oz	25 oz	0	0.5	Alternate with non-FRAC code 7 fungicides.
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	0	0.5	No more than 2 sequential apps. before switching to another effective fungicide with a different mode of action. See label for additional instructions pertaining to greenhouse useage.
	9	Scala SC (pyrimethanil)	7 fl oz	35 fl oz	1	0.5	Use only in a tank mix with another effective non-FRAC code 9 fungicide; has a 30 day plant back with off label crops.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	Limit is 5 apps./season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 8 month plant back restriction with off label crops.
	11	Heritage Quadris FL (azoxystrobin)	3.2 oz 6.2 fl oz	1.6 lb 37 fl oz	0	4 h	Must alternate or tank mix with a fungicide from a different FRAC group; use of an adjuvant or tank mixing with EC products may cause phytotoxicity; avoid applications until 21 days after transplanting or 35 days after seeding, or within +/- 6 days of a postemergence broadcast application of Sencore®.
	11	Cabrio 2.09 F (pyraclostrobin)	16 fl oz	96 fl oz	0	0.5	Only 2 sequential appl. Allowed. Limit is 6 appl./crop. Must alternate or tank mix with a fungicide from a different FRAC group.
	11	Evito Aftershock (fluoxastrobin)	5.7 fl oz	22.8 fl oz	3	0.5	Limit is 4 appl./crop. Must alternate or tank mix with a fungicide from a different FRAC group.

Table 12.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Target spot Continued	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	1.6 pt	8 pt	0	0.5	Must alternate with a non-FRAC code 11 fungicide; use of an adjuvant may cause phytotoxicity; do not apply until 21 days after transplanting or 35 days after seeding; avoid applications within +/- 6 days of a postemergence broadcast application of Sencore®.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	8 fl oz	47 fl oz	0	0.5	Do not apply until 21 days after transplant or 35 days after seeding. Limit is 4 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 1 year plant back restriction for certain off label crops.
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.
	11 & 27	Tanos (famoxadone + cymoxanil)	8 oz	72 oz	3	0.5	Do not alternate or tank mix with other FRAC group 11 fungicides.
	40 & 3	Revus Top (mandipropamid + difenoconazole)	7 fl oz	28 fl oz	1	0.5	4 apps per season; no more than 2 sequential apps. Not labeled for transplants.
Septoria leaf spot	M1	(copper compounds) Many brands available: Badge SC, Badge X2, Basic Copper 50W HB, Basic Copper 53, C-O-C-S WDG, Champ DP, Champ F2 FL, Champ WG, Champion WP, C-O-C DF, C-O-C WP, Copper Count N, Cuprofix Ultra 40D, Cueva, Kentan DF, Kocide 3000, Kocide 2000, Kocide DF, Nordox, Nordox 75WG, Nu Cop 50WP, Nu Cop 3L, Nu Cop 50DF, Nu Cop HB	SEE INDIVIDUAL LABELS		1	Varies by product from 4 h to 2 days.	
	M3	(mancozeb) Many brands available: Dithane DF, Dithane F45, Dithane M45, Koverall, Manzate, Manzate Pro-Stik, Penncozeb 4FL, Penncozeb 75DF, Penncozeb 80WP	SEE INDIVIDUAL LABELS		5		
	M3	Ziram 76DF (ziram)	4 lbs	23.7 lb	7	2	Do not use on cherry tomatoes.
	M3 & M1	ManKocide (mancozeb + copper hydroxide)	5 lbs	112 lb	5	2	
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo Zn, Chloronil 720, Echo 720, Echo 90 DF, Echo Zn, Equus 500 Zn, Equus 720 SST, Equus DF, Initiate 720	SEE INDIVIDUAL LABELS		0	0.5	Use higher rates at fruit set and lower rates before fruit set.
	4 & M5	Ridomil Gold Bravo 76.4 W (chlorothalonil + mefenoxam)	3 lb	12 lb	14	2	Limit is 4 apps./crop.
	7	Fontelis (penthiopyrad)	24 fl oz	72 fl oz	0	0.5	No more than 2 sequential apps. before switching to another effective fungicide with a different mode of action. See label for additional instructions pertaining to greenhouse useage.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	47 fl oz	0	0.5	Limit is 5 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Has up to a 8 month plant back restriction with off label crops.
	11	Heritage Quadris FL (azoxystrobin)	3.2 oz 6.2 fl oz	1.6 lb 37 fl oz	0	4 h	Must alternate or tank mix with a fungicide from a different FRAC group; use of an adjuvant or tank mixing with EC products may cause phytotoxicity; avoid applications until 21 days after transplanting or 35 days after seeding, or within +/- 6 days of a postemergence broadcast application of Sencore®.
	11	Cabrio 2.09 F (pyraclostrobin)	16 fl oz	96 fl oz	0	0.5	Only 2 sequential appl. Allowed. Limit is 6 apps/crop. Must alternate or tank mix with a fungicide from a different FRAC group.

