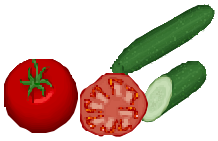
UNIVERSITY OF FLORIDA
EXTENSION
Institute of Food and Agricultural Sciences

Berry/Vegetable Times

April 2004



In this issue...

Calendar of Events 2004

May 11 Pesticide Testing, Hillsborough County Extension Office, Seffner, 9 am. 744-5519.

May 22 Tampa Bay Beekeepers Honey Bee Beginning and Advanced Seminar. Hillsborough County Extension Office, Seffner, 8:30-3:30. For more information call, (813) 684-7814 or 654-4705. There is a fee for attending.

June 6-8 Florida State Horticultural Society Annual Meeting, Sheraton World Resort, Orlando. For more information http://www.fshs.org.

June 21-24 International Symposium on Tomato Disease and 19th Annual Tomato Disease Workshop. Grosvenor Resort, Walt Disney World, Orlando. For more information visit http://plantdoctor.ifas.ufl.edu.

From Your Extension Agent…

As the strawberry season winds down, the 2004 blueberry and spring vegetable harvest is gearing up. I want to mention a few problems to be on the lookout for in these commodities, especially since we had rainy windy weather in mid-April.

Thrips: One major concern we have had recently is the heavy thrips outbreak in the vegetable industry. It was feared we had a new type of thrips, such as *Thrips palmi*, which could be a major problem for us. Dr. Dak Seal of the Tropical Research and Education Center at Homestead who is an expert on *Thrips palmi* visited the area on Sunday, April 18 to check out the problem we have been having. According to Dr. Seal we do not have *T. palmi* but we do have flower thrips and they are probably the Western Flower thrips, *Frankliniella occidentalis*. We normally have flower thrips but this year the numbers are much higher. Dr. Seal does not believe the thrips will cause much damage but if you have high numbers and want to spray he recommends Spintor at the 7-8 oz. rate and if numbers of thrips are still high after 7-10 days you can spray Lannate. We are very lucky this is not *T. palmi* since they are more devastating than flower thrips because they feed on the foliage as well as flowers. We are very grateful to Dr. Seal for making the long trip up here especially on a Sunday to help up with this problem in our fields.

Blueberries: Be on the watch for anthracnose fruit rot (ripe rot). The causal agent can be *Colletotrichum gloeosporioides or C. acutatum*. For those of you who grow strawberries these will be all too familiar to you. The rot develops as the fruit ripen. The blossom end of the fruit becomes soft and may be slightly sunken and usually you can see masses of salmon colored spores in the lesion. Fungicides that can be used for this are Captan, Abound and Cabrio.

Another blueberry disease to watch for is Botryosphaeria stem blight. This is caused by *Botryosphaeria dothidea*. This is a dieback disease and early symptoms are a yellowing and reddening of the leaves on 1 or a few branches. In most cases one branch will die and the rest of the bush will be fine. Infection is mostly through wounds. When the plants are producing lush tender growth in the spring and become infected the dieback can occur very quickly. There is no fungicide registered for this but it is considered to be good practice to apply a fungicide after pruning and to watch for leaf spot diseases in the summer and apply fungicides as needed to keep as many healthy leaves on the plant as possible to maximize plant vigor.

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A monthly newsletter of the University of Florida IFAS, Gulf Coast Research and Education Center, and Florida Cooperative Extension Service.
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Cucurbits: Be on the lookout for downy mildew, powdery mildew, and gummy stem blight. Downy mildew appears as small chlorotic or yellowish areas on the upper leaf surface and can become brown and form dead patches. Lesions can grow together and become so large the entire leaf dies which can lead to sunscald on the fruit. Powdery mildew forms white fuzzy patches on both the upper and lower surfaces of leaves. Gummy stem blight can affect the leaves and stem. The most characteristic symptom is that the stem cankers can exude a brown to reddish brown gummy liquid. The plant can be killed and if fruit is infected there can be a rapid decay of the interior of the fruit.

There is a wide range of products listed for these diseases. Read the fungicide label to be sure the type of cucurbit you are growing and the disease you want to control is on the product label. The manex, manzate, dithane formulations generally list downy mildew and gummy stem blight. The chlorothalonil products such as Equus, Echo, and Bravo and the strobulurins, such as Amistar and Cabrio, and the combination product , Pristine, list downy mildew, powdery mildew and gummy stem blight. Ridomil and Aliette have downy mildew listed on their labels. Flint, sulfur and Nova are registered for powdery mildew.

