Crop Profile for Figs in California

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General Production Information

- California ranks first in the nation in fig production, accounting for nearly 100% of all figs produced nationally (1). California ranks second, after Turkey, in the worldwide production of figs (2).
- In 1998, 16,276 acres produced 1.05 tons of dried figs per acre at a price of $586 per ton (9).
- The value of California's fig crop in 1998 was $9,662,554 (9).
- In 1998, the variety Calimyrna was produced on approximately 45% of the acreage. The varieties Adriatic, Mission and Kadota were produced on 25%, 23% and 7% of the acreage, respectively (9).

Production Regions

Fig-producing regions typically have mild winters and hot, dry summers. The fig tree can withstand some frost and are drought-tolerant. Figs can be grown on a wide range of soils, but the soil should be well-drained (3). The San Joaquin Valley is the predominate fig-producing area in California with Madera, Merced, and Fresno counties leading in production (1).

Production Practices

Franciscan missionaries planted the first figs in California in 1769. There are two types of figs grown in California: Smyrna and common figs. Smyrna figs require pollination by a fig wasp, *Blastophaga psenes*, whereas, common figs produce fruit without pollination. Some common fig cultivars grown in California are Kadota, Mission, Conadria, and White Adriatic. The Smyrna-type fig cultivar grown in California is Calimyrna (2, 3). Figs that require wasp-pollination consist of two groups of trees, the caprifig and the edible fig. The caprifig produces an inedible false-fruit that is necessary for the pollination of edible figs because they provide the habitat for the wasp. Since it has been discovered that spores of *Fusarium moniliforme* were transmitted from caprifigs to the edible fig, caprifigs are no longer planted in rows among the edible fig. Instead separate plantings are established and caprifigs are picked just before the wasps begin to emerge. Disease-free caprifigs are then placed in wire baskets or paper bags hung in the trees of edible figs (6).

Young figs are grown from rooted cuttings. The trees are planted approximately12 feet apart with 20-28 feet between rows. Fig trees will bear sufficient fruit for commercial harvest after 2-3 years. Irrigation

systems include furrow, flooding, sprinklers and drip. Nitrogen is the only nutrient applied regularly at 20 – 40 lb/acre (2, 3).

A small percent of figs are hand picked for fresh market. Most figs semi-dry on the tree and are allowed to fall to the ground to be mechanically collected. Harvests occur at 1-2 week intervals during the harvest season from June 10 – October 15 (1, 2).

Pesticide Data:
Label rates, re-entry intervals and pre-harvest intervals for all chemicals listed in this document are from labels. Many of the labels are contained in the Crop Protection Reference (4) or at http://www.cdms.net/manuf/manufac.asp. Percent of acres treated, average number of applications, median application rate, and total lb a.i. applied are from the California Department of Pesticide Regulation (5).

Insect Pests

Driedfruit Beetles

Driedfruit beetle: ***Carpophilus hemipterus***
Freeman sap beetle: ***Carpophilus freemani***
Confused sap beetle: ***Carpophilus mutilatus***

Driedfruit beetles, also known as sap beetles, belong to the family Nitidulidae. Driedfruit beetle, *Carpophilus hemipterus*, is the most common species, but the Freeman sap beetle, *C. freemani*, and the confused sap beetle, *C. mutilatus*, are also common and can be the most abundant in some orchards. Adults are small brown or black beetles with or without lighter spots on the wings, depending on the species. They range in size from 0.1 to 0.2 inch long. Larvae are white and 0.1 to 0.2 inch long when mature. They have tan head capsules, three pairs of true legs, and two hornlike structures on the posterior. Driedfruit beetles have a wide host range and will infest any ripe or fermenting fruit.

Driedfruit beetles can be very damaging to figs. Their presence in the fruit results in downgrading or rejection of the fruit. They transmit spoilage organisms that cause fruit souring. They also increase the attractiveness of the fruit to other pests such as vinegar flies and navel orangeworm.

All commercial varieties of figs are susceptible to infestation by driedfruit beetles. However, varieties that have small eyes, such as Missions, are usually less affected. Calimyrna has a large eye that renders it easily infested.

Since driedfruit beetles feed on moldy, mummified fruit, growers attempt to remove all fruit from the orchards to reduce the overwintering population. Early, rapid harvesting and fumigation with methyl bromide or aluminum phosphide are used to avoid subsequent emergence and infestation of the later maturing portion of the crop.

Growers monitor driedfruit beetles by baiting traps with cull fruit, water, and yeast (7).