Table 12.4. Continued.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Septoria leaf spot	11	Flint	4 oz	16 oz	3	0.5	Limit is 5 apps/crop. Must alternate or tank mix with a fungicide from a different FRAC group.
Continued		(trifloxystrobin)					
	11	Reason 500 SC (fenamidone)	8.2 oz	24.6 lb	14	0.5	Must alternate with a fungicide from a different FRAC group.
	11 & M5	Quadris Opti (azoxystrobin + chlorothalonil)	1.6 pt	8 pt	0	0.5	Must alternate with a non-FRAC code 11 fungicide; use of an adjuvant may cause phytotoxicity; do not apply until 21 days after transplanting or 35 days after seeding; avoid applications within +/- 6 days of a postemergence broadcast application of Sencore®.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	8 fl oz	47 fl oz	0	0.5	Do not apply until 21 days after transplant or 35 days after seeding. Limit is 4 apps per season with no more than 2 sequential apps. Must tank mix or alternate with another effective fungicide from another FRAC group. Up to a 1 year plant back restriction for certain off label crops.
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.
	11 & 27	Tanos (famoxadone + cymoxanil)	8 oz	72 oz	3	0.5	Do not alternate or tank mix with other FRAC group 11 fungicides.
	40 & 3	Revus Top (mandipropamid + difenoconazole)	7 fl oz	28 fl oz	1	0.5	4 apps per season; no more than 2 sequential apps. Not labeled for transplants.
Southern blight	11	Evito Aftershock (fluoxastrobin)	5.7 fl oz	22.8 fl oz	3	0.5	Limit is 4 appl/crop. Must alternate or tank mix with a fungicide from a different FRAC group.
(suppression)	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.
	14	Blocker 4F Terraclor 75 WP (PCNB)	SEE INDIVIDUAL LABELS		Soil treatment at planting	0.5	See label for application type and restrictions.
Timber Rot, Sclerotinia stem rot, or White mold (<i>Sclerotinia sclerotiorum</i>)	11	Heritage	3.2 oz	1.6 lb	0	4 h	Must alternate or tank mix with a fungicide from a different FRAC group; use of an adjuvant or tank mixing with EC products may cause phytotoxicity; avoid applications of Heritage/ Amistar until 21 days after transplanting or 35 days after seeding, or within +/- 6 days of a postemergence broadcast application of Sencore®.
		Quadris FL (azoxystrobin)	6.2 fl oz	37 fl oz			
	11	Cabrio 2.09 F (pyraclostrobin)	16 fl oz	96 fl oz	0	0.5	Only 2 sequential apps. allowed. Limit is 6 apps/crop. Must alternate or tank mix with a fungicide from a different FRAC group.
(suppression)	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8 fl oz	24 fl oz	7	0.5	Limit is 3 apps per season; no more than 2 sequential apps. See label about compatibility with other formulated products and adjuvants.

¹ FRAC code (fungicide group): Number (1 through 46) and letters (U and 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. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2013; <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.

Appendix 1. Biopesticides

Gary E. Vallad, Susan E. Webb and Hugh A. Smith

Table 13.1. Biopesticides and other alternative products labeled for plant pest management.

