

## Sources and Considerations for Predatory Mites

James F. Price

Those who choose to use predatory mites for twospotted spider mite management this season should have selected suppliers and initiated discussions about the events to come. In case this has not occurred, this article lists points to consider in selecting a supplier of *Phytoseiulus persimilis* predators. Some elements are especially important in selecting suppliers and are presented below. The suppliers should be recognized in the area for providing high-quality predators in a timely manner.

The *Phytoseiulus persimilis* predators should be from a strain selected for tolerance to organophosphorus insecticides. The suppliers should be prepared to send a replacement shipment immediately if the original shipment is of insufficient quality or is damaged. The suppliers should be knowledgeable about their products, our strawberry cultural system (pests and diseases encountered; insecticides, miticides, fungicides, and bactericides used; plant spacing; planting, growth, irrigation, harvest and termination schedules, frost protection methods, temperatures, humidities, etc.), and how the predators can be managed successfully here. Suppliers, and growers alike, should insist that predators be used only in conjunction with weekly scouting by a professional contractor or a well-trained employee whose primary responsibility is to scout.

The author knows of two firms that regularly supply predators to Plant City area strawberry growers, Agri-Tech Services (Gordon DeCou, Home: 941-756-2981, Cell: 941-745-4416, email: agritech@gte.net) and EcoSolutions (Jim Cashion, 727-787-3669, email: ecosolutions@mindspring.com). Others may exist in the area.

There are many suppliers available through Suppliers of Beneficial Organisms in North America, an electronic publication by the California Department of Pesticide Regulation and available on-line at [http://www.cdpr.ca.gov/docs/ipminov/ben\\_supp/contents.htm](http://www.cdpr.ca.gov/docs/ipminov/ben_supp/contents.htm). Only a small portion of the suppliers from this list possess the understanding of our system of culture to provide the support growers need.

**? DRIP IRRIGATION SCHOOL**  
**WEDNESDAY NOVEMBER 13th 10 am- 4 pm**  
John R. Duval

Do you want to make the most efficient use of your water, fertilizer, and chemical resources? Then come to the Drip Irrigation School taking place Wednesday November 13th from 10 AM to 4 PM at the GCREC-Dover and find out how. Topics to be covered include injection of fertilizers and chemicals, irrigation scheduling, drip system trouble shooting, soil water monitoring, and irrigation BMPs.

Lunch is provided and 1 ½ CEU credits (of which ½ will be CORE) and 2 ½ CCA credits will be available. If you are interested in attending please call Christine Manley at 813-744-6630 ext 60 to reserve your space. For more information and the program please go to <http://strawberry.ifas.ufl.edu>.

## Strawberry Culture under Protective Structures I. Production Systems

Dr. Daniel Cantliffe, Dr. Silvia I. Rondon, and Ashwin Paranjpe

The loss of methyl bromide in the year 2005, the regulations on water-use for frost protection and transplant establishment, regulations on pesticide usage, reduced number of farms due to rapid urbanization, increasing labor cost, and low productivity during winter (November to February), are some of the major concerns for the Florida strawberry industry. Growing strawberries in passive-ventilated greenhouses using soil-less substrates, and integrating biological control in the pest management practices may offer a viable alternative for strawberry growers.



Figure 1.  
The Protected  
Agriculture Project,  
Gainesville, FL

The Florida/Israeli Protected Agriculture Project (Figure 1) (<http://www.hos.ufl.edu/protectedag>) headed by Dr. Dan Cantliffe of the Horticultural Sciences Department, University of Florida, has been conducting various experiments to generate practical and location-specific information for greenhouse production of cucumbers, peppers, Galia melons, and strawberries in north-central Florida. Researchers are studying various growing systems (containers), soil-less substrates, plant densities, new varieties, and methods of biological control for producing off-season vegetables under passive-ventilated greenhouses. This article specifically deals with some of our production systems research. In next month's Berry Times, a follow-up article will discuss our work on the biological control of strawberry pests. Information about the research done with other crops can be accessed at the previously listed website.