Control

Non-Chemical:
Fig orchards are located as far as possible from other host orchards such as stone fruits and citrus since driedfruit beetles can fly several miles to find a suitable host. Bait trapping of driedfruit beetles in large containers baited with cull fruit, water, and yeast may be effective in reducing the population if done before the fruit ripens and becomes attractive (7).

Chemical:
A dormant treatment may be useful in reducing overwintering populations in isolated orchards that have experienced severe problems with this pest.

- Aluminum Phosphide - In 1997, 452.55 lb a.i. were applied to 120 acres, 3,491.5 tons, and 2,859,100 cubic feet of figs and fig facilities in California.

Fig Scale
Lepidosaphes conchiformis

Overwintering fig scale adults are dark brown with a greasy appearing wax coating. Summer broods and younger scales are lighter in color. Eggs are laid in spring and crawlers hatch when leaves are unfolding. First generation scales settle on leaves, but later generations settle on leaves, twigs, or fruit. Adult female scales are oystershell shaped, about 0.1 inch long and overwinter on 1- to 2-year old wood. There are usually three to four generations per year. Scale feeding causes a callous tissue to form on the skin giving the fruit a warty appearance. Fruit with scale damage is downgraded and is no longer suitable for use in a consumer packages. The fruit is instead used in manufacturing products (7).

Control

Non-Chemical:
A wasp parasite (*Aphytis* sp.) generally gives excellent control of the fig scale. If the scale parasite has been disrupted for some reason, chemical control may be necessary (7).

Chemical:
Dormant season treatments will usually control the scale and will have the least disruptive effect on the parasites. Narrow range oils are used when needed, but were not used in 1996 and 1997.

Navel Orangeworm

Amyelois transitella

The adult navel orangeworm is a secondary pest of fig. The adult moth is grayish-brown, approximately 0.6 inch long and has short snoutlike projections from the front of the head. Larvae are caterpillars that are white to deep pink and are up to 0.8 inch in length when mature. Eggs are laid in fissures on the ripening fruit or under the scales around the eye and are white, turning pink within a few days of being laid. Navel orangeworms have a wide host range and overwinter in mummified fruits hanging on trees. Navel orangeworm caused damage when feeding on the fruit (7).

Control

Non-Chemical:
Growers harvest rapidly and early and remove and destroy leftover cull fruit. Surrounding hosts such as almonds are also cleaned up. An introduced parasite, *Goniozus legneri*, has been released with some success in almond orchards for control of navel orangeworm. No data has been developed for the efficacy of the wasp in fig orchards (7).

Chemical:
Chemicals applied for the control of driedfruit beetles may partially control navel orangeworm populations. No chemical control guidelines have been developed for navel orangeworm in figs (7).

Vinegar Flies
Drosophila spp., principally *D. melanogaster*

Drosophila adults are small, tan to amber-colored flies with red eyes, about 0.12 inch long. Larvae are small, white, legless maggots up to 0.2 inch long. Vinegar flies cause damage similar to the driedfruit beetle in that the presence of vinegar flies in the fruit causes downgrading or rejection of the fruit. They can also transmit spoilage organisms to sound fruit. Late ripening varieties are especially susceptible to damage. Vinegar flies breed in fermenting or decaying fruit (7).

Control

Non-Chemical:
Fermenting or decaying fruit is disced under or shredded to reduce the population. A rapid and early harvest will reduce exposure of fruit to infestation (7).

Chemical:
Chemicals applied for driedfruit beetle control will partially reduce vinegar fly populations.

- Piperonyl Butoxide/Pyrethrins – Label has a rate of 0.075-0.6 lb piperonyl butoxide/acre and 0.0075-0.06 lb pyrethrins/acre. 12–hour REI. In 1997, 16 lb piperonyl butoxide were applied to

0.11% of the fig acreage in California 1 time at a median rate of 0.15 lb a.i./acre. In 1997, 2 lb pyrethrins were applied to 0.11% of the fig acreage in California 1 time at a median rate of 0.02 lb a.i./acre.

Webspinning Spider Mites
Pacific spider mite: *Tetranychus pacificus*
Twospotted spider mite: *Tetranychus urticae*

The twospotted spider mite is most common in the Sacramento Valley and the Pacific spider mite in the San Joaquin Valley. Abundant webbing on both sides of the leaves is evidence of an infestation. The two mites are not easily distinguished and they overwinter as adult females under bark and in weeds. Eggs are laid on the underleaf surface and there are many overlapping generations each summer. Spider mites feed by sucking the contents out of leaf cells which reduces tree vitality. Heavy feeding causes browning of leaves and defoliation. Vigorously growing trees are much more tolerant to mite attack than trees under stress (7).

