UF UNIVERSITY of FLORIDA
IFAS Extension

# Chapter 38.
# Strawberry Production in Florida

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## 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
Carmine
Camino Real
Gaviota
Strawberry Festival
Sweet Charlie
Treasure
Ventana
Winter Dawn

## 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 not to set the transplant too deep, covering the crown, or too shallow, leaving roots exposed.

## FERTILIZER AND LIME

For sprinkler-irrigated crops, broadcast all $P_2O_5$, micronutrients and 25% of N and $K_2O$ before mulch bedding. Place remaining N and $K_2O$ in band in center of bed 3 to 4 inches deep. Slow-release N can supply a portion of N requirement (25%) applied in the broadcast material. Soil test results for strawberry on mineral soils are given in Table 2.

**Table 1.** Planting information for strawberry.

| **Planting dates** | |
|---|---|
| North Florida | Sept 20 - Oct.15 |
| Central Florida | Sept 25 - Oct 25 |
| South Florida | Oct 1 - Dec 1 |
| **Establishment 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 - 60[1] |
| Plant populations[2] (acre) | 16,000-22,000 |

[1] From transplanting date.

[2] Populations based on closest between and within row spacing.



This document is HS736, Horticultural Sciences Dept., UF/IFAS, Fla. Coop. Ext. Serv., November 2006

For drip-irrigated crops broadcast all $P_2O_5$, micronutrients and up to 20 to 25% of N and $K_2O$ in before bedding. Apply remaining N and $K_2O$ 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 8, *Principles and Practices for Irrigation Management of Vegetables*, Table 4 to 6) of strawberry transplants will be low (20% to 40% of ETo, see Chapter 8, *Principles and Practices for Irrigation*

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

| Target pH | N lb/A | $P_2O_5$ (lb/A/crop season) | | | | | $K_2O$ (lb/A/crop season) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | VL | L | M | H | VH | VL | L | M | H | VH |
| 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 ($K_2O$)

| Production system | Nutrient | Recommended-Base fertilization[z] Total (lbs/A) | Preplant[y] (lbs/A) | Injected[x] (lbs/A/day) Growth period[w] First 2 weeks | Sept. to Jan. | Feb. and Mar. | April | Recommended-Supplemental fertilization[z] Measured "low" plant nutrient content[v,t] | Extended harvest season[v,t] |
|---|---|---|---|---|---|---|---|---|---|
| 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] |
| | $K_2O$ | 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 ($K_2O$)

[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 $K_2O$ are applied preplant. Reduce schedule proportionally to the amount of N and $K_2O$ 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 8 on irrigation scheduling in Florida). Supplemental fertilizations is to be applied in addition to base fertilization when appropriate. Supplemental fertilization is not to be applied "in advance" with the preplant fertilizer.

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

*Management of Vegetables*, Table 3). As plants grow, mid-season water requirements will gradually approach 50% of ETo for drip irrigated plants and 70% of ETo for overhead irrigated plants. Water requirements during late season growth will average 60% of ETo for drip irrigated plants and 85% of ETo for overhead 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 also is 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 strawbery 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. 38-1.

