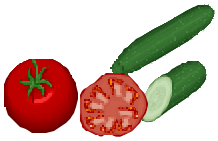
UNIVERSITY OF FLORIDA
EXTENSION
Institute of Food and Agricultural Sciences

# Berry/Vegetable Times

November 2004



*In this issue...*



## Calendar of Events

**Nov. 9 Pesticide License Testing. Hills. Co. Extension Office. (813) 744-5519.**

**Nov. 14-16 17th International Pepper Conference, Naples Beach Hotel and Golf Club. For more information go to http://conference.ifas.ufl.edu**

**Dec. 7 Rule Development Workshop on Vegetable and Agronomic Crop Best Management Practices Manual. Hill. Co. Extension Office at 2 pm. Call Alicia Whidden at (813) 744-5519,**

**Dec. 14 Pesticide License Testing. Hills. Co. Extension Office. (813) 744-5519.**


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

**Good News for Pesticide License Holders!**

Recently some rule changes were made to the laws that effect licensed pesticide applicators. If you renew by Dec. 31, 2004 the requirement is a total of 8 continuing education units (CEUs). Of that 8, a minimum of 2 must be core CEUs and you can have up to 4 core that will count towards the total of 8 CEUs. The balance need to be in your license category which for most of you is private applicator agriculture. The law was to change on January 1, 2005 to a total of 12 with 4 of that required to be core CEUs. License holders have gotten lucky! Changes to the law became effective September 17,2004 and the total number of CEUs that a private applicator pesticide license holder will be required to have to renew their license after January 1, 2005 will stay the same. After January 1, 2005 when you renew under the new law you will need a total of 8 CEUs and 4 of that must be core CEUs.

There are several ways to earn core CEUs. You can attend meetings offering core CEUs or look for the core articles being published in Citrus and Vegetable magazine. Chemical companies are sponsoring publication of articles on core subjects in Citrus and Vegetable. Each article has a set of questions that you must answer for credit. Contact the author to request the questions, read the article and answer the questions and mail to the author. If you answer correctly you will receive 1 core CEU. This is a great way to get those 4 core CEUs you need especially if your renewal date is not far away. Please be sure and thank the sponsors of the articles as this would not be possible without their generosity.

Another change to the law is in recordkeeping. Now the starting and ending time of spraying a restricted use pesticide is required. This replaces the general time of application that you were able to use in the past.

So remember if your license renewal is after this year, you now will need 4 core CEUs and 4 private applicator CEUs. Also put down the beginning and ending time of spraying restricted use pesticides in your records.

A Worker Protection Standards (WPS) Train-the-Trainer has been proposed for the early part of December to be held at the Hillsborough County Extension Office in Seffner. If you are interested please contact me at the office (813) 744-5519 or email AJWhidden@ifas.ufl.edu and if there is enough interest we will hold the class.

Happy Thanksgiving!

*Alicia Whidden*

## Post-transplanting "Clean-up" Sprays

James Price and Curtis Nagle

Inspections of shipped strawberry transplants often reveal spider mites, aphids and sometimes armyworms or their eggs that survived from cool climate nurseries. Inspections of shipments before transplanting and early field scouting should be performed to detect such problems and control measures may be indicated when they are found. Some growers apply a broad-pest-spectrum clean-up spray soon after the overhead watering has ended.

These early-season sprays are not subject to some of the concerns that exist for them later in the season. For instance, the impact of lingering residues that could damage some natural predator and parasite populations is minimal because so little of the mature canopy is present at the time of application. Additionally, fewer natural predator and parasite colonies exist to be disrupted at this early stage of the crop.

There are three popular insecticides that growers normally include in the clean-up sprays to control some of the insects, including aphids and armyworms, that may accompany transplants. Few of them are reliable in controlling mites. There are some important points for growers to consider in choosing among these three insecticides and they are presented below.

One common clean-up insecticide is Brigade® (bifenthrin). Brigade is a pyrethroid and should not be used if *Phytoseiulus persimilis* predator mites will be released in the next several weeks.

