Berry/Vegetable Times

January 2006

UNIVERSITY OF FLORIDA
IFAS EXTENSION

2006 Calendar of Events

Jan. 25 Frost/Freeze Protection Workshop for Strawberry, Blueberry, and Ornamental Plant Nursery Operations. Hillsborough County Extension Office, Seffner, 11:00 -4:30. Lunch provided. Please RSVP to Alicia Whidden at 813-744-5519, ext. 134.

Feb. 6 Strawberry Field Day 2006 at GCREC 1:30 to 4:00 pm. Presentations and tour, CEU's applied for. More details on Page 8.

Feb. 14 Pesticide License Testing. Hillsborough County Extension Office, Seffner. 9 am. For more information call Dave Palmer, 813-744-5519, ext 103.

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STRAWBERRY FIELD DAY COMING UP

The first Strawberry Field Day to be held at the new Gulf Coast Research and Education Center facility in Balm will be on Monday, February 6. The meeting will start at 1:30 in the auditorium then we will move out to the fields. This is a great chance to see the newest varieties from the strawberry breeding program as well as to get an update on the latest research. There will be a demonstration of fumigation rig modifications for low dose applications and soil moisture monitoring technology. GCREC is located at 14625 County Road 672. More details on Page 8.

We look forward to seeing you Monday, Feb. 6 at 1:30 at GCREC-Balm for a great Strawberry Field Day.

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Predicting Future Strawberry Yield

Steven MacKenzie and Craig Chandler

An accurate prediction of strawberry fruit yield in a given week made well ahead of time conceivably could help growers determine labor requirements and plan marketing strategies. For crops other than strawberry, mathematical models based on green fruit or flower counts have been used to forecast future yields. Theoretically, a similar model could be used to predict yields of strawberry. Over the past year at the GCREC we have been collecting data and mining records of field trials to produce a yield prediction model for strawberry. Predicting strawberry yields from flower or green fruit counts poses a unique challenge. Unlike most fruit crops, which have a flush of flowers followed by fruit set, fruit and flower production from strawberry overlaps. The first challenge that must be over come in developing a model

(Continued on page 2)

to predict fruit yield is to determine what to count. We have focused on using flower counts on specified dates to determine weekly yields in the future, as flower counts will allow for the longest range prediction and flower age is easier to pinpoint. Once we determined that flowers would be used to determine future yields, we measured the time it takes for a flower to become a fruit. This time period is highly variable depending on the cultivar and temperature during ripening. For these reasons sampling dates to predict yields for a given time period differ between cultivars. Also, temperatures prior to the harvest affect the time between when flower counts are made and the harvest. The first model that is being produced at the GCREC focuses on the cultivar Strawberry Festival. Based on the interval from open flower to mature fruit it appears that yield estimates can be made for Strawberry Festival approximately 3.5 weeks prior to the week of harvest. For each harvest week, the current model being evaluated requires flowers with fresh pollen to be counted from 100 randomly selected ‘Strawberry Festival’ plants twice to determine yield for a one week time period. Average flower counts per plant can then be multiplied by a factor to determine the number of fruit expected per plant. Given that the grower knows the number of plants in the field, future fruit number can then be determined.

Currently the models that have been developed appear to give accurate predictions of fruit number. However, a good model must take into account the proportion of fruit that will be culled because they are small, misshapen or diseased and the size of fruit that will go to market. Based on data collected over seasons at the experiment station in Dover, poor fruit size can reduce early season yield by as much as 30% relative to an average year. This reduction in yield not only occurs because the fruit are smaller, but in fields with small fruit there are a higher proportion of culls. The determinants of average fruit size appear to differ between the first bloom, in which fruit are produced from the crown of the transplant, and later blooms in which fruit are produced from secondary crowns. For the second bloom period, fruit size is negatively correlated with the number of fruit produced per plant. Also, there are more culls on plants with higher fruit numbers. Based on the past years data it appears that these effects can be accounted for in a yield prediction model in which flower counts are the only input variable. Predicting fruit size early in the season is much more problematic as factors that influence fruit size such as overall health of transplants, the crown diameter of transplants and weather phenomena outside of Florida cannot be determined from flower counts. For this reason yield estimates from flower counts would be less accurate early in the season.

During the 2004-2005 season a yield prediction model was used to predict yield from 100 ‘Strawberry Festival’ plants over the course of the season. Yield predictions were made 3.5 weeks in advance. The size of the fruit was very close to what would be expected during this season and the model performed very well. A graph displaying predicted yield and actual yield for the 16 weeks the trial was conducted is given in Figure A. This season we have used the model to predict yield from 480 ‘Strawberry Festival’ plants by counting flowers from 100 plants each week. Once again predictions were made 3.5 weeks in advance. On average the model predicted that yields would be greater than what was observed (Figure B). An analysis of why this is the case showed that the model was accurately predicting fruit numbers, but berry size was significantly smaller than sizes observed in past seasons. As a result, the model underestimated the number of fruit that would be culled and overestimated the size of the fruit. When ranges of fruit sizes from past data was incorporated into prediction models to come up with a range in which yield might fall, in only one week did actual yield fall outside of the prediction interval.