## INSECT AND MITE MANAGEMENT

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

## PRODUCTION COSTS

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

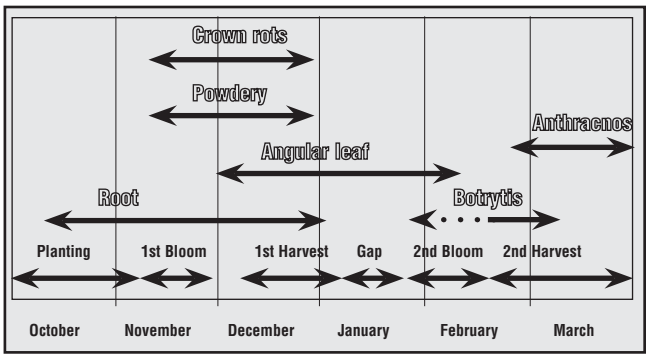


**Fig. 38-1**. Peak disease periods for south Florida.

**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 |
|---|---|---|---|---|
| Carfentrazone (Aim) | Strawberry | Preplant<br>Directed-hooded<br>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 burn-down of emerged broadleaf weeds. May be tank mixed with other registered herbicides. May be applied at up to 2 oz (0.031 lb ai). Use a quality spray adjuvant such as crop oil concentrate (coc) or non-ionic surfactant at recommended rates. | | | | |
| Clethodim (Select) | Strawberry | Postemergence | 0.1-0.125 | --- |
| **Remarks:** Use Select for the control of annual and perennial grasses. Use a crop-oil concentrate at 1% v/v in the finished spray volume. Do not apply more than 8 fl. oz. product/A per application. Do not apply within 4 days of harvest. | | | | |
| Glyphosate (Roundup, Durango Touchdown, Glyphomax) | Strawberry | Chemical fallow<br>Preplant<br>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 12E) (Devrinol 10G) | 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<br>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) | 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<br>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. | | | | |
| Pelargonic Acid (Scythe) | Strawberry | Preplant<br>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. | | | | |
| 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 approved for disease management of strawberry diseases in Florida

| Chemical | Fungicide Group[a] | Maximum Rate/Acre/ Application | Maximum Rate/Acre/ Season | Min. Days to Harvest | Pertinent Diseases or Pathogens | Remarks |
|---|---|---|---|---|---|---|
| Abound (azoxystrobin) | 11 | 15.4 fl ozs | 1.92 qts | 0 | Anthracnose<br>Powdery mildew<br>Botrytis (suppression only) | Do not make more than 2 sequential applications and no more than 4 applications per crop year. See label for instructions on dipping transplants |
| Aliette WDG[1] (fosetyl-Al) | 33 | 5 lbs | 30 lbs | 12 hours | Phytophthora diseases | Do not tank mix with copper fungicides |
| Cabrio EG (pyraclostrobin) | 11 | 14 fl ozs | 70 fl ozs | 0 | Anthracnose<br>Leaf spot<br>Powdery mildew<br>Botrytis (suppression only) | Do not make more than 2 sequential applications and no more than 5 applications per crop year |
| Captan 50 WP (captan) | M3 | 6 lbs | 48 lbs | 1[2] | Anthracnose<br>Botrytis fruit rot<br>Leaf spot | Rate per treated acre. Special label for FL allows up to 24 applications per season |
| Captan 80 WDG (captan) | M3 | 3.75 lbs | 30 lbs | 1[2] | Anthracnose<br>Botrytis fruit rot<br>Leaf spot | Rate per treated acre. Special label for FL allows up to 24 applications per season |
| Captec 4L (captan) | M3 | 3 qts | 24 qts | 1[2] | Anthracnose<br>Botrytis fruit rot,<br>Leaf spot | Rate per treated acre. Special label for FL allows up to 24 applications per season |
| Captevate 68 WDG (captan + fenhexamid) | M3 + 17 | 5.25 lbs. | 21 lbs. | 0 | Botrytis fruit rot<br>Anthracnose | Do not make more than 2 consecutive applications |
| Copper (many brands)[3] | M1 or M9 | varies | varies | 1-2 | Angular leaf spot | Frequent use of copper fungicides may cause foliar burn |
| Elevate 50 WDG (fenhexamid) | 17 | 1.5 lbs | 6 lbs | 0 | Botrytis fruit rot | Do not make more than 2 consecutive applications |
| Nova 40W (myclobutanil) | 3 | 5 oz. | 30 oz. | 0 | Powdery mildew,<br>Leaf spot,<br>Leaf blight | Do not plant rotational crops until 30 days after last application |
| Potassium bicarbonate (many brands)[4] | | varies | varies | 1 | Powdery mildew | Do not mix with highly acid products |
| Potassium phosphate (many brands)[5] | | varies | varies | 0 | Phytophthora diseases | May cause foliar burn if applied with copper based products |
| Pristine (pyraclostrobin + boscalid) | 11 + 7 | 23 ozs | 115 ozs | 0 | Botrytis fruit rot<br>Anthracnose<br>Powdery mildew<br>Leaf spot | Do not make more than 2 consecutive applications and no more than 5 applications per crop |
| Procure 50WS (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 |
| Ridomil Gold EC (metalaxyl-M) | 4 | 1 pt/trtd. acre | 1 ½ qts/trtd acre | | Phytophthora diseases | See label for use in drip irrigation |
| Rovral 4[6] (iprodione) | 2 | 2 pts | 2 pts | N/A | Botrytis fruit rot,<br>Stem end rot,<br>Phomopsis soft rot,<br>Leaf spot,<br>Rhizoctonia diseases[7] | Do not make more than 1 application per season. Do not apply after bloom initiation |