Product (active ingredient)	Rate	REI	PHI	Insects	MOA Code ¹	Notes ²
Agree WG (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11A	Apply when larvae are small for best control. Can be used in greenhouse. OMRI-listed ² .
Aza-Direct (azadirachtin)	1-2 pts, up to 3.5 pts, if needed	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, weevils, whiteflies	un	Antifeedant, repellent, insect growth regulator. OMRI-listed ² .
Azera (pyrethrins, azadirachtin)	1.0-3.5 qt	12	0	aphids, beetles, caterpillars, leafminers, whiteflies	3A, un	Apply when larvae are small for best control. Can be used in greenhouse. For organic production.
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11A	Treat when larvae are young. Good coverage is essential. Can be used in the greenhouse. Can be used for organic production.
Deliver (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11A	Use higher rates for armyworms. OMRI-listed ² .
Des-X (soap, insecticidal)	2 % V/V	12	0	aphids, mites, plant bugs, whiteflies	--	OMRI-listed ² .
DiPel DF (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. See label for rates for specific pests. Good coverage is essential. OMRI-listed ² .
Entrust SC (spinosad)	see label for specific crops	4	see label	caterpillars, some beetles, thrips. See label for specific pests on specific crops	5	See label for resistance management and for maximum allowed amount per season. OMRI-listed ² .
Gemstar LC (<i>Helicoverpa zea</i> NPV)	4-10 fl oz	4	0	corn earworm (tomato fruitworm), tobacco budworm	--	Naturally occurring insect virus. OMRI-listed ² .
Grandevo (<i>Chromobacterium</i> <i>subtsugae</i> strain PRAA4-1)	1.0-3.0 lb	4	0	See label for specific pests for specific crops. For control of caterpillars, aphids, whiteflies and other insects.	--	Can be used in organic production. OMRI-listed ²
Javelin WG (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.50 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms)	11A	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² . See label for crops (most cole crops).
M-Pede 49% EC (soap, insecticidal)	1-2 % V/V	12	0	aphids, leafhoppers, mites, thrips, whiteflies	--	OMRI-listed ² .
Mycotrol O (<i>Beauveria bassiana</i>)	0.5-1.0 qt	4	0	aphids, thrips, whiteflies, psyllids	--	May be used in greenhouses. Not compatible in tank mix with fungicides. OMRI-listed ² .
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, cabbage looper, caterpillars, cutworms, diamondback moth, dipterous leafminers, leafminers, imported cabbageworm, whiteflies	un	IGR and feeding repellent. Greenhouse and field. OMRI-listed ² .
PFR-97 20% WDG (<i>Isaria fumosoroseus</i> Apopka Strain 97)	Foliar and soil: 1-2 lb	4	0	Foliar: whiteflies, aphids, thrips, spider mites, broad mites, <i>Liriomyza</i> leafminers, psyllids, plant bugs: Soil: thrips pupae, rootworms, wireworms, grubs, symphylans	--	Can be used on vegetables grown for transplant. Do not mix with fungicides or apply within 5 days of fungicide applications other than copper. Dust/mist respirator must be used for mixing and applying. For organic production.
Pyganic 5.0 (pyrethrins)		12	0	most insects	3A	Harmful to bees. Can be used in greenhouses. OMRI-listed. ²
Seduce Insect Bait (spinosad)	20-44 lb	4	see specific crops on label	cutworms, earwigs	5	For organic production
Trilogy (extract of neem oil)	0.5-2% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11A	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 7.2 April 2012. Number codes (1 through 28) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. un = unknown, or a mode of action that has not been classified yet.

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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.

Table 13.2. Biopesticides and other alternative products labeled for plant disease management.