Hopefully after this season a model will be available to predict yields for 'Strawberry Festival' which can be refined yearly as new information becomes available. Based on our experience with predicting yield for this cultivar, models for additional cultivars will likely be easier to create and therefore be available in a timely manner.

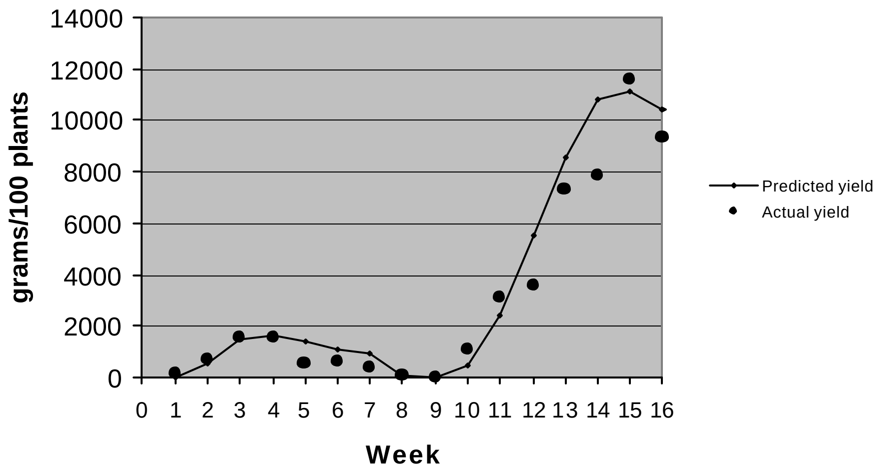

Figure A. Predicted and actual fruit yield from strawberry over 16 weeks during the 2004-2005 season in Dover, FL.

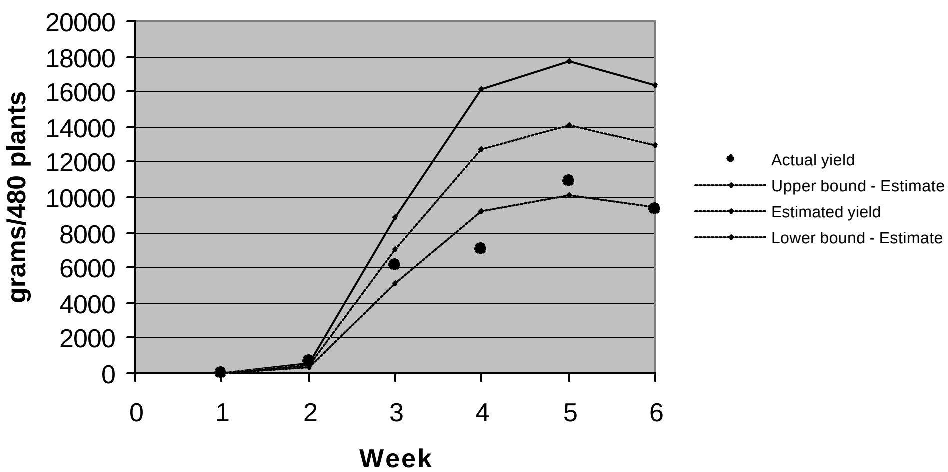

Figure B. Predicted and actual fruit yield from strawberry over the first 6 weeks of the 2005-2006 season in Balm, FL.

Note: Dr. MacKenzie is a postdoctoral associate working in the strawberry pathology and breeding programs at GCREC.

Why were November/December Strawberry Yields in West Central Florida Lower this Season than Last?

Craig Chandler

Florida Strawberry Growers Association records show that west central Florida strawberry growers harvested significantly less fruit in November and December 2005 than during the same period in 2004. A change of varieties or a decrease in acreage could cause such a yield reduction, but varieties and acreage have been relatively stable over the last several years. The other variable that can have a great influence on yield is temperature – most obviously temperature in the fruiting field, but also temperature in the nursery, particularly temperature in the nursery during the few weeks before digging. Mean monthly temperatures in the fruiting field area for Oct., Nov., and Dec. 2005 varied only a degree or less from mean temperatures for the same periods in 2004, so this is unlikely to be a contributor to lower yields. Total solar radiation recorded at GCREC for Oct. and Nov. 2005 was 6% and 8% less than for Oct. and Nov. 2004 respectively, indicating that there was more cloud cover at the beginning of this season than last. This increased cloud cover may have had some effect on plant growth and development, but is probably not the main cause of significantly lower yields.

