

Chapter 20. Strawberry Production in Florida

B.M. Santos, N.A. Peres, J.F. Price, C.K. Chandler, V.M. Whitaker, W.M. Stall, S.M. Olson, S.A. Smith and E.H. Simonne

BOTANY

Nomenclature

Family - Rosaceae

Strawberry - *Fragaria x ananassa*

Origin

The cultivated strawberry is of recent origin resulting from a cross between *F. chiloensis* and *F. virginiana*. The former is native to the west coast of North and South America and the latter is native to the east coast of North America.

Related Species

Strawberry is the only vegetable crop in the Rosaceae family. However, a large number of ornamental plants and important tree fruits such as apple, pear, cherry, and plum are included in this family.

VARIETIES

Strawberry varieties grown in Florida are:

- Camarosa (UC - Davis)
- Carmine (UF)
- Camino Real (UC - Davis)
- Gaviota (UF)
- Strawberry Festival (UF)
- Sweet Charlie (UF)
- Treasure (JP Research)
- Ventana (UC - Davis)
- Winter Dawn (UF)

POLLINATION

Pollination of all pistils of the strawberry flower and subsequent fertilization results in maximum fruit size and attainment of shape typical of the variety. Although many insects may effect the transfer of pollen from the anthers to the pistil, honeybees are the most effective transfer agent. Accordingly, populations of wild bees in the vicinity of strawberry fields should be encouraged, care in pesticide application exercised, and possible use of rented domesticated bees considered.

PLANTING

Two types of transplants are used to begin fruiting fields in Florida, bare-root green-top plants and containerized transplants. Bare-root transplants are the most widely available type of transplant but are more difficult to establish in the field. These transplants require overhead sprinkler irrigation during the hottest part of the day for the first 7 to 12 days after planting. This irrigation reduces wilting and leaf loss while the plant develops a root system sufficient to support itself. Containerized transplants require much less overhead irrigation for reestablishment. Regardless of the type of transplant used, it is important to make planting holes approximately 2 to 3 inches deep to allow covering all roots, while setting the crowns of transplants at soil level. Buried crowns will result in weak plant establishment, whereas exposed crowns will dehydrate quickly and could reduce plant population. The most typical planting dates and establishment practices are shown in Table 1.

FERTILIZER AND LIME

Soil test results for strawberry on mineral soils are given in Table 2.

Table 1. Planting information for strawberry.

Planting dates	
North Florida	Sept 15 - Oct.15
Central Florida	Sept 15 - Oct 25
South Florida	Oct 1 - Dec 1
Establishment information	
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 ² (acre)	16,000-22,000

¹ From transplanting date.

² Populations based on closest between and within row spacing.

For drip-irrigated crops broadcast all P₂O₅, micronutrients and up to 20 to 25% of N and K₂O in before bedding. Apply remaining N and K₂O through drip tube with the schedule given in Table 3, starting 2 to 3 weeks after planting.

PLANT TISSUE ANALYSIS

Plant tissue analysis information for strawberry is given in Table 4. The analysis is done at first harvest using the most recently matured leaf.

PETIOLE SAP TESTING

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

IRRIGATION

Initial water requirements (see Chapter 3, *Principles and Practices for Irrigation Management of Vegetables*, Table 4 to 6) of strawberry transplants will be low (20%

Table 2. Soil test results and fertilizer recommendations for strawberry on 4-foot bed centers on mineral soils.¹

Target pH	N lb/A	P ₂ O ₅					K ₂ O				
		VL	L	M	H	VH	VL	L	M	H	VH
(lb/A/crop season)											
6.5	150	150	120	100	0	0	150	100	80	0	0

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

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

Production system	Nutrient	Recommended-Base fertilization ^z								Recommended-Supplemental fertilization ^z	
		Total (lbs/A)	Preplant ^y (lbs/A)	Injected ^x (lbs/A/day)				Measured "low" plant nutrient content ^{v,t}	Extended harvest season ^{v,t}		
				Growth period ^w							
				First 2 weeks	Sept. to Jan.	Feb. and Mar.	April				
Drip irrigation, raised beds, and polyethylene mulch	N	150	0-40	0.3	0.6	0.75	0.6	0.6 to 0.75 lbs/A/day for 7 days ^u	0.6 to .75 lbs/A/day ^s		
	K ₂ O	150	0-40	0.3	0.6	0.75	0.6	0.6 to 0.75 lbs/A/day for 7 days ^u	0.6 to .75 lbs/A/day ^s		

^z A=10,890 linear bed feet per acre (4-ft bed spacing); for soils testing "very low" in Mehlich 1 potassium (K₂O)

^y Applied using the modified broadcast method (fertilizer is broadcast where the beds will be formed only, and not over the entire field).

