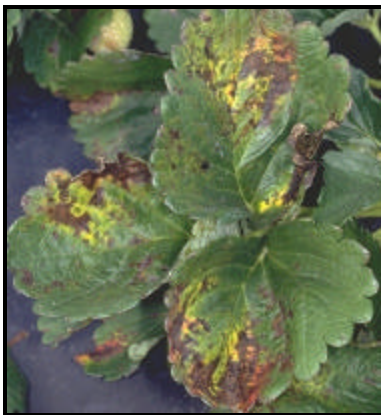


## Angular Leaf Spot and Its Control - Jim Mertely and Craig Chandler

*Xanthomonas fragariae*, the bacterium that causes angular leaf spot, is present in many west central Florida production fields. This season's El Nino weather pattern has apparently contributed to its development and spread. *X. fragariae* multiplies prolifically in the small angular spots it produces on diseased leaves. The bacterium oozes out of the spots on the underside of the leaf as a viscous secretion. Development of the pathogen is favored by mild humid days (65-70° F) and cold nights with near-freezing temperatures, while spread is facilitated by rainfall, overhead irrigation, and harvest operations. Serious losses may occur during epidemics when fruit caps (calyces) are spotted or dry up in systemically infected plants.



Evidence of  
angular leaf spot

Angular leaf spot is ideally controlled by the use of healthy transplants to exclude the bacterium from newly-planted fields. Most epidemics are thought to originate from infected planting materials because *X. fragariae* is restricted to strawberry, and does not persist well in annual strawberry if crop residues are disposed of properly. Control measures are limited once the disease appears in the field. Our current control recommendations are listed below:

- A. Avoid harvesting and moving equipment through the field when the plants are wet.
- B. Harvest fields showing the least amount of symptoms first; move progressively to the field showing the most symptoms.
- C. Monitor weather conditions closely, and use sprinkler irrigation only when freeze protection is absolutely necessary.

- D. Use copper-based bactericides judiciously. While these products should suppress the disease, they may also reduce yields if overused. The best practice might be to spray only if lesions start to appear on fruit calyces. Thorough coverage is necessary since most inoculum is produced and spread from the underside of the leaf.

More details about angular leaf spot can be found on our website at <http://strawberry.ifas.ufl.edu>. Click on the plant pathology button at the top of the home page, and see information and photos found under "Plant Pathology Fact Sheets" and "Digital Library of Diseases". Additional information is available on the internet from universities in other strawberry-growing states, e.g., [www.nysaes.cornell.edu/pp/extension/tfabp/salsmf.shtml](http://www.nysaes.cornell.edu/pp/extension/tfabp/salsmf.shtml) and [www.ipm.ucdavis.edu/PMG/r734100611.html](http://www.ipm.ucdavis.edu/PMG/r734100611.html).

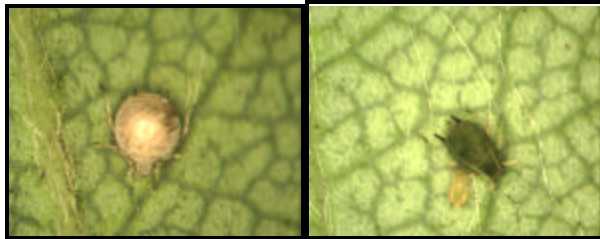
## Aphids in Strawberry - Jim Price

This season aphids are persisting in west central Florida strawberries through December and the problem merits attention. There are usually two aphids that are commonly found on Florida strawberry, the strawberry aphid and the melon aphid (also called the cotton aphid). The two appear similar in the field and usually are managed alike. Aphids on strawberry are tiny green to dark blue-green insects that easily can be encircled by an "o" on a printed page. Only a few aphids have wings, but all have a pair of cornicles, "exhaust pipes", one on each side of the rear end, which should be used as a diagnostic aid in the field.

Almost all of the aphids found in strawberry are females that can give live birth to females that will bear young in a few days. That rapid reproduction rate leads to their pest status on strawberry. The presence of aphids, their fragile, white, cast skins and sugary excretions on fruit are objectionable to consumers and reduce quality. Too many aphids sucking plant juices can devitalize the plant and may reduce yields. Accordingly, attention needs to be directed toward aphids and remedial measures applied as necessary.

In our environment there are several parasites and predators of aphids that always will eliminate aphids as a problem, but sometimes not before economic damage has occurred. Hover (syrphid) fly larvae, lacewing adults and larvae, several lady beetle adults and larvae, midge larvae, and some other insects eat many aphids during their development and contribute greatly to aphid control.

