

Chapter 19.

Spinach Production in Florida

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BOTANY

Nomenclature

Family - Chenopodiaceae
Spinach - *Spinacia oleracea*

Origin

Spinach is believed to be native to the Middle East in the general area of Iran.

Related Species

Beet and Swiss chard are the only other vegetables of significance in the Chenopodiaceae family. The most important economic plant in this family is the sugar beet.

VARIETIES

Spinach varieties grown in Florida include:

Smooth leaf

A&C #30 (H)¹
 Space (H)

Semi-savoy leaf

Chinook II (H)
 Gladiator (H)
 Melody (H)
 Skookum (H)
 Tyee (H)

Savoy leaf

Ambassador (H)
 Hybrid 612 (H)

¹H = hybrid.

SEEDING AND PLANTING

Planting dates and seeding information are given in Table 1.

FERTILIZER AND LIME

For mineral soils, broadcast all P₂O₅, micronutrients, and 25 to 50% of N and K₂O. Topdress remaining N and K₂O about 2 to 3 weeks after seeding (see Table 2).

For organic soils, broadcast all fertilizer before seeding. Up to 30 lbs/A of N might be needed in cool, winter weather or after leaching rain.

PLANT TISSUE ANALYSIS

Plant tissue analysis information for spinach is given in Table 3. The analysis was done 30 days after seeding, using the most recently matured leaf.

IRRIGATION

Initial water requirements of spinach (see Chapter 3, *Principles and Practices for Irrigation Management of Vegetables*, Table 4 to 6) will be low (20% to 40% of ETo, see Chapter 3, *Principles and Practices for Irrigation Management of Vegetables*, Table 3) until rapid leaf growth occurs. Water requirements rapidly increase to 95% of ETo and remain at or only slightly below that level through harvest.

WEED MANAGEMENT

Herbicides labeled for weed control in spinach are listed in Table 4.

DISEASE MANAGEMENT

Information on managing diseases of spinach are listed in Table 5.

INSECT MANAGEMENT

Table 6 outlines the insecticides approved for use on insects attacking spinach.

Table 1. Seeding and planting information for spinach.

Planting dates	
North Florida	Sept - Mar
Central Florida	Sept - Mar
South Florida	Oct - Feb
Seeding 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 ¹ (acre)	261,136

¹ Population based on closest between and within row spacing.

Table 2. Soil test and fertilizer recommendations for mineral soils for spinach.¹

Target pH	N lb/A	P ₂ O ₅					K ₂ O				
		VL	L	M	H	VH	VL	L	M	H	VH
6.5	90	120	100	80	0	0	120	100	80	0	0

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

¹ Seeds and transplants may benefit from applications of a starter solution at a rate no greater than 10 to 15 lbs/acre for N and P₂O₅, and applied through the plant hole or near the seeds.

Table 3. Plant tissue analysis for spinach 30 days after seeding. Dry wt. basis.

Status	N	P	K	Ca	Mg	S	Fe	Mn	Zn	B	Cu	Mo
	Percent						Parts per million					
Deficient	<3.0	0.3	3.0	0.6	1.0	0.3	50	50	50	20	5	0.1
Adequate range	3.0-4.5	0.3-0.5	3.0-4.0	0.6-1.0	1.0-1.6	0.3-0.6	50-150	50-100	50-80	20-40	5-10	0.1-1.0
High	>4.5	0.5	4.0	1.0	1.6	0.6	150	100	80	40	10	1.0

Table 4. Chemical weed control in spinach.

Active Ingredient lb. a.i./A	Trade name Formulation/A	Weeds Controlled / Remarks
*** PREPLANT / PREEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 2 EC or 1.9 EW 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 0.3 – 1.0	Various formulations consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burn down. Consult label for individual product directions.
Pelargonic Acid	(Scythe) 4.2 EC 3 – 10%	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.
*** POSTEMERGENCE ***		
Carfentrazone up to 0.031	(Aim) 2 EC or 1.9 EW up to 2 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	Certain broadleaf weeds. Do not exceed a total of 0.5 pt./A per growing season. Apply in the 2- to 5- leaf stage of crop growth. PHI 21 days.
Clethodim 0.09 – 0.13	(Select, Arrow) 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. Use a crop oil concentrate at 1% v/v in the finished spray volume. Nonionic surfactant with Select Max. PHI 14 days.
0.07 - 0.25	9 - 16 fl. oz.	
Pelargonic Acid	(Scythe) 4.2 EC 3 – 10%	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 to 1.5 pt.	Controls growing grass weeds. A total of 3.0 pts. /A applied in one season. Include a crop oil concentrate. Unsatisfactory results may occur if applied to grasses under stress. PHI 15 days.