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

^w Typical growing season for strawberry grown in central Florida. For strawberry grown in North Florida, schedule should be modified according to EDIS publication HS-956 accessible at <http://edis.ifas.ufl.edu/HS190>.

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

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

^t Supplemental fertilizer applications are allowed when irrigation is scheduled following a recommended method (see Chapter 3 on irrigation scheduling in Florida). Supplemental fertilizations is to be applied in addition to base fertilization when appropriate. Supplemental fertilization is not to be applied "in advance" with the preplant fertilizer.

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

to 40% of ETo, see Chapter 3, *Principles and Practices for Irrigation Management of Vegetables*, Table 3). As plants grow, mid-season water requirements will gradually approach 50% of ETo for drip irrigated plants. Water requirements during late season growth will average 60% of ETo for drip irrigated plants. Field conditions that are too wet may promote undesirable disease conditions for plants and fruit. Therefore, irrigations should be scheduled to maintain proper bed moisture levels without resulting in excessive moisture or prolonged wetness to plants or row middles.

Sprinkler irrigation may be needed to help establish transplants. Sprinkling is needed during the hot part of the day to keep transplants from wilting and to minimize leaf loss. Irrigation for transplant establishment is usually needed for the first 7 to 12 days of plant establishment.

WEED MANAGEMENT

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

DISEASE MANAGEMENT

Several fungal diseases cause losses each season in Florida. These include Botrytis fruit rot (*Botrytis cinerea*), anthracnose fruit rot (*Colletotrichum acutatum*), Colletotrichum crown rot (*Colletotrichum gloeosporioides*), powdery mildew (*Sphaerotheca macularis*), and Phytophthora wilt and crown rot (*Phytophthora citricola* and *P. cactorum*). The only bacterial disease of importance is angular leaf spot (*Xanthomonas fragariae*).

Control of these diseases typically relies upon the use of disease free transplants and preventative applications of protectant fungicides. We currently recommend that growers apply protectant fungicides weekly throughout the season. Additional fungicide treatments should be made to control specific disease problems when they develop or when experience suggests they may develop. Chemicals approved for disease management on strawberry are listed in Table 7. Peak disease periods for south Florida are shown in Fig. 1.

INSECT AND MITE MANAGEMENT

Table 8 outlines the insecticides and miticides approved for use on strawberry.

PRODUCTION COSTS

An example of breakeven production costs for strawberry are given in Table 9.

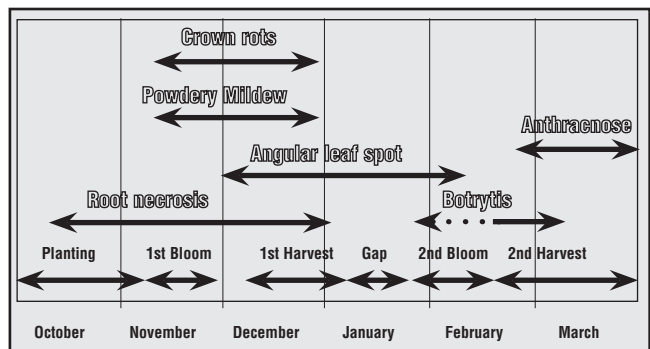


Fig. 1. Peak disease periods for central Florida.

Table 4. Plant tissue analysis for strawberry at first harvest. Dry wt. basis.

Status	N	P	K	Ca	Mg	S	Fe	Mn	Zn	B	Cu	Mo
	Percent						Parts per million					
Deficient	<3.0	0.2	1.5	0.4	0.25	0.2	50	30	20	20	5	5.0
Adequate range	3.0-3.5	0.2-0.4	1.5-2.5	0.4-1.5	0.25-0.50	0.2-0.6	50-100	30-100	20-40	20-40	5-10	5.0-8.0
High	>3.5	0.4	2.5	1.5	0.50	0.6	100	100	40	40	10	8.0
Toxic (>)								800				

Table 5. Sufficiency ranges for petiole sap testing for strawberry grown in Central Florida.