Another one is Lorsban 75WG® (chlorpyrifos) that possesses "Florida only" FIFRA 2 (ee) supplemental labeling permitting its use for armyworms and aphids on strawberries. Lorsban is a pre-bloom organophosphate and cannot be applied after berries start to form. That means if it is to be used in the Plant City area, the use must occur immediately after the overhead irrigation ends. This product is the least problematic, of the three clean-up insecticides mentioned here, for an impending release of *P. persimilis* predator mites.

The last commonly used clean-up insecticide is Lannate® (methomyl). Lannate is a carbamate and should not be used within about 3 weeks of a release of *P. persimilis* predator mites.

Other insecticides sometimes are applied along with the above three. Miticides may be chosen, in addition to these common clean-up insecticides, to bring accompanying spider mites into check.

## Plant Pathology Research for 2004-05

Natalia Peres

The 2004-05 strawberry season promises to be a busy one for the plant pathology group. To date, we have a total of ten experiments planned. As in past years, fungicides will be evaluated for control of Botrytis fruit rot (Botrytis cinerea), anthracnose fruit rot (Colletotrichum acutatum), and powdery mildew (Sphaerotheca macularis) as well as colletotrichum crown rot (C. gloeosporioides). A dip experiment will also be conducted to evaluate the effect of fungicides on establishment and control of root rot (C. acutatum). Additionally, the potential effect of fungicides applied at different times prior to harvest will be evaluated for the appearance of gray mold in storage (after harvest).

In another experiment short and long infection periods (i.e., short wetness and long wetness) will be simulated to induce symptoms of anthracnose fruit rot. The effect of contact and systemetic fungicides to control the disease after the infection has been established will be evaluated. Commercial cultivars and advanced selections will also continue to be evaluated for susceptibility to Botrytis fruit rot and anthracnose.

Additionally, offsprings from a cross between parents susceptible to and resistant to anthracnose fruit rot will be evaluated to gain a better understanding of the inheritance of resistance.

An experiment has been implemented in cooperation with Dr. Jim Gilreath to test four different fumigants applied through drip irrigation as an alternative to methyl bromide for the control of soilborne pathogens

And, lastly, an experiment in cooperation with Dr. John Duval is being conducted to determine if certain post-emergence herbicide practices can result in fruit malformation.

In order to be able to conduct and evaluate these trials, a new lab assistant, Catalina Torres, has been hired. Catalina has a BS degree in agricultural science and joined our group just in time for the new season.

*Catalina Torres joins the plant pathology program.*

# Using Predatory Mites in Strawberries This Season

Silvia Rondon, Daniel Cantliffe, and James Price

The twospotted spider mite (TSM), *Tetranychus urticae*, is the key pest affecting commercial strawberry production in Florida (Fig. 1). Traditionally, control strategies for TSM relied on several applications of miticides during the strawberry production season which resulted in high control costs and the development of resistance. Biological control, which involves the use of beneficial arthropods to control pests, is a viable alternative for a sustainable strawberry production system.

*Phytoseiulus persimilis* has been the main predatory mite released in Florida and other strawberry production areas (Fig. 2). 'Persimilis' establishment has been successful in the central and southern regions of Florida, but in the northern areas of the state has failed to establish effectively (unpublished data). *Neoseiulus californicus* is another predatory mite species that has been released sporadically throughout Florida (Fig. 3); however, its establishment and potential beneficial activity has not been documented. In the 2003-2004 strawberry season, Jim Price, Oscar Liburd, Silvia Rondon, Dan Cantliffe, and Norm Leppla from the University of Florida, and Roger Francis and Merle Shepard from Clemson University, conducted on-farm trials in collaboration with growers, extension agents, and crop consultants to demonstrate the benefits of using both predatory mites for TSM control. Similar experiments are being repeated now.