Control

Non-Chemical:
Naturally-occurring predaceous mites, *Metaseiulus* spp., and sixspotted thrips, *Scolothrips sexmaculatus*, feed heavily on webspinning mites and may give complete control in the orchard. The western flower thrips, *Frankliniella occidentalis*, feeds on mite eggs and may prevent a mite population from increasing (7).

Chemical:

- Narrow Range Oil - In 1997, narrow range oil was used on 0.13% of the fig acreage. Narrow range oil is acceptable for use on organically grown produce.
- Diazinon – In 1997, 53 lb a.i. were applied to 0.36 % of the fig acreage in California 1 time at a median rate of 0.5 lb a.i./acre. Currently labeled for figs under SLN registration for fruit fly quarantine treatment only.
- Sulfur – Label has a rate of 3.2-4.8 lb a.i./acre as a dilute application or 12-24 lb a.i./acre as an air or concentrate application. 24–hour REI. In 1997, 9,434 lb a.i. were applied to 4.21% of the fig acreage in California 1.5 times at a median rate of 1.35 lb a.i./acre.

Insects that either do not require chemical treatment or that no chemical control guidelines have been developed for include; Green June Beetle, Darkling Ground Beetle and Carpenter Worm.

Weeds

In addition to problems at harvest, weeds can cause a multitude of other problems in fig orchards by reducing the growth of young trees because they compete for water, nutrients, and space. Weeds also increase water use, cause vertebrate and invertebrate and other pest problems, and may enhance the potential for disease such as crown rot. Most orchards are no-till requiring the use of herbicides and/or mowing to control weeds. The increasing use of more efficient low-volume irrigation systems has increased the need for selective pre-emergence herbicide use in drip, microsprinkler, and sprinkler-irrigated orchards. Pre-emergent herbicides are generally used only in the tree row. This reduces the total amount of herbicides and prevents the surface roots in the tree row from being damaged by cultivation equipment. By treating the tree row only, 25% to 33% of the total acreage is treated. Pre-emergence and post-emergence, or combinations of pre- and post-emergent herbicides are often used between tree rows. Soil characteristics have an effect on the weed spectrum (often 15-30 species per orchard), the number of cultivations and irrigations required, and the residual activity of herbicides. Irrigation methods and the amount of irrigation or rainfall affects herbicide selection and the residual control achieved.

Fig orchards may benefit from plants on the orchard floor if they are carefully managed. These plants in a well-maintained ground cover, can help increase water infiltration, reduce soil compaction, maintain soil organic matter content, cool the orchard, and provide habitat for beneficial insects (8). **Monitoring:** Treatment decisions and herbicide selections are based on dormant and early summer weed surveys.

Control

Chemical:

- Glyphosate – Label has a rate of 1-5 lb a.i./acre and a 14-day PHI. 12–hour REI. In 1997, 17,024 lb a.i. were applied to 72.24% of the fig acreage in California 2 times at a median rate of 0.52 lb a. i./acre.

- Oryzalin – Oryzalin is a pre-emergence herbicide and has a label rate of 2-6 lb a.i./acre. 12–hour REI. In 1997, 3,098 lb a.i. were applied to 13.96% of the fig acreage in California 1 time at a median rate of 2.65 lb a.i./acre.

- Oxyfluorfen – Oxyfluorfen is a pre-emergence or early post-emergence herbicide and has a label rate of 0.5-2.0 lb a.i./acre post-emergence and 1.25-2 lb a.i./acre pre-emergence. 24–hour REI. In 1997, 2,317 lb a.i. were applied to 41.28% of the fig acreage in California 1 time at a median rate of 0.72 lb a.i./acre.

- Paraquat Dichloride – Label has a rate of 0.63-0.94 lb a.i./acre and a 13-day PHI. 12–hour REI. In 1997, 219 lb a.i. were applied to 2.55% of the fig acreage in California 1 time at a median rate of 0.76 lb a.i./acre.

Diseases

Fig Endosepsis
Fusarium moniliforme
Fusarium solani
***Fusarium dimerum* (=*F. episphaeria*)**

Fig endosepsis is also called internal rot, brown rot, eye-end rot, pink rot and soft rot. Infected caprifigs or edible figs have internal brown streaks and discolored areas at the base of flowers. Occasionally entire flowers are brown. The brown streaks eventually become yellow-brown spots affecting many flowers within the fig. In early infection, no external symptoms are noticeable. Eventually a water-soaked circular area of skin, usually beginning around the eye, appears. This area eventually extends down the sides to the neck and turns purple in color. A clear or amber-colored syrupy liquid may exude from the eye of the fig. Infection of the pulp causes off-flavor of the fruit.