Crop development stage	Fresh petiole sap concentration (ppm)	
	NO ₃ -N	K
November, soon after planting	800-900	3000-3500
December, first harvesting	600-800	3000-3500
January, main season	600-800	2500-3000
February, main season	300-500	2000-2500
March, main season	200-500	1800-2500
April, late harvest, near end of season	200-500	1500-2000

Table 6. Chemical weed controls: strawberries.

Herbicide	Labeled crops	Time of application to crop	Rate (lbs. AI./Acre)	
			Mineral	Muck
Acifluorfen (Ultra Blazer)	Strawberry	Directed-shielded Row-middles	0.375	---
Remarks: Ultra Blazer is for selective postemergence control of certain broadleaf weeds. May be applied a 1.5pts/a as a directed shielded spray between mulched beds. Do not allow contact with strawberry plants. Do not apply more than 3 pts per season.				
Carfentrazone (Aim)	Strawberry	Preplant Directed-hooded Row-middles	0.031	0.031
Remarks: Aim may be applied as a preplant burndown treatment and/or as a post-directed hooded application to row middles for the burndown of emerged broadleaf weeds. May be tank mixed with other registered herbicides. May be applied at up to 2 oz (0.031 lb ai). Use a quality spray adjuvant such as crop oil concentrate (coc) or non-ionic surfactant at recommended rates.				
Clethodim (Select 2 EC) (Arrow) (Intensity) (Select Max)	Strawberry	Postemergence	0.09-0.25	
Remarks: Postemergence control of actively growing annual grasses. Apply at 6-16 fl oz/acre (Select, Arrow) or 9-16 fl oz/acre (Select Max). Higher rates are listed for perennial grasses. Use a crop oil concentrate for Select and Arrow, but a non-ionic surfactant may be used for Select Max. Do not apply within 4 days of harvest .				
Flumioxazin (Chateau)	Strawberry	Row Middles	0.1	
Remarks: Chateau may be applied at 3 oz product per acre with a shielded or hooded sprayer for the preemergence control of a large number of broadleaf weeds. Apply prior to weed emergence. Do not apply after fruit set. Do not allow spray or spray drift in contact with the foliage..				
Glyphosate (Roundup, Durango Touchdown, Glyphomax)	Strawberry	Chemical fallow Preplant Pre transplant	0.3 - 1.0	
Remarks: Roundup, Glyphomax and Touchdown have several formulations. Check the label of each for specific labeling directions.				
Napropamide (Devrinol 2E) (Devrinol 50DF)	Strawberry	Posttransplant and established plants	2.0 - 4.0	---
Remarks: Controls annual grasses and annual broadleaf weeds. Water in to a depth of 2 to 4 inches. Does not control established weeds. Do not apply from bloom to harvest.				
Oxyfluorfen (Goal 2 XL) (Goaltender)	Strawberry	Fallow bed prior to transplanting Mulch culture	0.25 - 0.5	---
Remarks: Must have a 30-day treatment to planting interval. Mulch may be put down any time during this period. Apply as a preemergence broadcast or banded treatment to pre-formed beds as a fallow bed application.				
Paraquat (Gramoxone Inteon) (Firestorm)	Strawberry	Postemergence directed spray	0.47	---
Remarks: Postemergence directed spray. For control of emerged annual broadleaf weeds and grasses and for top kill and suppression of emerged perennial weeds between the rows after crop emergence or establishment. Apply 1.2 pts Gramoxone Extra or 1.6 pts of Boa per sprayed acre in a minimum of 20 gals. spray mix. Use shields to prevent spray contact with crop plants. Use a non-ionic surfactant. Do not apply more than 3 times per crop season. Do not apply within 3 days of harvest.				
Paraquat (Gramoxone Inteon)	Strawberry	Post Harvest directed spray Desiccation	0.5	
Remarks: Special Local Needs (24c) Label for desiccation of strawberry plants following harvest. Add a non-ionic surfactant or crop oil concentrated to the spray mix.				

Table 6. Continued.

Herbicide	Labeled crops	Time of application to crop	Rate (lbs. AI./Acre)	
			Mineral	Muck
Pelargonic Acid (Scythe)	Strawberry	Preplant Directed-Shielded	3-10% v/v	--
Remarks: Product is a contact, nonselective, foliar herbicide. It has no residual control. May be tank mixed with soil residual herbicides. Consult label for rates.				
Pendimethalin (Prowl H ₂ O)	Strawberry	Post directed Row middles	0.072	---
Remarks: May be applied pre-transplant, but under under mulch. May be applied at 1.5pts/A to row middles. Do not apply within 35 days of harvest.				
Terbacil (Sinbar)	Strawberry	Pretransplant	0.2	---
Remarks: Make a once-per-year application of 4 oz. of Sinbar per acre after bedding but prior to transplanting. Note - a 110 day PHI is on label. Check rotational crop limitations.				