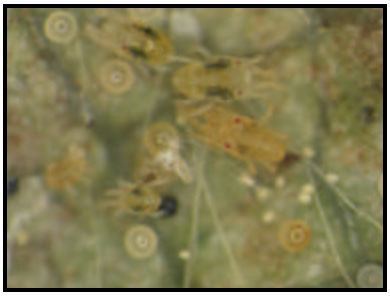


*Fig. 1. Heavy infestation of twospotted spider mites adults and eggs. Credit: S.I. Rondon, UF/IFAS.*

*Fig. 2. Phytoseiulus persimilis. Credit: S.I. Rondon, UF/IFAS.*

*Fig. 3. Neoseiulus californicus. Credit: S.I. Rondon, UF/IFAS.*

On-farm demonstration trials were conducted in three regions in the southeastern U.S., (1) central Florida (Citrus and Hillsborough Counties), (2) northern Florida (Bradford and Duval Counties) and (3) Charleston, South Carolina.

In central Florida, on-farm trials were conducted in two fields of cooperating growers at Floral City (Citrus County), and Balm (Hillsborough County), FL; a third farm located at the University of Florida Dover Research Station (Hillsborough County) also was included.

In each farm, treatments included two predatory mite species (*Phytoseiulus persimilis* and *Neoseiulus californicus*) and a chemical miticide control. The grower standard program acted as a control for comparisons with predatory mite treated areas. One hundred leaflets per treatment, collected randomly from each treatment, were sampled weekly. The undersurfaces of leaflets were examined for the presence of TSM with the aid of a 14 X lens. Predatory mites were released at a rate of 1 predatory mite per strawberry plant when approximately 10% of the leaves were infested with TSM (motiles and/or eggs) (Fig. 4). If populations of TSM exceeded 10 % before predatory mites had been released, a low-risk miticide (Acramite or Vendex) was sprayed at the recommended rate to reduce the TSM population.

*Fig. 4. Release of predatory mites in the strawberry crop. Credit. S.I.Rondon, UF/ IFAS.*

Preliminary results from these trials indicated that it takes approximately 2 to 3 weeks for either predatory mite to get established. During the 2003-2004 season, strawberry transplants from most nurseries arrived with less than usual TSM problems. At our location in Floral City, good results were observed for TSM control on young transplants by applying Brigade® (bifenthrin) pyrethroid plus Diazinon® (organophosphate) immediately after transplant (last week of October). The effectiveness of Brigade and Diazinon plus the

cold weather resulted into a low density of TSM from November through early February. Both predators were released on February 26 at a rate of one predatory mite per plant when TSM population reached 12 %. Predatory mites established in the crop approximately 3 weeks after release. In the grower standard program, no additional miticides were applied. Harvest continued until the first week of April. By the end of March, '*Persimilis'* had reduced the TSM population approximately 10%; however, by the time *'Californicus'* was established, the season was essentially over. At the Balm site, TSM infestations were very spotty throughout the experiment. '*Persimilis'* was released on December 16, while '*Californicus'* was released February 26. In Dover, TSM densities remained at an unusually low level the entire season, perhaps as a result of a cooler than average winter. '*Persimilis'* was released on December 9 (at about 13% average spider mite infestation) and *'Californicus'* was released on December 23 (at about 5% infestation). TSM levels were at about 5% infestation in both predator areas on 25 February.

Thus, the use of low-risk miticides in combination with properly timed releases of predatory mites should provide adequate control of TSM throughout the season. Discussion and detailed results of the on going trials will be available in future issues of Berry/ Vegetable Times. We would like to thank Al Herndon (Ferris Farm) and Cammy Hinton (Hinton's Farm) for their collaboration. Also thanks to Koppert who provided us with the predatory mites. If you have any questions please contact Silvia Rondon. (srondon@mail.ifas.ufl.edu).