However, it is the activity of a very tiny, mosquito-looking wasp that parasitizes aphids and ensures the end of aphid problems here. Parasitized aphids become brown and slightly enlarged, reminiscent of a brown paper sac. Eventually the parasitized, “paper sac” aphids have a young female parasite cut a round hole in their upper-rears. The parasites then emerge to parasitize other aphids. Harsh, broad-spectrum insecticides can kill these predators and parasites and eliminate this effective natural control



Parasitized, “paper sac” aphid compared to a normal aphid

Drs. Dan Cantliffe, Silvia Rondon, and Jim Price of the University of Florida are working to develop plans to use insectary-reared predators practically and economically in concert with naturally occurring agents in strawberry for aphid control. Presently, however, growers wishing to reduce aphids before naturally occurring predators and parasites have done so must rely on insecticides. Fortunately, several exist and some may require only one application for satisfactory control. Among the products registered in Florida and practical for use in a winter annual hill cultural system are: Diazinon, malathion, methomyl, naled, azadirachtin, *Beauveria bassiana*, bifenthrin, endosulfan, oils (read phytotoxicity precautions on product labels), and soap.

Careful attention to conserving naturally occurring parasites and predators and applying appropriate insecticides only as needed can eliminate economic losses to aphids and enhance the reputation of Florida strawberry. You may obtain more information regarding this subject at <http://edis.ifas.ufl.edu/IN400>.

### Causes of Misshapen Fruit in Strawberry - Craig Chandler

High numbers of misshapen fruit in a field lower harvest efficiency and marketable yield. There are many potential causes of misshapen fruit, but those listed below appear to be the most common:

- **Cultivar.** Differences in fertility (i.e. the viability of male [pollen] and female flower parts) among cultivars have been documented. Breeders are currently striving to develop cultivars that produce symmetrically shaped fruit under a range of environmental conditions.
- **Fruit position.** Primary fruit (king berries) generally have a greater tendency to be malformed

than secondary and tertiary fruit. This may be due to lower male fertility in primary flowers, compared to secondary and tertiary flowers.

- **Weather.** Pollination may be poor during extended periods of low light intensity (e.g., when there are several days of heavy cloud cover during December or January) or during cool, wet weather. Freezing weather may also result in misshapen fruit. In west central Florida, strawberry flowers will be damaged when the temperature of the flower surface is about 30 °F (-1.1 °C). A period of very warm weather followed by a freeze may raise the freeze damage threshold to near freezing, and, conversely, a period of cold weather can lower the threshold. The most likely portion of the flower to be damaged is the tip. As the fruit develops, the damaged tip becomes a sunken area surrounded by normal tissue. Large fruit may split. Cultivars are known to vary in their susceptibility to this type of damage. Earl Albregts and Charlie Howard, in a study conducted at the Dover center in the early 1980s, found that ‘Dover’, a cultivar that has a dense canopy which conceals most of its flowers and many of its fruit, was less susceptible to freeze damage than ‘Tufts’, a cultivar with a more open canopy (Albregts and Howard, 1985).
- **Pesticides.** The application of pesticides to plants may, under some circumstances, adversely affect the plant, flowers, and fruit. Captan applied at a high concentration (2000 ppm) has been shown to inhibit pollen germination (Eaton and Chen, 1969). The application of certain insecticides can reduce the population of insect pollinators, which in turn may result in more misshapen fruit.
- **Nutrient deficiency or excess.** Boron deficiency (leaf concentration less than 25 ppm) can result in fruit malformation, while excessive nitrogen applications have been shown to result in an increase of misshapen fruit (Albregts and Howard, 1982).

Misshapen fruit



Albregts, E.E. and C.M. Howard. 1982. Effect of fertilizer rate on number of malformed strawberry fruit. Proc. Fla. State Hort. Soc. 95:323-324.

Albregts, E.E. and C.M. Howard. 1985. Cycling irrigation for freeze protection during a radiation freeze. Soil and Crop Sci. Soc. Fla. Proc. 45:125-128.

Eaton, G.W. and L.I. Chen. 1969. The effect of captan on strawberry pollen germination. J. Amer. Soc. Hort. Sci. 94:558-560.