This is just a quick list of potential problems for you to be aware of. If I can be of any help please call me at the Extension office at 813-744-5519, ext. 134.

Alicia Whidden

Flower thrips found in local fields.

Twenty-five Years of the North American Strawberry Industry

Tom Sjulin, Director of Strawberry Production and Research for Driscoll Strawberry Associates, Inc., Watsonville, California

The following article focuses on industry developments in the past 25 years, and gives a personal view of what I expect for the next 25 years.

The California strawberry industry has strengthened its grip on the North American industry in the past 25 years. In 1978, California produced 76% of the total US production, Florida produced 5%, and the rest of the US's share was 18%. Last year, California's share of the total was 88%, Florida was 8%, and the rest of the US was 4%. During this same period, total US production tripled from 659 million pounds to 2.1 billion pounds. The production value of the crop has grown even faster, from $209 million in 1978 to $1.33 billion in 2003.

Several factors have contributed to California's increasing domination of the North American strawberry industry. Acreages have increased in California and Florida, while those in other states have declined. Yields have continued to climb over the past 25 years through improved varieties and production practices. Fresh market quality has also improved during this period, with some varieties combining large, attractive fruit with high flavor and good shelf life. Finally, new production systems combined with new genetics has allowed the California industry to spread its increased production across more weeks of the year without dramatically increasing peak volumes. These factors have helped offset declining grower margins, which have resulted in lower prices per pound on an inflation-adjusted basis.

The increased yields in California during the past 25 years cannot be attributed to soil fumigation, as methyl bromide-chloropicrin soil fumigation was a standard practice at the start of this period. Improved irrigation and fertilization practices, improved pest and disease control and improved varieties have all contributed to the yield improvement. Adoption of day-neutral varieties along the central coast of California has extended the flower initiation period, thus giving higher yields. New varieties for southern California are better adapted to early planting through clear plastic mulch, and have higher yields in the January through March period.

Peak volumes in California have declined as a percent of total annual volumes from about 10% in the peak week to 5 to 6%. This is due to a combination of the earlier harvests in southern California, the widespread adoption of later-fruiting day-neutral varieties in the central coast districts, and the development of significant late-fall to early-winter production from summer-planted day-neutral varieties in southern California. This spreading of the production curve across more weeks of the year has resulted in more orderly marketing of the increased volume, and helped maintain shelf space in the produce market.

Florida has improved yields over the past 25 years, although the past three years have been affected by unfavorable weather. The Univ. of Florida breeding program led by Craig Chandler has turned out a succession of better varieties, growers have improved soil preparation, fertilization and irrigation practices, and planting stock is now grown relatively free of infection by anthracnose, a serious disease that impacts both plant health and fruit production.

The Future of the North American Strawberry Industry. One thing is certain, the North American strawberry industry will

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face its share of challenges but will continue to grow and prosper for quite some time to come. Helping drive this expansion is an aging North American population that is more concerned about eating right, and the explosion of research underscoring the health benefits of small fruit consumption. Consumers will be looking for fresh berries all year, so I expect that shipments outside the traditional peak months will increase more rapidly.

Central Mexico will obviously increase in importance as a supplier of fresh berries to North America in the winter. Signs of that abound in Central Mexico. When you drive into Los Reyes in the state of Michoacan, international shippers make offers to growers via billboards; U.S. company names are being hung on cooling facilities; and new plantings of strawberries, raspberries and blackberries are everywhere. Why Central Mexico? At these higher elevations, it rarely rains in the winter, the days are sunny and warm but not too hot, and the nights are cool and dry, all of which is a great recipe for growing berries. There is plenty of land, water and labor, and truckloads of berries can reach a lot of the North American population.

The Florida strawberry industry will be affected by Central Mexico, and may even shrink in size. But Florida is close to a lot of the U.S. population and has strong breeding programs. Their challenge will be to stabilize production swings during years of unstable weather. They may have to follow the citrus industry, and move south of Plant City.