During Fall 2000 and 2001, a study was conducted to compare the quality and yield of 'Sweet Charlie'

strawberry grown in polyethylene bags placed on the ground, polyethylene bags placed on elevated gutter sections, or in a specially designed 'Hanging Bed-Pack' trough system (Figure 2) (Polygal Plastic Industries, Ramat Hashofet, Israel), elevated 1.8 m above the ground level. Soil-less substrates like perlite, peat, and pine bark were also evaluated for their performance in protected strawberry culture. When plants were grown in polyethylene bags placed on a gutter, yields were slightly higher than when plants were grown in elevated troughs or in bags placed on the ground. Yields were not affected by the type of soil-less substrate. These studies provided us with some basic information on how the various growing systems and soil-less substrates perform under protected strawberry culture.

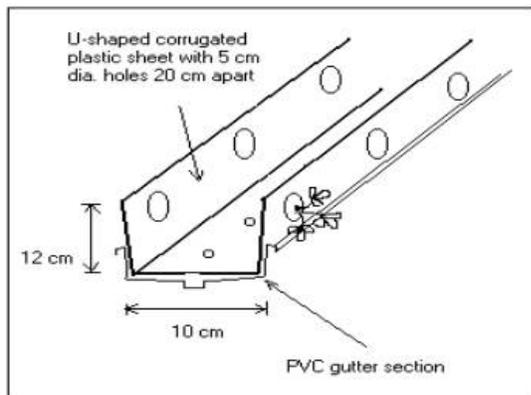


Figure 2. 'Hanging Bed-Pack' trough system

For the profitability of a protected strawberry operation, maximum space utilization is critical. A study was conducted during Fall 2001 to determine the effect of high plant densities on yield and quality of 'Sweet Charlie' strawberry grown in a passive-ventilated greenhouse (Figure 3). Plug transplants were planted in a 'Hanging Bed-Pack' trough system filled with locally available 1-inch sieved pine bark (Elixson Wood Products Inc., Starke, FL). The troughs were spaced 25.5, 23.5, 21.6, and 19.6 inches apart (center-to-center), resulting in four between-row spacings. Plugs were either transplanted in every hole (7-inch within-row spacing), or every other hole (14-inch within-row spacing). The combinations of four between-row spacings and two within-row spacings resulted in eight plant densities ranging from 36,120 plants to 73,578 plants per acre. Early yield (Nov 28 – Jan 28) and total yield (Nov 28 – Mar 22) per acre increased linearly as plant density increased. The early yield per plant (approximately 200 grams) was similar at all plant densities whereas the total yield per plant was higher at 14-inch within-row spacing than at the 7-inch within-row spacing (425 grams vs. 411 grams). The average fruit weight was 19.9 grams and more than 90 percent of the yield was marketable.



Figure 3. 'Sweet Charlie' strawberries growing in 'Hanging Bed-Pack' trough system filled with pine bark

Since plant density in protected strawberry cultivation can be five times greater than the plant density in the field, and higher air temperatures can be maintained inside the passive-ventilated greenhouses during winter, early yield from greenhouse-grown strawberries (3,192 12-lb flats/acre) can surpass the total yield (2,226 12-lb flats/acre; Florida Agricultural Statistics, (www.nass.usda.gov/fl) of field-grown strawberries. The total yield obtained from our greenhouse trials (6,605 12-lb flats/acre) was almost three times that of field-grown strawberries. The use of locally available and relatively inexpensive soil-less substrate like pine bark (\$6.50 / yd<sup>3</sup>) eliminates the need for methyl bromide and offers a cost-effective alternative to more expensive and commonly used soil-less substrates like perlite (\$31 / yd<sup>3</sup>) and peat (\$53 / yd<sup>3</sup>). Thus, protected strawberry culture at high plant densities can enhance early fruit production, which, at higher off-season market prices, can translate into higher income. This fall, we are conducting a variety trial to test the performance of 'Sweet Charlie', 'Festival', 'Earlibrite', 'Treasure', 'Carmine', FL 97-39, and 'Camarosa' under protected culture.