Fusarium moniliforme and other species of *Fusarium* cause endosepsis (12). *Fusarium* spp. overwinter in the summer crop of the caprifig. Spores are produced in the spring and are transferred by the fig wasp when it emerges from the fruit to "pollinate" the spring caprifig crop. Wasps enter the Calimyrna figs when they are still green to lay eggs. The wasp dies inside the fruit and the fungus develops on its body. Since the fungus is unable to invade unripe fig tissue, infection occurs when the fruit begins to ripen. Both caprifigs and Calimyrna figs are affected by endosepsis as are other varieties that are pollinated by the wasp. Parthenocarpic cultivars occasionally develop fig endosepsis (7).

Control

Non-Chemical:
It is important that the unharvested mamme (winter) crop in the orchard be eliminated before disease-free mammes are reintroduced (6). Avoid overcaprification by cutting down any caprifig trees present in a Calimyrna orchard (10, 11).

Chemical:
The inedible, mamme caprifigs are split in half, using care to not harm the wasp, and any with internal discoloration are discarded. Healthy fruit is treated with benomyl to ensure that the *Fusarium* spores do not contaminate emerging wasps. The treated fruit is then placed in a paper bag or a basket and hung in the edible fig orchard to pollinate the edible fig (6).

A mixture of benomyl, chlorothalonil, and dicloran and the addition of small amounts of dish soap (or naconnol, a surfactant) provide the best reduction of endosepsis in the winter crop. However, there were no uses of these materials in 1997.

Diseases of fig that either do not require chemical treatment or no chemical controls are available include; Alternaria Rot, Smut, Sour Rot, Botrytis Limb Blight, and Fig Mosaic Virus.

Nematodes

Lesion nematode: ***Pratylenchus vulnus***
Root knot nematode: ***Meloidogyne incognita*** **and** ***M. javanica***
Dagger nematode: ***Xiphinema index***

Nematodes are microscopic roundworms that live in soil and plant tissues and feed on plants by puncturing and sucking the cell contents with a spear-like mouthpart called a stylet. Lesion, root knot, and dagger nematodes are known to cause reduction in growth and yield. Fig trees are likely to be more susceptible to temperature and water stress. Lesion nematode infested trees may appear stunted with very few feeder roots. Roots may have reddish brown lesions that eventually turn dark. Root knot nematode infested trees are also likely to have reduced growth and appear stunted. The roots have distinctive swellings, called galls. Dagger nematode causes gall formation on root tips. These symptoms are indicative of a nematode problem, but are not diagnostic as they could result from other causes as well. If no other cause is evident, the orchard should be sampled to determine if plant parasitic nematodes are present. Since nematode problems on fig in California have not been extensively studied, there are no specific treatment recommendations. However, trees planted in soil fumigated with 1, 3-dichloropropene and metam sodium are known to grow considerably better than trees planted in non-fumigated soil (7). There were no fumigation treatments for nematodes in 1997.

Vertebrate Pests

Ground squirrels and gophers are pests in fig orchards. Birds are also a problem and are especially damaging in remote orchards where their high concentration can result in significant economic losses. A bird pecked fig is unsuitable for consumer packages and must be used for manufacturing products at a financial loss to growers.

Control

Chemical:

- Strychnine - In 1997, 0.2 lb a.i. were applied to 480 of California's fig acres.
- Diphacinone – In 1997, 0.7 lb a.i. were applied to 1,570 of California's fig acres.

FACILITIES AND STORAGE

Storage pests of figs include several species of insects. Dried figs are generally fumigated to control theses pests.

- Methyl Bromide - In 1997, 8,299.13 lb a.i. were applied 7,121,048.8 cubic feet and 26 tons of figs and fig facilities in California.

- Chloropicrin - In 1997, 555.06 lb a.i. were applied 1,682,000 cubic feet of fig facilities in California.

- Aluminum Phosphide - In 1997, 452.55 lb a.i. were applied to 120 acres, 3,491.5 tons, and 2,859,100 cubic feet of figs and fig facilities in California.

Contacts

Ron Klamm
Fig Advisory Board
3425 North First Street, Suite 109
Fresno, CA 95726-6819
(559)224-3447

Profile Written by:

Kristen Farrar
California Pesticide Impact Assessment Program
University of California
Davis, CA 95616
(530) 754-8378

Reviewed by:

Ron Klamm, California Fig Advisory Board
Louise Ferguson, UCCE, Kearney Agricultural Center
Themis Michailide, UCCE, Kearney Agricultural Center

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