Table 7. Fungicides registered for use on Florida strawberries.

Chemical	Fungicide Group	Max Rate / Acre		Min. Days to Harvest	Pertinent Diseases	Remarks
		Application	Season			
Badge SC, Basic Copper 53, Badge X2, Champ DP Dry Prill, Champ Formula 2 Flowable, Champ WG, Champion Wettable Powder, COC DF, COC WP, C-O-C-S WDG, Copper Count-N, Cuprofix Ultra 40 Disperss, Kentan DF, Kocide 2000, Kocide 3000, Kocide DF, Nordox, Nordox 75WG, Nu Cop 3L, Nu Cop 50 DF, Nu Cop 50 WP, Nu Cop HB (copper)	M1	See label	See label	1-2	Angular leaf spot	Frequent use of copper fungicides may cause foliar burn
Kumulus DF, Micro Sulf, Microfine sulfur, Microthiol Disperss, Sulfur 90W, Super-Six, Wettable Sulfur, Wettable Sulfur 92, Yellow Jacket Dusting Sulfur, Yellow Jacket Wettable sulfur (sulfur)	M2	See label	See label	1	Powdery mildew	Do not use during hot weather
Thiram Granuflo (thiram)	M3	4.4 lb	22 lb	3	Botrytis fruit rot	Do not rotate treated crops with other crops for which Thiram is not registered
Captan 50W, Captan 50 WP, Captan 80 WDG, Captec 4L (captan)	M4	See label	See label	1	Anthracnose Botrytis fruit rot Leaf spot	Rate per treated acre. Special label for FL allows up to 24 applications per season
Sanction (potassium phosphate; sulfur)	M2+33	6 pts	24 pts	N/A	Powdery mildew	Do not apply during hot weather. May cause injure during certain climatic conditions
Captevate 68 WDG (captan + fenhexamid)	M4 + 17	5.25 lb	21 lb	0	Botrytis fruit rot Anthracnose	Do not make more than 2 consecutive applications

Table 7. Continued.

Chemical	Fungicide Group	Max Rate / Acre		Min. Days to Harvest	Pertinent Diseases	Remarks
		Application	Season			
Thiophanate-methyl 85 WDG, T-Methyl 70 W WSB, T-Methyl E-AG 4.5 F, T-Methyl E-AG 70 WSB, Topsin 4.5 FL, Topsin 70 WDG, Topsin M 70 WP, Topsin M WSB (thiophanate-methyl)	1	See label	See label	1	Botrytis fruit rot Colletotrichum crown rot Leaf scorch Leaf blight Powdery mildew	Fungicides from different chemical groups should be used in spray program for disease resistance management
Enclosure 4, Iprodione 4L AG , Nevado 4F, Rovral 4 Flowable (iprodione)	2	2 pt	2 pt	N/A	Botrytis fruit rot Phomopsis soft rot Leaf spot Stem end rot	Do not make more than 1 application per season. Do not apply after first fruiting flower
Bumper 41.8 EC, Orbit, Propiconazole E-Ag 41.8 EC, Tilt (propiconazole)	3	4 fl oz	16 fl oz	0	Anthrachnose Leaf spot Powdery mildew	Do not make more than 2 consecutive applications
Nova 40W, Rally 40WSP, Sonoma 40 WSP (myclobutanil)	3	5 oz	30 oz	0	Powdery mildew Leaf spot Leaf blight	Do not plant rotational crops until 30 days after last application
Procure 50WS Procure 480 SC (triflumizole)	3	8 oz	32 oz	1	Powdery mildew	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
MetaStar 2E AG (metalaxyl)	4	2 qts	6 qts	0	Phytophthora diseases	See label for use in drip irrigation
Ridomil Gold EC, Ridomil Gold SL (mefenoxam)	4	1 pt/trtd acre	1 ½ qt/ trtd acre	0	Phytophthora diseases	See label for use in drip irrigation
Scala SC (pyrimethanil)	9	18 fl oz	54 fl oz	1	Botrytis fruit rot	Do not make more than 2 consecutive applications. Do not use more than 2 of 6 appl. in any one season
Abound Heritage (azoxystrobin)	11	15.4 fl oz	1.92 qt	0	Anthrachnose Powdery mildew <i>Botrytis</i> (suppression only)	Do not make more than 2 sequential appl. and no more than 4 appl/crop year. See label for instructions on dipping transplants
Cabrio EG (pyraclostrobin)	11	14 fl oz	70 fl oz	0	Anthrachnose Leaf spot Powdery mildew <i>Botrytis</i> (suppression only)	Do not make more than 2 sequential applications and no more than 5 appl/crop year

Table 7. Continued.