Table 5. Spinach fungicides and other disease management products.

Fungicide Group ¹	Chemical (active ingredient)	Maximum Rate / Acre		Minimum Days to		Pertinent Diseases or Pathogens	Remarks ²
		Applic.	Season	Harvest	Reentry		
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	-	-		Varies by product from 4 hrs to 2 days	Anthracnose Downy mildew White rust Cercospora spot	
M2	(sulfur) Many brands available: Micro Sulf, Microfine Sulfur, Microthiol Disperss, Sulfur 90W, Yellow Jacket Wettable Sulfur	-	-	1	1	Cercospora spot Downy mildew	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
M3	Defiant 75WP (thiram)	5.3 oz/ 100 lbs of seed			1	Damping off	Seed treatment only.
4	Allegiance FL (metalaxyl)	0.75 fl oz/ 100 lb seed			1	Pythium seedling blight	Seed treatment only. See label for details.
4	Sebring 2.65ST (metalaxyl)	0.75 fl oz/ 100 lb seed			1	Pythium seedling blight	Seed treatment only. See label for details.
4	Apron XL LS (mefenoxam)	0.64 fl. oz./ 100 lb seed			2	Pythium seedling blight	Seed treatment only.
4	Metastar 2E AG (metalaxyl)	8 pt			2	Pythium seedling blight	Apply as a broadcast soil application and incorporate into top 2 inches. See label for directions.
4	Ridomil Gold EC or SL (mefenoxam)	2 pt			2	Pythium seedling diseases	Apply at seeding in a 7-12" band on soil over seed furrow.
4	Ridomil Gold GR (mefenoxam)	40 lb			2	Pythium seedling diseases	
4	Ridomil Gold SL (mefenoxam)	0.25 pt	0.5 pt	21	2	Downy mildew, White rust	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	Downy mildew White rust	Follow Ridomil Gold EC at planting . Apply no more than 2 foliar applications.
4	Ultra Flourish (mefenoxam)	4 pt			2	Pythium seedling diseases	See label for specifics regarding preplant incorporated applications and surface applications at the time of planting.
9 & 12	Switch 62.5WDG (cyprodinil/fludioxonil)	14 oz	56 oz	7	0.5	Alternaria Powdery mildew	See label.
11	Cabrio EG (pyraclostrobin)	16 oz	48 oz	0	0.5	Downy mildew	Limit is 3 appl./crop & alternate chemistry.

Table 5. Continued.

Fungicide Group ¹	Chemical (active ingredient)	Maximum Rate / Acre		Minimum Days to		Pertinent Diseases or Pathogens	Remarks ²
		Applic.	Season	Harvest	Reentry		
11	Quadris (azoxystrobin)	15.4 fl oz	3.75 qt	0	4 hrs	Downy mildew Stemphylium leaf spot	Alternate with a fungicide of dissimilar mode of action.
11	Reason (fenamidone)	8.2 fl oz	24.6 fl oz	2	0.5	Downy mildew White rust	Alternate every other application with a fungicide of dissimilar mode of action.
12	Maxim 4FS (fludioxonil)	0.16 fl oz/ 100 lb of seed			0.5	Various seedling diseases	Seed treatment only.
21	Actigard 50WG (acibenzolar)	0.75 oz	2.25 oz	7	0.5		Do not apply to young seedlings.
21	Ranman (cyazofamid)	2.75 fl oz	13.75 fl oz	0	0.5	White rust	Do not make more than 3 sequential applications.
27	Curzate 60DF (cymoxanil)	5 oz	30 oz	1	0.5	Downy mildew	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	Downy mildew	Do not alternate or tank mix with another FRAC group 11 fungicide.
33	Mono- and di-potassium salts of phosphorous acid (See individual labels) including: Alude, Fosphite, Fungi-Phite, Prophyt, Phostrol, Rampart, Reveille, Topaz (potassium phosphite) Phorcephite (potassium phosphite/potassium phosphate)	-	-	0	4 hrs	Pythium, Downy mildew White rust	Do not exceed 6 appl/ crop. Caution should be used when applying in a management program including copper fungicides. See label for foliar, root dip and irrigation application details.
33	Aliette80WDG (fosetyl-Al)	5 lbs	35 lb	3	0.5	Downy mildew White rust	Caution should be used when applying in a management program including copper fungicides or adjuvants.
33	Legion 80WDG (fosetyl-Al)	5 lbs	35 lb	3	0.5	Downy mildew White rust	Caution should be used when applying in a management program including copper fungicides or adjuvants.
33	Linebacker 80WDG (fosetyl-Al)	5 lbs	35 lb	3	0.5	Downy mildew White rust	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 hrs	Downy mildew	Do not exceed 2 sequential applications. See label for soil applications.
43	Presidio 4L (fluopicolide)	4 oz	1 pt	2	0.5	Downy mildew White rust	Must be tank-mixed with a fungicide of a different mode of action. See label for rotational restrictions.
P	Regalia (Extract of <i>Reynoutria sachalinensis</i>)	1% v/v	12 qt	7	4 hrs	Bacterial blight	Begin applications preventatively. Spray volumes should be 50-100 GPA.