### Irrigating New Plantings

John R. Duval

Fruiting fields have been established and the fruit will soon begin arriving, time for a breather. Think again! As soon as over head irrigation is stopped, it is time to start scheduling drip irrigation and fertigation. This is perhaps the most critical time to pay attention to these details. Plants are actively growing now and need fertilization and adequate water. Most pre-plant fertilizer has been leached out of the root zones of plants and needs to be replenished, and while beds may seem to contain adequate moisture this may not be the case. Young plants have limited root systems and can only mine water from a small volume of soil.

Calcium deficiency induced tip-burn



Frequently we see calcium deficiencies on young leaves during November, not due to lack of calcium in the soil but due to fluctuating soil moisture. Calcium movement in the soil and plant occurs by mass flow. This means that calcium moves only in the water stream. Applications of calcium as a foliar spray have limited use because calcium is not very mobile from one plant part to another. The best means to avoid this is to maintain proper soil moisture in the beds (soil water tension between 8 and 15 centibars). IFAS recommendations for fertilization are 0.3 lbs nitrogen and potassium per acre per day for the first two weeks after establishment and 0.6 lbs nitrogen and potassium per acre per day until February.

These recommendations are a guide and can be adjusted due to weather, variety or other factors that may alter the crop's requirement for fertilizer.

## Spotlight on Diagnosis

Jim Mertely and Dan Legard

Samples began arriving at the UF Strawberry Diagnostic Lab about three weeks ago. Some arrived in the box, while others had already been planted. This season appears to be repeating what occurred last year. Nearly all the samples have been diagnosed with anthracnose disease caused by *Colletotrichum acutatum*. Many were showing sunken dark spots on the petioles, which is typical of this fungus. The plants also showed a mixture of tan living and dark dying roots, which probably account for establishment problems reported by the growers.

A total of eight samples have been diagnosed with anthracnose to date. 'Treasure' was the most seriously affected cultivar. Samples of cultivar 'Camarosa', 'Gaviota', and 'Festival' were also positive for this disease. 'Camarosa' may account for more samples in the future, since several nurserymen have reported problems with this cultivar. Hopefully, the late arrival of 'Camarosa' from northern nurseries will allow these plants to become established under cooler conditions, and reduce stress-related losses to *C. acutatum*.

## Plant Sanitation: Is it worth doing?

Jim Mertely

Most strawberry fields have already been planted and watered in. At this point, many growers will consider trimming old leaves off of their established plants. This form of pruning or plant sanitation has traditionally been carried out to suppress disease and improve the appearance of the plant. When these old leaves are removed, as the theory goes, pathogens are removed with them, and a source of inoculum for newly emerging leaves is eliminated.

We tested this theory in a series of field experiments to determine the effects of plant sanitation on Botrytis fruit rot (gray mold). Trimming old leaves after plant establishment slightly reduced Botrytis fruit rot during the 1996-97 experiment, but was only partly effective in 1998-99, when disease pressure was higher. In addition, the yields of trimmed plants were no higher than those of plants that had not been trimmed. During both seasons, a standard fungicide control program based on captan provided better control of Botrytis fruit rot, and higher yields than plant sanitation. While this was not surprising, there were several unexpected results. For example, combining plant sanitation and fungicide applications did not improve disease control over fungicides alone. In addition, the combined treatment yielded less than the fungicide treatment alone. This suggests that cutting old leaves that have not completely died may weaken the plant and decrease yield. Based on these results, we do not recommend that growers use plant sanitation to control Botrytis in Florida, although it may prove useful in special situations. An organic or home grower may obtain some control by selecting a cultivar with resistance to Botrytis fruit rot (e.g., 'Camarosa' or 'Carmine'), and periodically removing old dead leaves.

The effect of plant sanitation on anthracnose diseases caused by *Colletotrichum acutatum* has not been investigated. However, the biology of this fungus suggests that trimming old leaves would not be very effective. During the establishment period, mild weather and overhead irrigation are favorable to the sporulation and spread of this fungus. Young tissues are highly susceptible to infection. Therefore, new leaves emerging during establishment would likely be infected before the old leaves are removed. These new leaves and petioles may not show symptoms immediately, but maintain the pathogen until February or March, when favorable weather and an abundance of susceptible flowers and fruit lead to epidemics of anthracnose fruit rot.