The California strawberry will face problems of land, water and labor, but where else in the world can you produce 100,000 pounds of strawberries per acre between March and November? Or 70,000 pounds per acre between January and June? The high yields per dollar input will keep California in the driver's seat in the face of declining grower margins, and the fruit quality will continue to improve through breeding and better management. The strawberry industry will continue to grow, even with some year-to-year ups and downs.

In the face of what I've presented, what can strawberry growers do? The answer is to find opportunity in the face of adversity. Look at the changes in the North American strawberry industry in the past 25 years, and take advantage of them. Consumers now eat fresh strawberries all year around and they show every sign of wanting more. Twelve years ago, prices crashed when the California industry shipped more than a million trays a week in early October; now we ship a million or more trays a week nearly to the end of October at profitable prices. We've figured out ways to pick a lot more strawberries in January through March and July through December without picking too many in April, and the consumers have responded. Sure, we don't sell many $30 trays anymore, but who buys $30 strawberries? A few foolish people who spend too much on dates, weddings and anniversaries. People are getting older, they are worried about what they've been eating the past 30 years, and they want to eat more fresh strawberries.

(This article was adapted from a presentation Dr. Sjulin made at the 2004 North American Berry Conference, February 23-25, 2004, at the Hilton Westshore in Tampa. The full version of Dr. Sjulin's presentation, including references and figures, can be viewed on the GCREC-Dover web-site at http://strawberry.ifas.ufl.edu)

Evaluations of Insecticides and Miticides at GCREC

Dave Schuster, GCREC
Vegetarian 04-04

Pesticidal trials are conducted every season at the GCREC to evaluate new and registered products either alone or in combinations/rotations for managing insect and mite pests of vegetables grown in west-central Florida. These trials provide information not only on what products are effective but also at what rate(s). Trials were conducted last fall for whitefly control on tomato and cantaloupe, armyworm and leafminer control on tomato, beet armyworm control on pepper, spider mite control on eggplant and broad mite control on pepper. All rates are given in amount of product/acre.

Whitefly on Tomato. The whitefly population was low early in the season but increased to a moderate level by about 9 weeks after transplanting. The standard in this trial was Admire 2F (16 oz; a registered nicotinoid insecticide) applied as a soil drench one day after transplanting followed by foliar sprays of Courier 70W (0.5 lb; a registered insect growth regulator) and then Knack 0.86EC (8.9 oz; a different registered insect growth regulator) when a threshold of 5 nymphs/10 leaflets was reached (one application each). Experimental insecticides Diamond 0.86EC (8 oz; a new insect growth regulator) and Oberon 240SC (8.5 oz; new insecticidal chemical class) were each applied twice foliarly based upon the above threshold following a soil application of Admire 2F (16 oz). Plots sprayed with either the Courier/Knack rotation, Diamond or Oberon were lower from that on foliage in check plots and were below the threshold about 10 days after the first application. Plots

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sprayed 8 times weekly with Endosulfan 3EC (21.4 oz; a registered organochlorine insecticide) or a combination of Ecozin 3%EC (8 oz; a registered neem product), Ultrafine Oil (0.5% v/v; a registered paraffinic oil), and Endosulfan 3EC (21.4 oz) had fewer nymphs than the check 9 weeks after transplanting and thereafter, although the numbers generally were not below the threshold. Counts of nymphs on plots sprayed with a Ecozin/Ultrafine Oil combination, PF-2000 (1% v/v; a detergent) or PREV-AM (0.8% v/v; an orange oil-based product) were statistically lower than those of non-treated plots on at least some dates, 8 weeks after transplanting, although counts were not below the threshold. Counts tended to be lower on PREV-AM treated plots, especially 11 and 12 weeks after transplanting.

Whitefly on Cantaloupe. The silverleaf whitefly population was moderate during the trial. Treatments included different rates of Admire 2F and Platinum 2SL (both registered nicotinoid insecticides) applied as drenches one week after transplanting, and Oberon 240 SC (8.5 and 7 oz; a new chemical class) and Courier 70W (0.5 lb; a registered insect growth regulator) applied foliarly 8 and 10 weeks after transplanting. The number of nymphs on plots treated with Admire was lower than the check plots until about 7 weeks after drenching at an 8 oz rate, 8 weeks at a 16 oz rate, and 9 weeks at a 24 oz rate. For Platinum, the number of nymphs was lower than that of the check until 7 weeks after drenching at a 6 oz rate and 8 weeks at an 8 oz rate. The number of nymphs on plots sprayed with Oberon at the 8.5 oz rate was lower than that of the check one day after the first application but not on other sampling dates. For Courier, the number was lower one day after the first application and two days after the second application.