Chemical	Fungicide Group	Max Rate / Acre		Min. Days to Harvest	Pertinent Diseases	Remarks
		Application	Season			
Flint (trifloxystrobin)	11	3.2 oz.	19.2 oz.	0	Powdery mildew Phomopsis leaf blight and soft rot Botrytis (suppression) Anthracnose (suppression)	Do not apply more than 2 sequential applications of Flint or other Group 11 fungicides. Do not exceed more than 6 total applications of Group 11 fungicides per season
Quintec (quinoxifen)	13	6 fl oz	24 fl oz	1	Powdery mildew	Do not make more than 2 consecutive applications or more than 4 applications per crop
Elevate 50 WDG (fenhexamid)	17	1.5 lb	6 lb	0	Botrytis fruit rot	Do not make more than 2 consecutive applications
Ph-D WDG (polyoxin-D zinc salt)	19	6.2 oz	3.1 oz	0	Anthracnose Botrytis fruit rot Powdery mildew	Do not make more than 5 applications. Use in alternation with different modes of action.
Quilt Xcel (azoxystrobin + propiconazole)	11+3	14 oz	56 oz	0	Anthracnose Leaf Spot Powdery mildew	Do not make more than 2 consecutive applications and no more than 4 appl/crop
Pristine (pyraclostrobin + boscalid)	11 + 7	23 oz	115 oz	0	Botrytis fruit rot Anthracnose Powdery mildew Leaf spot	Do not make more than 2 consecutive appl. and no more than 5 appl/ crop
Switch 62.5 WG (cyprodinil + fludioxonil)	9 + 12	14 oz	56 oz	0	Botrytis fruit rot Anthracnose	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
Fosphite, Fungi-Phite, Helena Prophyt, Phorcephite Phostrol, Rampart, Topaz (potassium phosphite)	33	See label	See label	0	Phytophthora diseases	May cause foliar burn if applied with copper based products
Aliette WDG, Legion 80WDG, Linebacker WDG (fosetyl-Al)	33	5 lb	30 lb	12 hr	Phytophthora diseases	Do not tank mix with copper fungicides, adjuvants or foliar fertilizers
Serenade Max, Serenade ASO (<i>Bacillus subtilis</i>)	44	See label	See label	0	Powdery mildew Botrytis fruit rot Anthracnose	Should to be used in combination with other fungicides
Regalia, Regalia SC (<i>Reynoutria sachalinensis</i>)	P	1% v/v	-	0	Powdery mildew	See label for additional instructions
Armcarb 100, Kaligreen, Milstop (potassium bicarbonate)	NC	See label	See label	1	Powdery mildew	Do not mix with highly acid products

Table 7. Continued.

Chemical	Fungicide Group	Max Rate / Acre		Min. Days to Harvest	Pertinent Diseases	Remarks
		Application	Season			
Actinovate AG (<i>Streptomyces lydicus</i>)	NC	12 oz.	-	0	Botrytis Powdery mildew	Should be integrated into an overall disease management strategy
Oxidate (hydrogen dioxide)	NC	64 fl. oz.	-	0	Botrytis Crown rot Powdery mildew Angular leaf spot	Conduct a compatibility test before tank mixing with fertilizers, fungicides or bactericides
Sonata (<i>Bacillus pumilus</i>)	NC	4 qt	-	0	Powdery mildew (suppression)	Use in a tank mix or rotational program with other registered fungicides
SoilGard 12 G (<i>Glicoladium virens</i>)	NC	See label	See label	See label	Pythium Phytophthora	See label for additional comments

Table 8. Selected insecticides approved for use on insect attacking strawberry.

