



*In this issue...*

Twenty-five Years of the North American Strawberry Industry	Page 2
<i>Diaprepes</i> Weevil Problem in Strawberries at GCREC Dover	Page 3
Summer Strategies for Strawberry Disease Control	Page 4
Early Crop Destruction of Abandoned Strawberry Field	Page 4
Wind Damage to Cucurbits	Page 6
Update on GCREC Balm	Page 6

**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 19<sup>th</sup> Annual Tomato Disease Workshop. Grosvenor Resort, Walt Disney World, Orlando. For more information visit <http://plantdoctor.ifas.ufl.edu>.

A monthly newsletter of the University of Florida IFAS, Gulf Coast Research and Education Center, and Florida Cooperative Extension Service.

Hillsborough County Cooperative Ext. Service  
5339 CR 579, Seffner, FL 33584  
(813) 744-5519 SC 541-5772

Alicia Whidden, Editor Mary Chernesky, Director

Gulf Coast Research and Education Center  
13138 Lewis Gallagher Road, Dover, FL 33527  
(813) 744-6630 SC 512-1160

Christine Cooley, Layout and Design  
Jack Rechcigl, Director  
<http://gcrec.ifas.ufl.edu>

**From Your Extension Agent... Alicia Whidden**

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 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 Lan-nate. 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 us 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.

**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

(Continued on page 2)

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 strobilurins, 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.

## Twenty-five Years of the North American Strawberry Industry

Tom Sjulín, 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 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

*(Continued on page 3)*

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 industry 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. Sjulín made at the 2004 North American Berry Conference, February 23-25, 2004, at the Hilton Westshore in Tampa. The full version of Dr. Sjulín's presentation, including references and figures, can be viewed on the GCREC-Dover web-site at <http://strawberry.ifas.ufl.edu> )*

## Diaprepes Weevil Problem in Strawberries at GCREC Dover

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.



Fig. 1. GCREC Dover field.

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.



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



Fig. 3 displaying a legless, white grub

(Continued on page 4)

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

## 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 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 signifi-

*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.*

cant...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

We have observed that being a strawberry grower is a full time job. The job as we 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 dis-

cover that other growers have opted to simply 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 familiar 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. 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.



Figure 1,2,3. Post season views of three abandoned strawberry fields promoting continued development and soil increase of soilborne nematodes and other disease pests.



Figure 4. Use of a post season crop destruction chemical to kill strawberry plants, roots, and sting nematodes in soil after final strawberry harvest.

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 increasingly 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 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 sprayed with Paraquat to kill the foliage, and ultimately roots of plants within rows.

## 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 severe 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 yield, it can be 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 field's water status will be necessary. With proper management, damaged vines should be able to continue producing, albeit at lower levels.

## GCREC Balm Update

Great progress has taken place as construction continues at the new Gulf Coast Research Center in Balm. Amidst the activity at the site, the exterior of the main building is nearly complete as well as the roadways throughout the center's grounds. For continued updates visit <http://gcrec.ifas.ufl.edu>.



Tampa Bay Beekeepers  
Honey Bee Seminar  
Hillsborough Co. Extension Office  
Seffner, FL

Saturday May 22, 2004

8:30 am to 3:30 pm

\$15 (before May 13)

\$20 (day of the event)

\$5 each additional family member

Everything beginning beekeepers need to know as well as advanced beekeeping techniques. Lunch will be provided.

For registration information:

(813) 684-7814 or (813) 654-4705