**Table 7.** Continued.

| Chemical | Fungicide Group[a] | Maximum Rate/Acre/ Application | Season | Min. Days to Harvest | Pertinent Diseases or Pathogens | Remarks |
|---|---|---|---|---|---|---|
| Rovral 75 WG (iprodione) | 2 | 1.33 | 1.33 | N/A | Botrytis fruit rot, Stem end rot, Phomopsis soft rot, Leaf spot, Rhizoctonia diseases[7] | Do not make more than 1 application per season. Do not apply after bloom initiation |
| 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 applications per season |
| Serenade Max (Bacillus subtilis) | | 3 lbs. | | 0 | Powdery mildew, Botrytis fruit rot, Anthracnose | Should to be used in combination with other fungicides |
| Sulfur (many brands)[8] | M1 or M9 | varies | varies | 1 | Powdery mildew | Do not use during hot weather |
| Switch 62.5 WG (cyprodinil + fludioxonil) | 9 + 12 | 14 ozs | 56 ozs | 0 | Botrytis fruit rot Anthracnose | Do not make more than 2 consecutive applications. Do not plant crops not on the label for 30 days after last application |
| Thiram 65 WSB (thiram) | M2 | 5 lbs | 25 lbs | 3 | Botrytis fruit rot | Do not rotate treated crops with other crops for which Thiram is not registered |
| Topsin 4.5 L (thyophanate-methyl) | 1 | 20 fl. oz. | 80 fl. oz. | 1 | Botrytis fruit rot, Colletotrichum crown rot, Leaf scorch, Leaf blight, Powdery mildew | Do not use Topsin alone. Fungicides from different chemical groups should be used in spray program for disease resistance management |
| Topsin M 70 W, Topsin M WSB (thyophanate-methyl) | 1 | 1 lb | 4 lbs | 1 | Botrytis fruit rot, Colletotrichum crown rot, Leaf scorch, Leaf blight, Powdery mildew | Do not use Topsin alone. Fungicides from different chemical groups should be used in spray program for disease resistance management |

N/A – Not available

[1] See label for instructions for dip and foliar treatments for red stele

[2] Unless protective clothing is worn

[3] e.g. Kocide, Champion, Champ, Basicop, Cuprofix Disperss, Copper Count-N, Nordox, Nu Cop

[4] e.g. Kaligreen, Armicarb, Milstop

[5] e.g. Fosphite, Helena Prophyt

[6] 2pts./100 gal. water may be used as a preplant dip immediately prior to planting

[7] Not listed on label

[8] e.g. Micro Sulf, Enduro, Sulfur 90W, Super-Six, Microthiol Disperss, Wettable Sulfur, Kumulus