## Plant Physiology Research for 2004-05

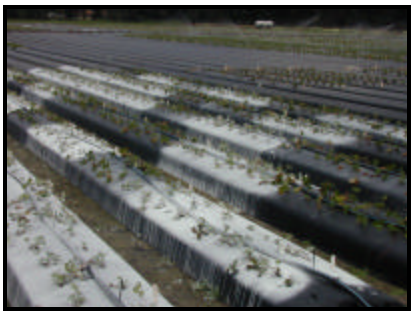
Elizabeth Golden and John Duval

The Nitrogen/Irrigation strawberry trial is in its final season. This trial is being conducted in collaboration with Dr. Eric Simonne. The study examines 'Festival', FL 97-39, and 'Ventana' to determine if IFAS recommendations could be refined to take into account plant type (i.e., small, medium or large canopy). Specifically, the trial seeks to determine for each of these cultivars what amount of water and fertilizer results in the highest marketable yield.

Transplant research continues with nurseries in Nova Scotia. We have established a trial to determine the effect of applying $CaNO_3$ to the nursery four weeks before digging. The hypothesis being tested is that nitrate levels in the plant can be increased prior to digging, and these higher levels will increase the initial vigor of the plants after establishment in the fruiting field.

Surround® crop protectant is being tested for its effectiveness to reduce heat stress on transplants. The main ingredient in Surround is Kaolin, a fine white clay. Beds were sprayed with Surround before planting. This treatment is similar to whitewash on beds but Surround washes off so that the benefits of the black plastic are available when temperatures drop. Surround was also sprayed on top of some plants when overhead irrigation concluded. Daily soil temperatures during establishment and harvest data will be recorded.

In the vegetable area, biological supplements are being tested to see if they have the ability to reduce fertilizer needs and increase yield in broccoli. Naturize™ and Behold are liquid supplements containing beneficial soil microbes. 150 ml of Naturize, Behold or water were applied to planting holes as plugs were set. 100% or 70% of the amount of fertilizer recommended by IFAS will be supplied weekly. Plant size and harvest dates will aid in determining functionality of products.



*Trial to evaluate Surround® crop protectant.*

## Resistance of Selected Strawberry Cultivars to Anthracnose Fruit Rot and Botrytis Fruit Rot

Craig Chandler, Jim Mertely, and Natalia Peres

In Florida, Botrytis fruit rot (caused by *Botrytis cinerea*) and anthracnose fruit rot (caused by *Colletotrichum acutatum*) are the most important pre-harvest fruit diseases on strawberry. Environmental conditions conducive to the development of Botrytis fruit rot occur every year in Florida, whereas conditions conducive to the development of anthracnose fruit rot occur more sporadically. When they do occur, however, losses can be severe. Fungicides are applied regularly to control or delay the onset of these diseases. Chemical control recommendations (i.e., product, rate, and frequency) have not traditionally incorporated knowledge of cultivar resistance, but this is beginning to change (See "Strategies for early season disease control" in July/Aug. Berry/ Vegetable Times Newsletter). Knowing the resistance or

susceptibility of a cultivar to *B. cinerea* and *C. acutatum* may allow us to develop cultivar specific recommendations. This should result in reduced fungicide use or improved disease control. This article summarizes the results of a three-year study to assess fruit rot resistance of cultivars of interest to Florida growers.

Twin field trials were established at the Dover research center during the 2001-02, 2002-03, and 2003-04 seasons: one for the determination of anthracnose resistance and the other for the determination of Botrytis resistance.

In the anthracnose trials, distinct levels of resistance were apparent (Table 1). 'Sweet Charlie' and 'Carmine' were the cultivars most resistant to anthracnose. The incidence of anthracnose fruit rot in 'Sweet Charlie' averaged 4% over three seasons, while 'Carmine', a new cultivar from the University of Florida, averaged 10% over two seasons. 'Festival' was intermediate in susceptibility to the disease, averaging 36% incidence (three seasons). 'Camarosa' and 'Treasure' were highly susceptible, averaging 78% incidence (three seasons) and 89% incidence (two seasons) respectively.