Product (active ingredient), Fungicide Group ¹	Crops	Pertinent Diseases or Pathogens	Minimum Days to:		OMRI Listed	Remarks ²
			Harvest	Reentry		
Actinovate (<i>Streptomyces lydicus</i> WYEC 108), NC	All Vegetables & Strawberries	<i>Alternaria</i> spp., Anthracnose, <i>Aphanomyces</i> , Botrytis, Charcoal Rot (<i>Macrophomina phaseolina</i>), Club root (<i>Plasmodiophora brassicae</i>), Downy Mildew, <i>Erwinia</i> spp., <i>Fusarium</i> spp., <i>Gaeumannomyces</i> , Powdery Mildew, <i>Pseudomonas</i> spp., <i>Phytophthora</i> spp., <i>Pythium</i> spp., <i>Rhizoctonia</i> spp., <i>Sclerotinia</i> spp., Southern Blight, <i>Verticillium</i> spp., <i>Xanthomonas</i> spp.	0	1 h	Yes	See label for specific rates and application recommendations.
Afla-guard GR, (<i>Aspergillus flavus</i> NRRL 21882)	Sweet Corn	<i>Aspergillus</i>	-	4 h	No	Do not exceed 20lb/acre per growing season. See label for specific application instructions.
AgriPhage (bacteriophage), NC	Tomato, Pepper	Bacterial spot, Bacterial speck	0	0	No	Bacterial strains must be characterized preiodically by manufacturer to correctly formulate the bacteriophage mixture.
Armcarb 100 Eco-mate Armcarb "O" (potassium bicarbonate), NC	All Vegetables & Strawberries	Anthracnose, Botrytis, Downy mildew, Phoma, Powdery mildew, Septoria leaf spot	0	4 h	No	See label for specific rates and application recommendations.
Ballad Plus, (<i>Bacillus pumilus</i> strain QST 2808) NC	All Legumes & Sweet Corn	Bacterial blight, Brown spot, Cercospora leaf spot, Common Rust, Downy mildew, Northern and Southern leaf blight, <i>Pseudomonas</i> spp. <i>Xanthomonas</i> spp.	0	4 h	No	See label for specific rates and application recommendations.
BioCover, (Oil, petroleum)	All Vegetables & Strawberries	Powdery mildew, Rust	0	4 h	No	See label for specific rates, application recommendations, and precautions regarding use with other pesticides.
Cease (<i>Bacillus subtilis</i> strain QST 713), 44	All Vegetables & Strawberries	Bacterial spot, Bacterial speck, Botrytis, Early Blight, Late Blight, Powdery mildew, Target spot, <i>Rhizoctonia</i> spp., <i>Pythium</i> spp., <i>Fusarium</i> spp., <i>Verticillium</i> spp., <i>Phytophthora</i> spp.	0	4 h	Yes	For foliar applications mix with copper compounds or other effective fungicides. Compatible with soil drench and in-furrow applications. See label for specific rates and application recommendations.
Contans WG (<i>Coniothyrium minitans</i> strain CON/M/91-08)	All Vegetables & Strawberries	<i>Sclerotinia sclerotiorum</i> and <i>Sclerotinia minor</i>	0	4 h	Yes	See label for specific rates and application recommendations.