Table 5. Continued.

Fungicide Group ¹	Chemical (active ingredient)	Maximum Rate / Acre		Minimum Days to		Pertinent Diseases or Pathogens	Remarks ²
		Applic.	Season	Harvest	Reentry		
NC	Actinovate AG (<i>Streptomyces lydicus</i>)	12 oz		0	1 hr	Alternaria Antracnose Botrytis Fusarium Pythium Phytophthora Rhizoctonia Sclerotinia	Apply to soil through irrigation, as a seed treatment, to foliage as a spray. See label for details.
NC	Armcarb 100 (potassium bicarbonate)	10 lb		0	4 hrs	Downy mildew	See label for details.
NC	Cease (<i>Bacillus subtilis</i> strain QST 713)	6 qt/100 gal mix		0	4 hrs	Downy mildew, Powdery mildew, Sclerotinia drop	Apply to soil through irrigation, or to foliage as a spray. See label for details.
NC	Companion L (<i>Bacillus subtilis</i> GB03)	1 gal		0	4 hrs	Alternaria Fusarium Soft rot Pythium Rhizoctonia	Can be applied in field, greenhouse, or hydroponically. See label for details.
NC	Kaligreen (potassium bicarbonate)	3 lb		0	4 hrs	Downy mildew	Apply in a minimum spray volume of 25 GPA.
NC	Milstop (potassium bicarbonate)	3 lb		0	4 hrs	Downy mildew	Apply in a minimum spray volume of 25 GPA.
NC	NutraPic (Chloropicrin)	500 lb			5	Soilborne fungi Nematodes	DANGER. Soil fumigant. Restricted use pesticide. See label for details.
NC	Oxidate (hydrogen dioxide)	1:100 dilution		0	0	Bacterial blight Botrytis Downy mildew Powdery mildew Rust	See label for details.
NC	PlantShield HC (<i>Trichoderma harzianum</i> Rifai strain KRL-AG2)	5 oz		0	0	Damping off	Apply in-furrow or in transplant starter solution.
NC	RootShield Granules (<i>Trichoderma harzianum</i> Rifai strain KRL-AG2)	12 lb/A field 1.5 lb/cu yd greenhouse			0	Damping off	Apply in-furrow in field or incorporate in soil mix for greenhouse. See label for details.
NC	Rhapsody (<i>Bacillus subtilis</i> strain QST 713)	6 qt		0	4 hrs	Downy mildew, Powdery mildew, Sclerotinia drop	See label for details.
NC	Serenade Max (<i>Bacillus subtilis</i> strain QST 713)	3 lb		0	4 hrs	Pink rot (<i>Sclerotinia</i>)	See labels for details.
NC	Sil-Matrix (Potassium silicate)	4 qts	10 gal	0	4 hrs	Powdery mildew	Apply at a rate of 2-4 qt/100 gal water

Table 5. Continued.

Fungicide Group ¹	Chemical (active ingredient)	Maximum Rate / Acre		Minimum Days to		Pertinent Diseases or Pathogens	Remarks ²
		Applic.	Season	Harvest	Reentry		
NC	Soilgard 12G (<i>Gliocladium virens</i> strain GL-21)				0	Damping off Root diseases	See label for details.
NC	Sonata (<i>Bacillus pumilis</i> strain QST 2808)	4 qt		0	4 hrs	Powdery mildew	For suppression or use as a preventative in a program with other registered fungicides.
NC	Sporatec (clove oil, rosemary oil, and thyme oil)	1.5 qt		0	0	Powdery mildew	Sporatec is a concentrated oil-based product. It requires the use of an approved adjuvant to improve spreading and sticking. OMRI listed
NC	Tenet WP (<i>Trichoderma asperellum</i> and <i>T. gamsii</i>)	3 oz/ 1000 ft of row			1 hr	Various soil-borne diseases	Apply up to 7 days before planting. For organic production.
NC	TerraClean (hydrogen dioxide)	1 gal/ 1000 gal of water			0	Various soil-borne diseases	Apply as a soil treatment prior to or after planting
NC	Trilogy (Neem oil)	2 gal			4 hrs		Apply at a rate of 0.5% - 1.0% in 25 to 100 gall water/acre or at 2 pt in a minimum of 5 GPA for low volume appls.