In the Botrytis trials, there were fewer statistical separations between cultivars than in the anthracnose trials, due primarily to a narrower range of disease incidence among cultivars. In 2002, the difference between cultivars with the highest and lowest incidence of Botrytis fruit rot was only 13% (Table 2). Nevertheless, 'Camarosa' and 'Carmine' had statistically lower incidences of Botrytis fruit rot than 'Sweet Charlie'. In 2003, when the range of disease incidence was even lower (5%), 'Carmine' had less Botrytis fruit rot than 'Festival' and 'Sweet Charlie'. In 2004, when disease pressure was high, 'Camarosa' had a statistically lower incidence of Botrytis fruit rot than 'Sweet Charlie'.

The Botrytis trials were somewhat compromised by a lack of adequate control of anthracnose fruit rot in certain cultivars. 'Camarosa' and 'Treasure' had >15% incidence of anthracnose fruit rot, despite two to four applications of Abound® (azoxystrobin). We suspect that plots of these two cultivars were established with plants latently infected with *C. acutatum* in the nursery.

**Table 1.** Incidence of anthracnose fruit rot during a 4-to-5 week period in February and March 2002, 2003, and 2004.

| | % Anthracnose | | |
|---|---|---|---|
| Cultivar | 2002 | 2003 | 2004 |
| Camarosa | 75 | 76 | 83 |
| Camino Real | — | — | 50 |
| Carmine | 10 | 9 | — |
| Festival | 29 | 47 | 31 |
| Gaviota | — | 55 | — |
| Sweet Charlie | 2 | 8 | 1 |
| Treasure | — | 96 | 81 |

**Table 2.** Incidence of Botrytis fruit rot during a 4-to-5 week period in February and March 2002, 2003, and 2004.

| | % Botrytis | | |
|---|---|---|---|
| Cultivar | 2002 | 2003 | 2004 |
| Camarosa | 6 | 4 | 17 |
| Camino Real | — | — | 26 |
| Carmine | 7 | 2 | — |
| Festival | 9 | 6 | 25 |
| Gaviota | — | 2 | — |
| Sweet Charlie | 19 | 7 | 39 |
| Treasure | — | 4 | 24 |

## Workshop on Vegetable BMP Manual

The Florida Department of Agriculture and Consumer Services, Office of Agricultural Water Policy, is hosting a rule development workshop on December 7 at the Hillsborough County Cooperative Extension Service to share their draft Vegetable and Agronomic Crop Best Management Practices (BMP) manual with area growers. This is an important workshop because state law requires that the BMP manual be adopted by rule under Florida Administrative Code, and the manual then becomes the vehicle by which growers can comply with emerging water quality requirements under Florida's Total Maximum Daily Load program. Please make plans to attend this meeting that begins at 2:00 p.m.! Access to the manual online is at: www.floridaagwaterpolicy.com under Best Management Practices The web site also have information on TMDLs and other water quality and BMP issues. Pesticide CEU's have been applied for.

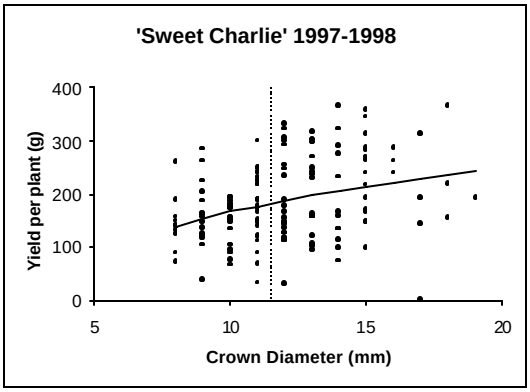
## Congratulations to Camille Esmel, graduate student with John Duval Plant Physiology program. Cami completed her defense for her Masters Degree and will continue her studies with Jim Gilreath in soil and weed science while working towards her PhD. Good job Cami!