Double Nickel 55, Double Nickel LC (<i>Bacillus amyloliquefaciens</i> strain D747), 44	All Vegetables & Strawberries	<i>Alternaria</i> spp., Anthracnose, Bacterial diseases, Botrytis, Early blight, Late blight, <i>Phytophthora</i> spp., Powdery mildew, <i>Pythium</i> spp., <i>Rhizoctonia</i> , <i>Fusarium</i> spp., <i>Rhizoctonia</i> , <i>Phytophthora</i> spp., <i>Pythium</i> spp.	0	4 h	Yes	See label for additional rates and recommendations for foliar and soil application rates and details for specific diseases. Use as a soil drench at transplant and periodically throughout the season. Can also be used as a seed treatment. See label for details.
Glacial Spray Fluid, (Oil, petroleum), NC	All Vegetables & Strawberries	Powdery mildew, Rust	0	4 h	Yes	See label for specific rates, application recommendations, and precautions regarding use with other pesticides.
JMS Stylet-Oil Organic JMS Stylet-Oil (paraffinic oil), NC	All Vegetables & Strawberries	Potato Virus Y, Tobacco Etch Virus, Cucumber Mosaic Virus	0	4 h	Yes, but only for one label.	See label for specific rates, application recommendations, and precautions regarding use with other pesticides.
Kaligreen (potassium bicarbonate), NC	All Vegetables & Strawberries	Powdery mildew	0	4 h	Yes	See label for specific rates and application recommendations.
Milstop (potassium bicarbonate), NC	All Vegetables & Strawberries	Anthracnose, <i>Alternaria</i> spp., Botrytis, Downy mildew, Powdery mildew	0	1 h	Yes	See label for specific rates and application recommendations.
Oxidate (hydrogen peroxide), NC	All Vegetables & Strawberries	<i>Alternaria</i> spp., Anthracnose, Bacterial diseases, Botrytis, Early blight, Late blight, <i>Phytophthora</i> spp., Powdery mildew, <i>Pythium</i> spp., <i>Rhizoctonia</i> , <i>Fusarium</i> spp., <i>Rhizoctonia</i> , <i>Phytophthora</i> spp., <i>Pythium</i> spp.	0	1 h for enclosed areas; until spray dries in open field areas.	No	See label for additional rates and recommendations for transplant production and details for specific diseases. Use as a soil drench at transplant and periodically throughout the season. Can also be used as a seed treatment. See label for details.
(potassium phosphite; mono- and di-potassium salts of phosphorous acid), 33 Many brands available: Alude, Appear, Confine Extra T&O, Fosphite, Fungi-Phite, Helena Prophyt, K-Phite 7LP AG, Phorcephite, Phostrol, Rampart, Reveille	All Vegetables & Strawberries	<i>Alternaria</i> spp., Anthracnose, Bacterial diseases, Downy mildew, <i>Fusarium</i> spp., Late blight, Leaf blights caused by <i>Cercospora</i> and <i>Septoria</i> spp., <i>Phytophthora</i> spp., Powdery mildew, <i>Pythium</i> spp., <i>Rhizoctonia</i> spp., Root rots	0	4 h	No	See label for details, specific recommendations, and precautions for tank mixing with copper-based fungicides.
PlantShield HC (<i>Trichoderma harzianum</i> Rifai strain KRL-AG2), NC	All Vegetables & Strawberries	<i>Fusarium</i> spp., <i>Rhizoctonia</i> , <i>Pythium</i> spp.	0	4 h	Yes	Can be applied to plant as a direct drench, furrow spray, chemigation, or in transplant starter solution. See label for details.