Armyworm and Leafminer Trial on Tomato. The armyworm population was heavy for a fall trial while the leafminer population was moderate. Plots sprayed five times with Avaunt 30WG (3.5 oz; a registered oxadiazine insecticide), Diamond 0.83EC (12 oz; a new insect growth regulator), Intrepid 2F (8 and 4 oz; a registered insect growth regulator), Intrepid 2F at 8 and 4 oz combined with SpinTor 2SC (4 oz; a registered naturalyte insecticide), or SpinTor (4 oz) alone, all yielded fewer fruit damaged by armyworm compared to the check; however, plots sprayed with SpinTor alone yielded more damaged fruit compared to all other treatments. None of the treatments resulted in fewer leafminers compared to the check.

Beet Armyworm on Pepper. The beet armyworm population was light for a fall trial. Plots sprayed every two weeks (four times) with Avaunt 30WG (3.5 oz; a registered oxadiazine insecticide), a combination of Proclaim 5SG (3.2 oz; a registered avermectin) and Dyne-Amic (0.1% v/v; a silicon/oil adjuvant), SpinTor 2SC (6 oz; a registered naturalyte insecticide) or Baythroid 2 (2.8 oz; a registered pyrethroid) yielded fewer fruit with severe (pod) damage compared to the check.

Spider Mite on Eggplant. The spider mite population was heavy early in the trial but declined about 9 weeks after transplanting. All treatments were applied twice, 14 days apart at 4 and 6 weeks after transplanting. The standard Agri-Mek 0.15EC (8 oz; a registered avermectin) resulted in fewer mites compared to the check for up to 28 days after the second application. Mesa 1% EC (24 and 12 oz; a new avermectin) controlled mites as well as and for as long as Agri-Mek. Oberon 240SC (8.5 and 7 oz; a new chemical class) provided comparable control for up to 14 days after the second application, while Acramite 50WS (1 lb; a registered carboxylic acid miticide) provided control for three days after the second application. A combination of Satisfy (5 oz; a plant growth regulator product) and Foli-Zyme (2 qt; a foliar nutrient product with calcium) did not reduce mite numbers compared to the check on any sampling date.

Broad Mite on Pepper. The broad mite population was heavy for a fall trial and was so severe that 100% of the terminal and lateral growing buds on non-sprayed plants were killed. Treatments were sprayed twice, 7 days apart at 6 and 7 weeks after transplanting. Plots sprayed with the standard Agri-Mek 0.15EC (8 oz; a registered avermectin) resulted in reduced numbers of mites 7 days after the first application and up to 21 days after the second application. Similar control of mites was observed with Mesa 1% (16 oz; a new avermectin) and Oberon 240SC (8.5 and 7 oz; a new chemical class) combined with Induce (0.05% v/v; a silicone adjuvant). Acramite 50WS (1 lb; a registered carboxylic acid ester miticide) combined with Trilogy (1% v/v; a registered neem oil) did not provide control of mites after one application but did provide control up to 21 days after the second application. Acramite 50WS (1 lb) alone or combined with Dyne-Amic (8 oz; a silicon/oil adjuvant) resulted in reduced numbers of mites relative to the control 7 and 14 days after the second application.

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The use of trade names in this publication is solely for the purpose of providing specific information. It is not a guarantee or warranty of the products names and does not signify that they are approved to the exclusion of others of suitable composition. Use pesticides safely. Read and follow directions on the manufacturer's label.

Plastic-Mulched Bed Temperature Extremes are Affected by Irrigation Method and Crop Canopy

Craig Stanley, GCREC
Vegetarian 04-04

On-going studies at GCREC-Bradenton investigating the influence of irrigation system and plant canopy development on soil bed temperatures are showing some very interesting results. These studies are part of an overall effort to develop predictive models which use bed temperature, soil moisture content, and environmental factors to simulate soil-applied agric-chemical movement and dissipation in a production bed.