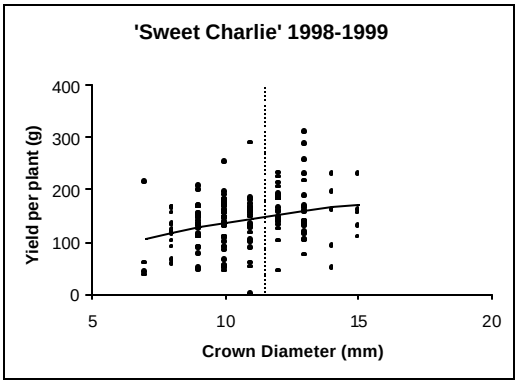
# Strawberry Transplant Size is Correlated With Early Season Yield

Steven MacKenzie

During the 1997-1998 and 1998-1999 growing seasons a study was conducted looking at yield from individual strawberry plants. Before transplanting the crown diameter of each plant was recorded and then yield data taken weekly (crown diameter is expressed in millimeters (mm) - for reference the diameter of a pencil is 7 mm). The data from this study was subsequently analyzed to see the effect that transplant size may have on yield during each month of the season. What was found is that transplant size is positively correlated with yield during the months of December and January. The relationship between yield summed over these two months and crown diameter is displayed in the graphs below. What the graphs show, apart from the extreme variability in yield for plants of all sizes, is that as crown size gets incrementally larger yield during the early months of the season goes up. However, the effect of increasing crown size appears to be reduced for larger crowns, as the regression line which best fits the data is not straight but becomes more horizontal with increasing diameter. Ultimately, the estimated gain in yield from a 1 mm increase in crown diameter for an individual plant ranges from approximately 14 g for a small diameter plant (7 mm) to approximately 6 g for a larger diameter plant (15 mm). The yield of plants less than or equal to 11 millimeters (mm) in diameter were also compared to those greater than 11 mm. The cutoff separating these two classes of plants is shown by the dotted line on the graph. In this analysis, for both cultivars tested, Dec./Jan. yield was higher for the larger diameter plants. For 'Sweet Charlie' during the 1997-1998 season yield was 29% higher (206 g/plant vs. 160 g/plant) and during the 1998-1999 season it was 24% higher (163 g/plant vs. 131 g/plant). For 'Camarosa' yield was 17% higher (158 g/plant vs. 135 g/plant) during the 1998-1999 season. I recently examined boxes of transplants and found a significant number of plants with crowns ranging from 8-11 mm, which would suggest that selection of larger plants could improve early season yield. The effect of transplant size was also examined for the months of February and March. During these months the correlation between transplant size and yield was not consistent.

In conclusion it appears that using larger transplants can improve early season yield. However, it also appears that the gain of using bigger transplants is diminished if transplants are relatively large already. Based on a visual analysis of the graph, early season yield will likely be compromised unless crowns are at least 12 mm in diameter at planting. The benefit of using even larger diameter plants is uncertain, but doesn't appear to be substantial.



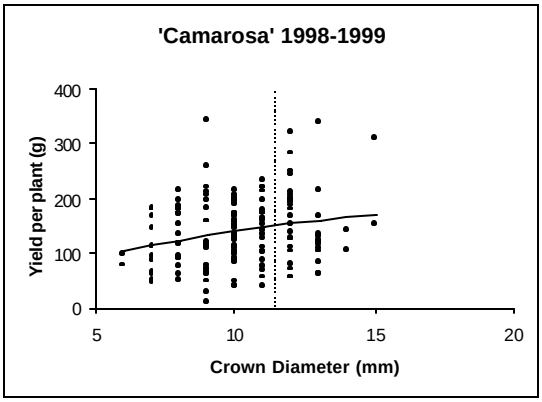




*Figure 1. The relationship between combined December and January yield per plant and crown diameter. Each dot represents a single plant.*

For planning purposes, it can be useful to know when diseases are likely to occur during the season. The diagram below shows when serious strawberry diseases have historically been a problem in west central Florida. **Crown rot** refers to the plant collapse caused by Collectotrichum gloeosporioides, while **root necrosis** refers to poor plant establishment and stunting caused by Collectotrichum acutatum. **Botrytis** refers to Botrytis fruit rot (Gray Mold) and **anthracnose** refers to anthracnose fruit rot (black spot).