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

**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 | AgriMek 0.15 EC | 16 oz/A | 12 hours | 3 | twospotted spider mites |
| Acequinocyl | Kanenite 15 SC | 21-31 fl oz./A | 12 hours | 1 | twospotted spider mites |
| Azadirachtin | Neemix 0.25% | 0.5-2 gal/A | 4 hours | 0 | armyworms, caterpillars, loopers |
| | 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, |
| | Azatin 3% XL Plus | 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 kurstakie | Javelin WG | 0.25-1.5 lbs/A | 4 hours | 0 | armyworms, cutworms, loopers, omnivorous leaf tier, |
| | Lepinox WDG | 1-2 lbs/A | 12 hours | 0 | armyworm, loopers |
| | Biobit HP | See label | 4 hours | 0 | armyworms, loopers, |
| | DiPel ES | See label | 4 hours | 0 | armyworm, caterpillar cutworm, looper |
| | DiPel DF | See label | 4 hours | 0 | armyworm, cutworm, |
| | Deliver | See label | 4 hours | 0 | armyworm, cutworm, looper |
| Bacillus thuringiensis aizawai | Agree WG | 0.5-2 lbs/A | 4 hours | 0 | armyworms |
| | Xentari | See label | 4 hours | 0 | armyworms, cutworms, 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 |
| Carbaryl | Sevin 4F | See label | 12 hours | 7 | cutworms, omnivorous leaftiers, tarnished plant bug |
| | Sevin 5% Bait | 40 lbs/A | 12 hours | 7 | armyworms, crickets, cutworms, grasshoppers |
| | Sevin 80% S | See label | 12 hours | 7 | armyworms, cutworms, omnivorous leaftier, tarnished plant bug |
| | Carbaryl 4 L | See label | 12 hours | 7 | cutworms, omnivorous leaftier, tarnished plant bug |
| Diazinon | Diazinon 50W | See label | 24 hours | 5 | aphids, twospotted mites, cyclamen |
| | Diazinon 4AG | See label | 24 hours | 5 | aphids, twospotted mites, cyclamen |
| | Diazinon AG 600 | See label | 24 hours | 5 | aphids, twospotted mites, cyclamen |
| | Diazinon AG 500 | See label | 24 hours | 5 | aphids, twospotted mites, cyclamen mites |
| Dicofol | Kelthane 50 WSP | See label | 48 hours | 3 | cyclamen mites, two spotted spider mites |
| | Dicofol 4 E | See label | 12 hours | 2 | Cyclamen mites, twospotted mites |
| Endosulfan | Thiodan 50WP | See label | 24 hours | 4 | cyclamen mite, tarnished plant bugs |
| | Phaser 3EC | See label | 24 hours | 4 | cyclamen mite, tarnished plant bugs |
| Etoxazole | 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 |
| 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 |

**Table 8.** Continued.

| Active Ingredient | Trade Name | Rate | Re-entry Interval | Days To Harvest | Pests Controlled |
|---|---|---|---|---|---|
| Malathion | Malathion 5EC | See label | 12 hours | 3 | aphids, spider mites, field cricket lygus bugs, thrips |
| | Malathion 8F | 1.5-2.0 pt/A | 12 hours | 3 | aphids, field crickets, leafhopper, lygus bugs, spider mites |
| Methomyl | Lannate LV | See label | 48 hours | 3-Fresh fruit 10- Processing fruit | aphids, armyworms, omnivorous leaftiers, lygus bugs, thrips |
| | Lannate SP | See label | 48 hours | 3-Fresh fruit 10- Processing fruit | aphids, armyworms, omnivorous leaftiers, lygus bugs, thrips |
| Methoxyfenozide | Intrepid 2F | 6-12 fl oz | 4 hours | 3 | armyworms, corn earworm, cutworm[1] |
| Naled | DiBrom 8-E | 1 pt/A | 48 hours | 1 | leafrollers, spider mites, omnivorous leaftiers, aphids, thrips, lygus |
| 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 | Non-bearing plants for 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 |
| Spinosad | Entrust | 1.25-1.5 oz/A | 4 hours | 1 | armyworms including beet armyworm, thrips, leaf rollers, omnivorous leaftiers, |
| | Spintor 2 SC | 4-6 fl oz/A | 4 hours | 1 | armyworms including beet armyworm, thrips, leaf rollers, omnivorous leaftiers |
| | 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 |
| Sulfur | Sulfur 6L | 5.33-13 pt/A | 24 hours | 0 | twospotted spider mite |
| Thiamethoxam | Actara 25 WG | See label | 12 hours | 3 | aphids, whiteflies |

[1] Suppression only

**Table 9.** Cost per flat for strawberries at various yield levels in the Plant City area, 2004-2005.

| | | Yield (flats/acre) | | | | |
|---|---|---|---|---|---|---|
| | Cost per acre | 2,400 | 2,500 | 2,600 | 2,700 | 2,800 |
| Variable Costs | $7,612.36 | $3.17 | $3.04 | $2.93 | $2.82 | $2.72 |
| Fixed Costs | $3,858.18 | $1.61 | $1.54 | $1.48 | $1.43 | $1.338 |
| Harvest Cost/unit | | $5.60 | $5.60 | $5.60 | $5.60 | $5.60 |
| Total Cost/unit | | $10.38 | $10.19 | $10.01 | $9.85 | $9.70 |