Plots were set up to measure temperatures in a grid fashion at 32 locations down to depths of 16 inches from the surface of each bed at 12 different sites including drip-irrigated and seepage-irrigated beds (east-west orientation) with and without tomato plants throughout the past 3 growing seasons. Thermocouples attached to logging devices measured temperatures every 15 minutes to see how bed temperature distribution changed through each day during each season. As an example, for mid-afternoon on May 11, 2003, bed temperatures for drip-irrigated tomatoes varied from 124°F (51°C) at the south bed shoulder just under the plastic to 84°F (29°C) at 8 inches from the surface in the bed center when the air temperature reached 74°F (23°C). On the same day at the same time, seepage-irrigated tomatoes showed temperatures of 107°F (42°C) at the bed shoulder and 84°F (29°C) at 8 inches from the surface in the bed center. Observations of temperature changes throughout the day indicated that seepage-irrigated beds generally showed lower temperatures at similar bed locations at the same time of day and cooled off more quickly during evening hours when compared to drip-irrigated beds. This was probably due to continuous replenishing of soil moisture from the cooler water table for seepage irrigation.

While this information is being collected for model development purposes, the data show the extreme temperatures that can be measured in the soil bed. Bed surface temperatures, especially for fall-crop tomatoes and peppers, must be considered to prevent excessive heat conditions for newly-set transplants. As expected, the maximum temperatures were generally measured at mid-afternoon so it would be recommended that, where possible, transplanting should be done in the morning hours to minimize transplant shock. Examples of bed temperature distribution (also showing thermocouple location) at 3 times of the day (May 11, 2003) are shown in Figure 1 (temperatures in °C).

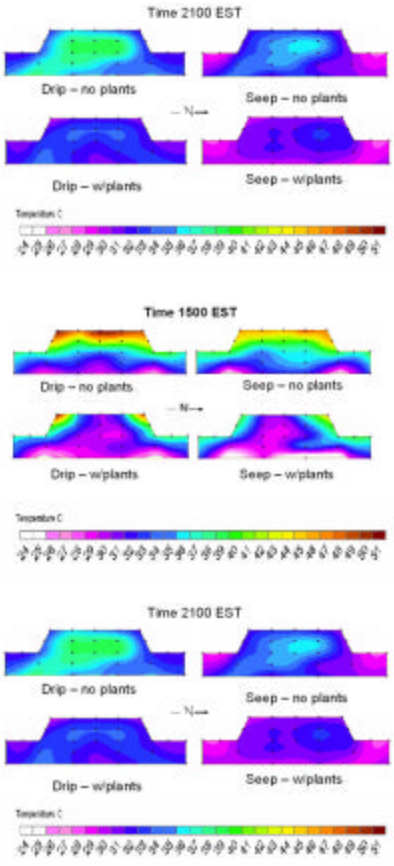

Fig. 1. Bed temperature distribution.

Any questions or comments on this information can be directed to Craig Stanley, GCREC-Bradenton, 941-751-7636 ext 248 (cds@mail.ifas.ufl.edu).

Wind Damage to Cucurbits

John R. Duval

With persistent winds during the month of March and first half of April significant wind damage has been noted at the GCREC and area farms on cucurbit crops. Incessant whipping of foliage and vines at the soil lines have caused sever abrasions which has caused vine girdling and vine damage. The most severe damage has been observed in summer squash. Those plants which were not wrung off at the mulch line, have developed long vertical cracks along the vine. These can be so severe as to give the vine the appearance of a ribbon. While it is not known how seriously this will affect the yield of affected squash it can deduced that some yield reduction will be evident as well as increased incidence of diseases which attack the vines of plants (gummy stem blight and fusarium wilt among others) through wounds. Therefore, scouting for disease will be more important for timing of fungicidal sprays. In addition, damaged vines will be unable to move water and nutrients as effectively as undamaged vines so greater monitoring of an effected fields water status will be necessary. With proper management, damaged vines should be able to continue producing, albeit at lower levels.

Diaprepes Weevil Problem in Dover Strawberry

Jim Price, GCREC

Weevil larvae tentatively identified as the *Diaprepes* root weevil of citrus, killed more than 400 strawberry plants on the GCREC Dover research farm this season. The larvae were noticed in late February, but likely had been present on roots for some time. They may have come from eggs laid by adult weevils that had inhabited a nearby small, un-kept citrus planting uprooted earlier for housing.