This leads us to temperatures in the nursery areas as a possible cause for delayed flowering and fruiting. Warm weather in the weeks prior to digging can delay plant maturity and the initiation of flower buds. Temperatures across eastern Canada, the largest supplier of transplants to Florida, were well above average this past September. This, according to the Meteorological Service of Canada, contributed to Ontario record. The summer and fall of 2004, by contrast, was unusually cool, wet, and cloudy.

In western North Carolina, another important nursery area for the propagation of transplants used by the Florida strawberry industry, the average temperatures for Sept. 2004 and 2005 did not differ greatly. The average high temperature for Sept. 2005 was about 5 °F higher than the average high temperature for Sept. 2004, but the average low temperature for Sept. 2005 was about 2 °F lower than average low temperature for Sept. 2004. Averages for both years were within the 70-80 °F day/50-60 °F night ranges we consider important for flower bud initiation and development.

So, in conclusion, it appears there is good chance that the relatively low Nov./Dec. yields of the 2005-06 season here in west central Florida are due primarily to the unusually warm weather experienced by the eastern Canadian nurseries this past late summer and early fall.

Winter Pruning for Blueberries

Alicia Whidden

Pruning blueberries while the plants are dormant encourages plant vigor and can enhance fruit quality and prevent overbearing. The time to do this late winter pruning is when the flower buds can easily be seen and should be finished before petal fall. Now that the leaves are off the plant this is a good time to be able to see the weak twiggy growth and clean it out so that the plant can put its energy into the fruiting canes. This is the time to cut back vigorous new canes to shorten them and adjust the amount of fruit the plant will be producing. Remember you are trying to regulate the fruit load so the berries will be larger and to stimulate vegetative growth for next year's crop of fruit and adjust the size and shape of your plants.

When your plants are six years or older you need to start thinking about pruning for cane renewal. As blueberry canes age they branch more and become twiggy and not as vigorous. When your bushes reach this stage if you remove a few of the older canes this will stimulate the plant to produce new vigorous canes and this will increase yield. When plants are 5 to 6 years old it is recommended to remove about 25% of the oldest canes each year. Cut these oldest canes back to strong laterals or to the base of the plant.

Just remember this is the best time of year to look at your plants and be able to see the weaker wood so you can remove it and get the bushes off to a good start for the spring. The source of the information for this article is from the EDIS publication-Pruning Blueberry Plants in Florida by J. G Williamson, F. S. Davies, P. M. Lyrene., HS985. It covers pruning for blueberries and is an excellent resource for all growers.

Information from the Annual International Research Conference on Methyl Bromide Alternatives and Emission Reductions. Oct 31- Nov. 3, 2005. San Diego, CA

J.W. Noling, CREC – Lake Alfred

Since 1994, the Annual International Research Conference on Methyl Bromide Alternatives and Emission Reductions has alternated between San Diego and Orlando. The objectives of these meetings is to provide a forum for annual summaries of new research findings regarding the ongoing methyl bromide phase out and evaluation of replacement pest control strategies.

This year the plenary sessions provided a forum for expression of commodity group concerns, legislated activities of the Montreal Protocol, updates of the current federal EPA reregistration process for many of the alternative fumigants (metham sodium, chloropicrin, methyl iodide, dazomet, and others), as well as methods for developing new fumigant regulatory policies in California. Overall, I think it fair to say that there was tremendous user group anxiety with EPA, who is expected to impose new product label constraints for many if not all of the alternative fumigants (reduced application rates, requirements for additional personal protective equipment for field workers, and or expanded buffer zones between agriculturally treated and urban areas). This will surely mandate a more intensive, overall re-evaluation of alternatives and reduced rate technologies for pest control efficacy and crop response consistency. For California, regulatory concerns were still being expressed regarding obtaining application permits for local fumigant use, township caps limiting amounts of fumigants used within a defined area, off-site out- gassing of applied fumigants and potential new requirements for expanded buffer zones.

Alternative Chemicals: It was clear from the San Diego meetings that a considerable amount of national and international research continues to evaluate the pest control efficacy and yield benefits of many of the currently registered fumigants such as Chloropicrin, Telone C35, InLine, and metham sodium (Vapam) alone and in combination. Most of the studies evaluating Telone C35 or Chloropicrin reported consistency and similarity of marketable yields with that of the methyl bromide and chloropicrin standard. Sequential drip application of metham sodium after Chloropicrin or Telone C35 was shown to improve weed control and crop yield in a number of studies (Gilreath et al.). In general, the efficacy of the alternative was influenced by the method and rate of application, as well as by the number and intensity of dominant pests present. It was again reiterated that additional management of some hard to control pest species (usually weeds) will almost certainly be required in the form of preplant, at-plant, or even post plant chemical applications. Several alternatives were declared appropriate short and medium term replacements for MBr in environments with low levels of lethal soil borne pathogens. There were however concerns re-expressed about pest build up, situations of high initial pest levels and consistent long term performance of these alternatives in these high risk areas (Aranda et al., Lampinen et al.).