To trim or not  
to trim



There is another form of plant sanitation that may be essential to good disease management. This is the practice of picking and throwing diseased fruit into the alleyways during each harvest operation. Based on theoretical considerations and our own observations, fruit sanitation should be carried out.

## Control of Powdery Mildew

Dan Legard

Powdery mildew is caused by the fungus *Sphaerotheca macularis*. The disease typically begins as small white patches of web-like growth on the bottom of leaves. Tiny, semi-transparent conidia give the patches a powdery appearance. As the disease progresses, it can spread until it covers most of the underside of the leaflet. On many cultivars, the fungus doesn't grow as much and it may be hard to see white patches on the leaves. Instead irregular-shaped yellow or black necrotic spots up to 3/8 inch (8.5 mm) develop on the lower surface of the leaf which eventually spread through to the upper surfaces. The edges of heavily infected leaflets may curl, and flowers and fruit can also be infected. The fungus colonizes achenes of the fruit and produce aerial mycelia that make the seeds appear fuzzy.

The fungus only infects strawberry and does not survive in the absence of living host tissue in Florida. In nursery areas, it can over-winter in infected leaves (as cleistothecia) and the most likely source of primary inoculum in Florida is transplants. Spores are produced on infected plants and air dispersed throughout the field and to neighboring fields. The development and spread of powdery mildew is favored by moderate to high humidity and temperatures of 60 to 80 F (15 to 27 C). Interestingly, rain or dew inhibits the fungus. Typically, powdery mildew is only a problem in west central Florida from late October to mid-December. However, when winter temperatures are mild, the disease can continue to cause damage.



*Evidence of powdery mildew on leaves  
and fruit*



Cultivars differ in their susceptibility to powdery mildew. To control powdery mildew on susceptible cultivars, apply fungicides at the first sign of disease. This is especially important when using protectants such as sulfur. Systemic fungicides like Topsin M<sup>®</sup> and other fungicides such as Nova<sup>®</sup> can effectively control powdery mildew if the pathogen population has not developed resistance to them. Survey the field looking for leaf distortion and discoloration that is indicative of powdery mildew, especially during the early and late season. Controlling the foliar infections helps to prevent fruit infections. Once disease is found we recommend that growers alternate applications of sulfur and Nova<sup>®</sup> or Topsin M<sup>®</sup> on a weekly schedule. Alternating fungicides reduces the chance that pathogens resistant to the fungicides will develop.

### **Dan Legard accepts position with California Strawberry Commission** Craig Chandler

Dr. Dan Legard recently accepted the position of Director of Research for the California Strawberry Commission. Dan began working at the University of Florida's Dover research center as an Assistant Professor of Plant Pathology in 1995, and was promoted to Associate Professor in 2001. Dan's research program has focused on Botrytis and anthracnose fruit rot and Colletotrichum crown rot— making significant contributions to our understandings of these serious diseases. In 1998, using grant and gift money, Dan hired Dr. Jim Mertely to assist with field and laboratory work and to manage the center's diagnostic clinic. Dan has run an active fungicide-testing program, which has been well supported by the agro-chemical industry. Several valuable fungicides have been registered and labeled for use in Florida as a result of this program. In addition to developing an internationally recognized research program, Dan has been very instrumental in the overall modernization of the Dover center, and deserves much credit for lab, field, and computer upgrades at the center over the past seven years. Finally I must mention that the center's popular web site and newsletter are primarily the result of Dan's vision (along with a lot of hard work and creativity from our very capable office coordinator, Christine Manley).

Dan will be moving to the Monterey Bay area of California in mid December. His efforts on behalf of the University of Florida and the Florida strawberry industry will be missed, but we are pleased his focus will remain on strawberries. Good luck Dan!

Jim Mertely will continue to manage the disease diagnostic clinic and handle other essential duties of the strawberry pathology program. A national search for a plant pathologist to fill Dan Legard's tenure-track position will be conducted over the next several months.

*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 named, 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.*

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