Weevils are snouted beetles and *Diaprepes* weevil adults are about ¾ inch long, black with orange, white or gray stripes. They often fall to the ground when disturbed. This species arrived in Florida in about 1964 from the Caribbean region and has not been previously reported from strawberry. Additional information on the *Diaprepes* weevil in Florida can be found by reaching http://EDIS.ifas.ufl.edu on the Internet and entering "Diaprepes" as the requested search term.

Affected plants at the GCREC Dover farm first wilted, then appeared to die from anthracnose disease (Fig. 1). This similarity may have prevented identification of earlier infestations in the Plant City area. The plants killed by the weevil larvae had few roots (Fig. 2) and would not adhere to the soil when pulled by the gathered leaves, while plants killed by anthracnose disease held tightly to the soil. The more recently killed and the wilting plants oftentimes had ¾ inch long white, legless grubs (Fig. 3) that burrowed from below and hollowed plant crowns.

Effective control measures with current strawberry insecticides may require label changes, so it is important that growers avoid infestations until those problems are solved. Until then, any clearing activities in infested citrus orchards near strawberry fields should occur well before transplanting.

Fig. 1. GCREC Dover field.

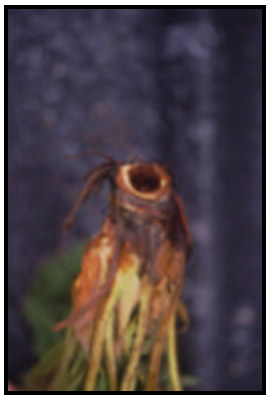

Fig. 2 showing lack of roots due to weevil infestation.

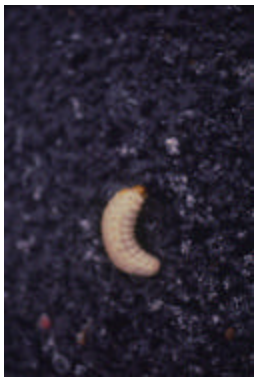

Fig. 3 displaying a legless, white grub.

Summer Strategies for Strawberry Disease Control

Jim Mertely, Teresa Seijo, Natalia Peres

Crop destruction for the control of strawberry diseases has become more problematic with the loss of paraquat for "burn-down" of the old crop, and the new popularity of double cropping. Nevertheless, it is a good cultural practice that reduces the risk of anthracnose fruit rot epidemics, and helps insure normal yields in future berry crops.

Studies at the UF Strawberry Lab have shown that the anthracnose fungus *Colletotrichum acutatum* easily survives on strawberry plants that are allowed to live over the summer. However, when the plants are killed and the crowns are buried in the soil, the anthracnose fungi infecting them soon die out and are no longer detected on crowns buried for 2 to 3 months. If there is no second crop, a 6-month interval between strawberry crops is more than sufficient to plant a cover crop and eliminate *C. acutatum* on old strawberry debris. If a second crop is planted, sufficient time is still available to clean up and bare fallow a field. This assumes that the old strawberry crop is destroyed and incorporated into the soil as soon as possible.

When a second crop is planted, old strawberry plants may be physically removed after the last harvest or as the new crop becomes established. If a second pass is made to kill volunteers sprouting from old buried crowns, this practice is at least as effective as herbicides, but probably not as effective as fumigants (e.g., K-Pam, Vapam). Rapid destruction of the second crop is also recommended, but more for suppressing polyphagous nematodes that feed on both crops. Dr. Joe Noling will address the topic of crop destruction and nematode control in

another article.

It is well known that *C. acutatum* often enters our production system on contaminated nursery plants. So why put out the extra effort and expense to destroy the old strawberry crop? During this past season, the number of anthracnose-infected samples submitted to our Diagnostic lab decreased strikingly compared to 2001-02 and 2002-03. This suggests that the nurseries in California and/or Canada are making progress in freeing their plant stocks from *C. acutatum.* Another argument against crop destruction stems from recent research showing that strawberry isolates of *C. acutatum* also survive on other crops and on weeds. However, this study (based on artificial inoculations in the green house) also showed steady decreases in populations over time. It is an open question whether *C. acutatum* persists on plants other than strawberry for meaningful lengths of time in the field. Given these facts, the possibility of infecting new strawberry crops with an over-summering pathogen becomes more significant…and is similar to shooting oneself in the foot. Crop destruction is a well-known practice that reduces the survival of many diseases, nematodes, and insect pests between crops.