Active Ingredient	Trade Name	Rate	Re-entry Interval	Days To Harvest	Pests Controlled
Abamectin	Abacus	16 fl oz/A	12 hours	3	twospotted spider mites
	AgriMek 0.15 EC	16 oz/A	12 hours	3	twospotted spider mites
	Reaper 0.15 EC	16 fl oz/A	12 hours	3	twospotted spider mites
	Temprano	16 fl oz/A	12 hours	3	twospotted spider mites
	Zoro	16 fl oz/A	12 hours	3	twospotted spider mites
Acetamiprid	Assail 30SG	see label	12 hours	1	aphids, flea beetles, obliquebanded leafroller, plant bugs (Lygus spp.), sap beetles, spittlebug, thrips, whiteflies
	Assail 70WP	see label	12 hours	1	aphids, flea beetles, obliquebanded leafroller, plant bugs (Lygus spp.), sap beetles, spittlebug, thrips, whiteflies
Acequinocyl	Kanenite 15 SC	21-31 fl oz./A	12 hours	1	twospotted spider mites
Azadirachtin	Neemix 4.5% EC	See label	12 hours	0	armyworms, caterpillars, loopers, thrips
	Ecozin 3% EC	See label	12 hours	0	aphids, beetles, borers, bugs, fruit flies,
	Ecozin Plus 1.2% ME	See label	4 hours	0	Aphids, armyworms, caterpillars, beetles, fruit flies, thrips, whiteflies
	Azahar	See label	4 hours	0	Aphids, armyworms, cutworms, beetles, flies, leafrollers, loopers, mites, thrips, whiteflies
	Azatin 3% XL	See label	4 hours	0	aphids, armyworms, beetles, caterpillars and loopers, thrips
	Aza-Direct	See label	4 hours	0	aphids, armyworms, flies, mites, thrips, whiteflies
Bacillus thuringiensis kurstaki	Javelin WG	0.25-1.5 lbs/A	4 hours	0	armyworms, loopers, omnivorous leaf tier, armyworm, loopers
	Lepinox WDG	1-2 lbs/A	12 hours	0	
	Biobit HP	See label	4 hours	0	armyworms, loopers,
	DiPel ES	See label	4 hours	0	armyworm, caterpillar, looper
	DiPel DF	See label	4 hours	0	armyworm,
	Deliver	See label	4 hours	0	armyworm, looper
Bacillus thuringiensis aizawai	Agree WG	0.5-2 lbs/A	4 hours	0	armyworms
	Xentari	See label	4 hours	0	armyworms, loopers,
Beauveria bassiana	Botanigard ES	See label	4 hours	0	aphids, thrips
	Mycotrol O	See label	4 hours	0	aphids, thrips
	Naturalis L	10-15 fl oz/A	4 hours	0	ants, aphids, armyworms, loopers, lygus bug, tarnished plant bug, thrips
Bifenazate	Acramite 50 WS	0.75-1 lb/A	12 hours	1	twospotted spider mite
Bifenthrin	Brigade WSB	See label	12 hours	0	aphids, armyworms, plant bugs, stink bugs, spider mites
Buprofezin	Courier 40SC	9-12 oz/A	12 hours	2	whiteflies
Carbaryl	Sevin 4F	See label	12 hours	7	cutworms, omnivorous leaftiers, tarnished plant bug
	Cutworm & Cricket Bait	See label	12 hours	7	armyworms, crickets, ants, grasshoppers
	Sevin 80% S	See label	12 hours	7	armyworms, omnivorous leaftier, tarnished plant bug
	Carbaryl 4 L	See label	12 hours	7	omnivorous leaftier, tarnished plant bug

Table 8. Continued.