Table 13.2. Continued.

Product (active ingredient), Fungicide Group ¹	Crops	Pertinent Diseases or Pathogens	Minimum Days to:		OMRI Listed	Remarks ²
			Harvest	Reentry		
Purespray Green (Oil, petroleum)	All Vegetables & Strawber- ries	Powdery mildew, Rust	0	4 h	Yes	See label for specific rates, application recommendations, and precautions regarding use with other pesticides.
Regalia SC (extract of <i>Reynoutria sachalinensis</i>), P	All Vegetables & Strawber- ries	Bacterial canker, Bacterial speck, Bacterial spot, Botrytis, Early blight, Phytophthora spp., Powdery mildew, Target spot, Late blight	0	4 h	Yes	Tank mix with other effective fungicides for improved dis- ease control under heavy pressure. See label for details.
RootShield Granular (<i>Trichoderma harzianum</i> Rifai strain KRL-AG2), NC	All Vegetables & Strawber- ries	<i>Fusarium</i> spp., <i>Rhizoctonia</i> , <i>Pythium</i> spp.	0	0	Yes	Granular formulation can be applied in furrow in the field, or to greenhouse planting mix. See label for details.
RootShield WP (<i>Trichoderma harzianum</i> Rifai strain KRL-AG2), NC	All Vegetables & Strawber- ries	<i>Fusarium</i> spp., <i>Rhizoctonia</i> , <i>Pythium</i> spp.	0	Until spray has dried.	Yes	Can be applied as a greenhouse soil drench, or by chemiga- tion in field and greenhouse operations. In furrow or transplant starter solution.
Serenade ASO, Serenade Max, (<i>Bacillus subtilis</i> strain QST 713), 44	All Vegetables & Strawber- ries	Bacterial speck, Bacterial spot, Botrytis, Early Blight, Late Blight, Powdery mildew, Target spot	0	4 h	Yes	For foliar applications mix with copper compounds or other effective fungicides for improved disease control. See label for details.
Serenade Soil (<i>Bacillus subtilis</i> strain QST 713), 44	All Vegetables & Strawber- ries	<i>Fusarium</i> spp., <i>Phytophthora</i> spp., <i>Pythium</i> spp., <i>Rhizoctonia</i> spp., <i>Verticil- lium</i> spp.	0	4 h	Yes	Formulation compatible with soil drench, in-furrow, and chemigation applications. Mix with other effective fungi- cides for improved disease control. See label for details.
Sil-Matrix (potassium silicate), NC	All Vegetables & Strawber- ries	Broad spectrum fungicide	0	4 h	No	Must be used in a rotational program with other fungicides when conditions are conducive for disease development. See label for details.
Soilgard 12G (<i>Gliocladium virens</i> GI-21), NC	All Vegetables & Strawber- ries	<i>Fusarium</i> root and crown rot, <i>Phytoph- thora capsici</i> , <i>Pythium</i> spp., <i>Rhizocto- nia</i> , <i>Sclerotinia</i> spp., <i>Sclerotium</i> spp.	0	0	Yes	For best results apply to transplants or as a drench dur- ing transplanting. Subsequent applications can be made as drench, directed spray, or by chemigation. Chemical fungicides should not be mixed with or applied to soil or plant media at the same time as SoilGard 12G. See label for details.
Sonata (<i>Bacillus pumilus</i> QST 2808), NC	All Vegetables & Strawber- ries	Early Blight, Downy mildew, Late Blight, Powdery mildew, Rust	0	4 h	Yes	Mix or alternate with other effective fungicides for im- proved disease control. See label for details.
Sporatec (oils of clove, rosemary and thyme), NC	All Vegetables & Strawber- ries	Bacterial spot, Botrytis, Early blight, Gray mold, Late blight, Powdery mildew	0	0	Yes	Exercise care when applying. Begin applications once disease is observed. Use of a spreader and/or penetrant adjuvant recommended for improved performance. Do not apply when temps are above 90°F. See label for details. Ingredients are exempt from FIFRA.
Tenet (<i>Trichoderma asperellum</i> ICC 012; <i>Trichoderma gamsii</i> ICC 080), NC	All Vegetables & Strawber- ries	<i>Fusarium</i> spp., <i>Phytophthora</i> spp., <i>Pythium</i> spp., <i>Rhizoctonia</i> spp., <i>Sclero- tium rolfsii</i> , <i>Sclerotinia</i> spp., <i>Thielaviop- sis basicola</i> , and <i>Verticillium</i> spp.	0	1 h	Yes	For best results apply 1 week prior to planting, with 2 or more additional applications throughout the production cycle. May be applied through fertigation systems in com- bination with most common fertilizers. Can be applied to fumigated soil after fumigant has dissipated. Tenet has no curative activity. See label for details regarding application and fungicide incompatibility.
Terraclean (hydrogen dioxide), NC	All Vegetables & Strawber- ries	Soilborne plant pathogens caused by species of <i>Fusarium</i> , <i>Phytophthora</i> , <i>Pythium</i> , and <i>Rhizoctonia</i>	0	0	No	Can be applied by flood irrigation, drip irrigation, or as a soil drench. See label for application details and instructions regarding applications with liquid fertilizer mixtures.
Trilogy (clarified hydrophobic extract of neem oil), NC	All Vegetables & Strawber- ries	<i>Alternaria</i> spp., Anthracnose, Botrytis, Early blight, Powdery mildew	0	4 h	Yes	See label for specific rates, application recommendations, and precautions regarding use with other pesticides.
Vacciplant (laminarin), P	All Vegetables & Strawber- ries	Anthracnose, Bacterial speck, Bacterial spot, Early blight, <i>Phytophthora</i> blight, Powdery mildew	0	4 h	No	Start applications preventively, when weather conditions are favorable for disease development. Repeat applications until disease conditions end. Add a labeled copper product to VacciPlant if the disease symptoms appear.

¹FRAC code (fungicide group): Number (33 and 44) and letters (NC and 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. However, products with NC or P are considered low risk and don't require any rotation unless specifically directed on the label. NC = not classified, includes mineral oils, organic oils, potassium bicarbonate, and other materials of biological origin; P = host plant defense inducers. Source: FRAC Code List 2013; <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

²Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. 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.