## Foliar Fertilization of Strawberry - John R. Duval

When it has been determined through foliar tissue analysis that a plant is deficient in a micro-nutrient (iron, zinc, copper, manganese, magnesium, boron) it is possible to alleviate symptoms quickly with a foliar spray. This practice should only be used as an 'emergency' method of fertilization. Leaves are not designed for nutrient uptake. The leaf surface is covered with a waxy cuticle which minimizes the absorption of nutrients. The longer the leaf stays wet (from the nutrient spray) the more effective the application is in terms of nutrient uptake. Therefore, growers should consider applying nutrient sprays late in the afternoon when the sun is setting and temperatures are dropping. The addition of a surfactant will also improve the effectiveness of foliar fertilization. However organosilicate surfactants should not be used due the possibility of burn and promotion of bacterial diseases. To avoid reducing the effectiveness of pesticides, nutrient sprays should not be tank mixed with other chemicals unless it is specifically stated on the label that it is safe to do so. The crops requirement for micro-elements may be met with only one or two nutrient sprays correctly timed and applied. Foliar fertilization products are available from most fertilizer dealers. Purchase a product that contains *only* the nutrient you are trying to supply. Supplying excess amounts of unneeded micro-nutrients can lead to toxicities in the plant and there is no way to remove excess nutrients from a plant. After cropping, soil testing and the addition of micro-nutrients to the soil can help eliminate future problems and reduce the need for foliar fertilization.

## Strawberry Flavor - Kurt Schulbach, Postdoctoral researcher, Food Science and Human Nutrition Dept., Univ. of Florida

Consumers are initially drawn to strawberries for their attractive shape and color, but it is the sweetness and flavor that keeps them coming back for more. Strawberry flavor is not a single flavor but a complex blend of many aromatic compounds. The unique taste and aroma of strawberries has been widely studied by flavor scientists since the 1930s. Hundreds of compounds with aroma have been identified in strawberry, none of which smell much like a strawberry! For example, strawberries contain a compound called linalool which smells like lemon blossoms, another called gamma-decalactone that has an odor of peaches, one called Furaneol which smells just like cotton candy, and another compound called ethyl butyrate which is reminiscent of Juicy Fruit gum. All these compounds and many others combine together to create the unique aroma of strawberry.

While we know a lot about the identity of the compounds in strawberry, there is still a lot more to be learned about which compounds are the most important, or which compounds make one strawberry variety preferred over another. Recently, we have conducted taste panels in order to describe the flavor of some strawberry varieties



Strawberries...one of the world's most popular fruit

and compare these sensory attributes to a chemical analysis of the fruit. Comparing fruit flavor with chemical composition provides some interesting information. For example, we have found that the compound gamma-decalactone seems to enhance the fruity flavor in Sweet Charlie, but this important compound is not found in Camarosa. Another compound, Furaneol (the one that smells like cotton candy) seems to enhance the sweetness of the fruit. It may be possible, through a breeding program, to develop varieties that produce relatively high quantities of this compound in their fruit, thus improving flavor.

Continued research into the complex flavor of strawberries at the University of Florida should help maintain the strawberry's position as one of the world's most popular fruits.

## Center Update – Christine Manley

Mark your calendars for our Field Day scheduled for February 13, 2003 starting at 2:30 pm. Meet and talk with our faculty and staff regarding the strawberry industry and the research conducted at GCREC. Our Field Day is opened to the public and will provide valuable information to the attendees as well as give us a chance to show the community what goes on behind the scenes of agricultural research.

For those interested in attend the 2003 Florida Postharvest Horticulture Industry Tour March 10-13 contact our office as soon as possible for details. The tour is being cosponsored by the University of Florida, Cooperative Extension Service, Horticultural Sciences Department and the Florida Fruit and Vegetable Association. This tour will provide an opportunity to experience first-hand the latest technologies for handling and shipping subtropical and tropical fruits, warm and cool season vegetables and ornamental crops. The tour will depart from Gainesville early Monday, March 10. Enrollment is limited to 35 participants and the deadline for early registration is February 14. Call Christine

Manley at (813) 744-6630 for a registration form or visit the Horticultural Sciences website at [www.hos.ufl.edu](http://www.hos.ufl.edu).

If you are interested in having your group tour our facilities, please contact Christine Manley (813) 744-6630 ext. 60 or [cmanley@ufl.edu](mailto:cmanley@ufl.edu). We encourage educators and schools to contact us for educational tours for students of any age. We are working on a special PowerPoint presentation that will be available to educators that will give an overview of our research in both elementary and technical versions. Watch for the release of this presentation on our website <http://strawberry.ifas.ufl.edu>.

Plans for our relocation to the new regional center in Balm are continuing to progress. Several committees have been formed to give input as to field layout and building design. These committees, made up of both staff and faculty, have been traveling to other research centers throughout the state to obtain ideas and inspiration as to how the new center should be designed. This has provided a lot of excitement and anticipation for our staff and faculty, and we are all looking forward to working in a state-of-the-art facility. We will keep you updated as information becomes available.

*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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