Active Ingredient	Trade Name	Rate	Re-entry Interval	Days To Harvest	Pests Controlled
Chlorantraniliprole	Coragen	3.5-5 fl oz/A	4 hours	1	Beet armyworm, cabbage looper, corn earworm, spider mites
Chlorpyrifos	Govern 4E	see label	24 hours	21	grubs
	Lorsban 75WG	see label	24 hours	21	grubs
Diazinon	Diazinon 50W	See label	24 hours	5	aphids, cyclamen mites
	Diazinon AG 600	See label	24 hours	5	aphids, cyclamen mites
	Diazinon AG 500	See label	24 hours	5	aphids, cyclamen mites
Dicofol	Dicofol 4 E	See label	31 days	2	cyclamen mites, twospotted mites
Endosulfan	Thionex 50W	See label	5 days	4	cyclamen mite, tarnished plant bugs
	Endosulfan 3EC	See label	48 hours	4	cyclamen mite, tarnished plant bugs
Etoazole	Zeal	See label	12 hours	1	twospotted spider mite, lygus, spittlebug, tarnished plant bug
Fenpropathrin	Danitol 2.4 EC	See label	24 hours	2	lygus, tarnished plant bug, twospotted spider mites
Fenbutatin oxide	Vendex 50 WP	1.5-2 lbs/A	48 hours	1	twospotted spider mites
Fenpyroximate	Portal 5% EC	2 pt/A	12 hours	1	twospotted spider mites, cyclamen mites, whiteflies
Hexythiazox	Savey 50 DF	6 oz/A	12 hours	3	twospotted spider mite
Imidacloprid	Admire 2 Flowable	24-32 fl oz/A	12 hours	14	aphids, whiteflies
	Admire Pro	10.5-14 fl oz/A	12 hours	14	aphids, whiteflies
	Alias 2F	24-32 fl oz/A	12 hours	14	aphids, whiteflies
	Couraze 1.6F	3.8 fl oz/A	12 hours	7	aphids, whiteflies
	Provado 1.6	3.75 fl oz/A	12 hours	7	aphids, whiteflies
Malathion	Malathion 5EC	See label	12 hours	3	aphids, field cricket, lygus bugs, thrips
	Malathion 8F	1.5-2.0 pt/A	12 hours	3	aphids, field crickets, leafhopper, lygus bugs
Methoxyfenozide	Intrepid 2F	6-12 fl oz	4 hours	3	armyworms, corn earworm
Naled	DiBrom 8-E	1 pt/A	48 hours	1	leafrollers, spider mites, omnivorous leaftiers, aphids, thrips, lygus
Novaluron	Rimon 0.83EC	See label	12 hours	1	sap beetle (Nitidulidae), Asian cockroach, armyworms, loopers, corn earworm
Neem oil	Trilogy	See label	4 hours	0	aphids, mites, whiteflies, thrips ¹
Potassium salts of acids (insecticidal)	M-Pede	See label	12 hours	0	aphids, leafhoppers, twospotted mites
Propargite	Omite CR	6 lbs/A	3 days	1 yr	twospotted spider mite
Pyrethrins	PyGanic EC 5.0	See label	12 hours	0	aphids, armyworms, beet armyworm, fruit flies, lygus, tarnished plant bugs, thrips, whiteflies
Pyrethrins & Piperonyl Butoxide	Evergreen EC 60-4	2-16 fl oz/A	12 hours	0	aphids, armyworms, beet armyworm, fruit flies, lygus, tarnished plant bugs, thrips, whiteflies
Pyrethrins & Rotenone	Pyrellin EC	1-2 pt./A	12 hours	12 hours	mites, thrips
Pyriproxyfen	Esteem 0.86 EC	10 fl oz/A	12 hours	2	banded wing whitefly, greenhouse whitefly, silverleaf whitefly
	Esteem Ant Bait	1.5-2 lbs/A	12 hours	1	red imported fire ant
(S) methoprene	Extinguish fire ant bait	See label	4 hours	0	fire ants
Spinetoram	Radiant SC	6-10 fl oz/A	4 hours	1	armyworms, leafrollers, thrips

Table 8. Continued.

Active Ingredient	Trade Name	Rate	Re-entry Interval	Days To Harvest	Pests Controlled
Spinosad	Entrust	1.25-1.5 oz/A	4 hours	1	armyworms including beet armyworm, thrips, leaf rollers, omnivorous leaf tiers,
	GF-120 NF Fruit Fly Bait	See label	4 hours	1	Tephritid flies
	Spintor 2 SC	4-6 fl oz/A	4 hours	1	armyworms including beet armyworm, thrips, leaf rollers, omnivorous leaf tiers
	Justice Bait	2.5-4 lb/A	4 hours	0	imported fire ants
Spiromesifen	Oberon 2SC	12-16 fl. oz/A	12 hours	3	Twospotted spider mite, whiteflies
Thiamethoxam	Actara 25 WG	See label	12 hours	3	aphids, whiteflies
Thiamethoxam & chlorantraniliprole	Voliam Flexi	See label	12 hours	3	Aphids, beet armyworm, cabbage looper, corn earworm, leafhoppers, whiteflies

Table 9. Breakeven production costs of strawberries at various yield levels in the Plant City area, 2008-2009.

	Cost per acre	Yield (12 lb flats/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