Crop destruction, crop rotation, rouging, and related cultural practices have been used for centuries to suppress plant diseases and insect pests. The increased use of pesticide sprays, chemical fumigants, and increased cost of land and labor have reduced our dependence on these time-tested methods, especially by producers of high-value specialty crops. However, times are changing. For a myriad of reasons, familiar pesticides are being lost or are being increasingly restricted in their use. Learning how to effectively combine modern methods with well-known cultural practices will become increasingly important. It is a good bet that more research and more pest management activities will be done under the IPM banner in the future.

Early Crop Destruction of Abandoned Strawberry Fields

J.W. Noling, Citrus REC
Alicia Whidden

I have observed that being a strawberry grower is a full time job. The job as I know and understand it does not end at the conclusion of the strawberry picking season ,which is now over a month past. The job is a full time responsibility, because it requires a year- round commitment to stewardship of the land. As a full time job, many strawberry growers have elected to double crop squash, cucumber, cantaloupe, or eggplant among others following the spring strawberry crop. If you drive the area you also quickly discover that other growers have opted to simple turn the water and nutrition off to the crop and abandoned the strawberry field to the elements. Figures 1,2, and 3 illustrate 3 different nematode infested strawberry fields abandoned after final strawberry harvest in early March 2004. For the remainder of this article, we would like to discuss the ramifications of field abandonment and for violating the early crop destruction principal of Integrated Pest Management (IPM).

The sting nematode, *Belonolaimus longicaudatus*, a pest we are very familar with, as are many growers in the Plant City area, is an obligate parasite requiring living plant root tissue to survive and grow. Without plant or pest controls, sting populations will continue to grow as long as roots are made available as food. The appearance of green foliar tissue within the abandon field (particularly after the recent rains) should remind growers that living roots continues to be made available as food to sustain nematode population growth. The month long plus delay in crop destruction could easily translate into one or more additional generations of nematodes with a geometric increase in soil population density. When and if the plants do die, sting nematode is reputedly known to migrate to deeper soil horizons to escape the inhospitable environment of surface soil. It is also well known that sting nematode is also capable of surviving for many months in soil in the absence of food. In addition to nematodes, there are other soilborne disease pests utilizing these food (roots) resources being made available within the abandoned field and are as well adapted to survive to a subsequent strawberry crop and which comeback to plague growers in following crops. As such, many different pest problems can be amplified during the field abandonment phase of strawberry production. In this case, one of the main problems with delaying crop destruction is that the consequence of the action is not as immediate as it should be to discourage the practice.

IPM is defined as the integration of pest management tactics, each capable of incrementally reducing pest populations towards a collective, economically acceptable, low level. IPM is now becoming a mandatory requirement for sting nematode management, since it is becoming increasing clear that single tactic approaches such as methyl bromide soil fumigation cannot prevent sting nematode problems from reoccurring within the field during the long production season. Since no single tactic is perfect and complete, a number of tactics must be coupled together. Lets assume that soil fumigation kills 95% of the nematode population in soil. Killing 95% of a soil population of 20 nematodes / 100 cc soil leaves 1 nematode remaining in soil, while killing 95% of 2000 leaves a population of 100 per 100 cc soil. It should be obvious that higher numbers generated during

field abandonment, can ultimately translate to higher numbers surviving fumigation, which then accelerates the first appearance of nematode problems in the field during the fall, and for increasing overall strawberry yield losses within the field.

Growers may not be able to completely eliminate the problem, but they can surely reduce soil density and thus delay the time in which the problem reappears within the field. It should be clear that to avoid or minimize sting nematode problems, growers must do everything they can to maintain sting populations as low as possible during each stage of the annual crop production cycle.

Clearly, the opportunity to enhance nematode control with fall soil fumigation and minimize reoccurring losses in strawberry crop yield due to nematodes begins with early crop destruction after final harvest of each and every crop. For fields which are repeatedly problematic with sting nematode, growers might also consider reduced rates of crop termination chemicals such as Vapam, Kpam, Telone EC, or Telone Inline, applied at seasons end to kill strawberry roots and suppress sting nematode populations. For these chemicals, application rates of 10-20 gallons per acre, applied in 100 to 150 gallons water per 100 linear feet of row, has been used effectively to kill plants, roots, and sting nematode in soil (Figure 4). As a minimum, the field should be foliar sprayed with Paraquat to kill the foliage, and ultimately roots of plants within rows.