Table 6. Selected insecticides approved for use on insects attacking spinach..

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
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 (per- methrin)	6.4-12.8 oz	12	1	aphids, beet armyworm, cabbage looper, corn earworm, cutworms, fall armyworm, leafhoppers, vegetable leafminer	3	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 armyworm (1 st and 2 nd instars), cabbage looper, corn earworm, cutworms, flea beetles, grasshoppers, potato leafhopper, saltmarsh caterpillar, thrips, vegetable weevil, yellowstriped armyworm	3	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 July 15, 2012 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.

Table 6. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
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 recommenda- tions 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 prod- uct per acre per season.
Coragen (chlorantraniliprole)	3.5-7.5 fl oz	4	1	beet armyworm, cabbage looper, corn earworm, leafminers, sup- pression of whitefly nymphs	28	Can be applied by drip chemiga- tion, 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 applica- tions. 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)	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.
Durivo (thiamethoxam, chlorantraniliprole)	10-13 oz	12	30	aphids, beet armyworm, cab- bage looper, corn earworm, fall armyworm, flea beetles, imported cabbageworm, leafhoppers, whiteflies	4A, 28	May be applied using one of sev- eral soil application methods. One application per season.
Entrust (spinosad)	0.5-3.0 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 elimi- nated 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 damag- ing levels. Two applications may be needed to control persistent aphid populations.
Intrepid 2F (methoxyfenozide)	4.0-16.0 fl oz	4	1	armyworms, cabbage looper, webworms	18	Do not apply more than 64 fl oz per acre per season.

Table 6. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
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 (army- worms)	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 cut- worm	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 army- worm	1A	Do not exceed 60 fl oz per acre per season.
Malathion 8 F (malathion)	1.5 pt	12	7	aphids	1B	
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	3	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, leafhop- pers, 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 (per- methrin)	6.4-12.8 oz	12	1	aphids, armyworms, beet army- worm, cabbage looper, corn ear- worm, cutworms, fall armyworm, leafhoppers, loopers, southern armyworm, tobacco budworm, vegetable leafminer	3	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/A 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, leafhop- pers, leafminers, mites, stink bugs, thrips, whiteflies,	3	Pyrethrins degrade rapidly in sun- light, but still may be harmful to bees. OMRI-listed ²

Table 6. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
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..
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.
Synapse WG (flubendiamide)	2.0-3.0 oz	12	1	armyworms, loopers	28	Do not apply more than 9.0 oz/acre per season.
*Telone C-35 (dichloropropene + chloropicrin)	See label	5 days -	preplant	symphylans, wireworms	--	See supplemental label for use restrictions in south and central Florida.
*Telone II (dichloropropene)		See label				
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: 1.0-3.0 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 cabbageworm, suppression of leafhoppers, saltmarsh caterpillar, tobacco budworm, suppression of whitefly	28, 16	Do not apply more than 3 times per season or more than 38 fl oz per acre per season. Same active ingredients as Synapse, Coragen, and Courier.
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.

Table 6. Continued.

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

¹Mode of Action codes for vegetable pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 6.1 August 2008.

- 1A. Acetyl cholinesterase inhibitors, Carbamates (nerve action)
- 1B. Acetyl cholinesterase inhibitors, Organophosphates (nerve action)
- 2A. GABA-gated chloride channel antagonists (nerve action)
- 3. Sodium channel modulators (nerve action)
- 4A. Nicotinic acetylcholine receptor agonists (nerve action)
- 5. Nicotinic acetylcholine receptor allosteric activators (nerve action)
- 6. Chloride channel activators (nerve and muscle action)
- 7A. Juvenile hormone mimics (growth regulation)
- 7C. Juvenile hormone mimics (growth regulation)
- 9B and 9C. Selective homopteran feeding blockers
- 10. Mite growth inhibitors (growth regulation)
- 11. Microbial disruptors of insect midgut membranes
- 12B. Inhibitors of mitochondrial ATP synthase (energy metabolism)
- 15. Inhibitors of chitin biosynthesis, type 0, lepidopteran (growth regulation)
- 16. Inhibitors of chitin biosynthesis, type 1, homopteran (growth regulation)
- 17. Molting disruptor, dipteran (growth regulation)
- 18. Ecdysone receptor agonists (growth regulation)
- 22. Voltage-dependent sodium channel blockers (nerve action)
- 23. Inhibitors of acetyl Co-A carboxylase (lipid synthesis, growth regulation)
- 28. Ryanodine receptor modulators (nerve and muscle action)
- un. Compounds of unknown or uncertain mode of action

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

* **Restricted Use Only.**