This year, not unlike others, there were numerous reports of studies characterizing environmental fate, emission, and soil concentration and distribution (dispersion) of the fumigants with time. New this year were studies which evaluated drip applied emulsified concentrate (EC) formulations of methyl bromide and chloropicrin, chloropicrin EC, and methyl iodide and chloropicrin EC formulations. In most studies, the broad spectrum pest control activity of methyl iodide was reported, typically as equal to that of methyl bromide and chloropicrin.

Renewed research emphasis was again observed in field trials with drip application (chemigation) of fumigant alternatives. In general and as reported at previous meetings, many evaluations of drip applied fumigants demonstrated the poor ability of these compound to diffuse at toxic concentrations far beyond the point of application (water front) and that improved application techniques (ie., two tapes per bed) will be required to improve efficacy of the drip applied alternatives in sandy soils. In general, fumigant concentrations were higher in the center of the bed than at the edge, and pest survival generally increased with depth and lateral distance from the point of drip emission.

Virtually Impermeable Films (VIF): With the expected annual decrease in methyl bromide availability and CUE approved levels, studies to investigate the use of more gas retentive, virtually impermeable films has accordingly intensified. Significant new advancements in our understanding of VIF and metalized mulch technology was reported by Dr. Jim Gilreath who showed that the metalized mulch had significant VIF type qualities, retaining higher methyl bromide concentrations in the soil, for longer periods of time, and providing effective nutsedge control with reduced rates of methyl bromide comparable to that of true VIF mulch film. Overall, and in none of the other VIF reported studies, did VIF treatments of methyl bromide/chloropicrin rate reductions of 20 to 50 percent significantly compromise pest control or crop yield compared to standard rates with low density polyethylene mulch. Some studies did report limits to which methyl bromide use rates could be reduced (50-75%) without loss of pesticidal efficacy and crop growth performance. Other studies demonstrated an apparent loss of fumigant synergy with chloropicrin when methyl bromide use rates were reduced below a critical level within a formulation (ie., 50:50). All in all, it was clearly predicted that during periods of increased price and reduced availability of methyl bromide, VIF and metalized mulched would become an integral component of the fumigated, raised bed, mulch covered production systems of the US. Another very important consideration of all barrier mulch technology was presented by Dr. Jim Gilreath, who demonstrated that to use these more gas retentive mulches required changes in application technologies to insure accurate and uniform dispensing of such low fumigant application rates (ie.,5- 6 gallons per acre). The proposed changes involved smaller delivery tubing size (1/16 inch diam.) and orifice plates at the top of the gas knives to insure adequate back pressure and uniform delivery (flow) and distribution from one gas knife to another.

NONCHEMICAL: Tomato grafting, usually in combination with other pest management tactics, was declared a viable alternative to methyl bromide for many of the Mediterranean countries. Given it's overall performance, particularly in combination with other crop management tactics, it was identified as a possible justification for reducing methyl bromide levels within critical use exemption requests (Besri). In Florida studies, Dr. Dan Chellemi demonstrated that long term, land management practices could have profound effects on soilborne pest problems and tomato yields. For example, allowing land to remain undisturbed as weed fallow between successive crops led to significant increases in damage from soilborne diseases and root-knot nematode which then lowered marketable yields of tomato. While nematode problems were reduced, maintaining a clean, weed-free fallow condition between successive tomato crops did not reduce the overall impact of soil borne diseases. Bahiagrass rotations significantly reduced diseased pressures but the rotational effect lasted only a single season.

NATIONAL MANAGEMENT STRATEGY: And finally, there was a considerable amount of time and energy committed to the discussion and initial development of a U.S. National Management Strategy, defining the timetable and information requirements to complete the phase-out of methyl bromide and ultimate transition to alternatives. It was clear from these and other presentations, that adoption of alternative chemical strategies and other IPM methods are likely to be expedited only if appropriate guidelines and recommendations for their use are developed which minimize performance inconsistency and grower uncertainty.

Chilli Thrips New to Florida Horticulture

James F. Price

A new thrips (chilli thrips or *Scirtothrips dorsalis*) that can be problematic to strawberries and vegetables has been found in Florida horticulture. The insect is difficult to distinguish in the field from more common flower thrips. The damage it causes is different though. It can feed on most above ground plant parts, but seems to prefer young flowers, fruit and leaves. Heavily infested plants become stunted, bronzed, and leaves often curl upward.

This thrips has a wide host range but is known to infest strawberries, vegetables including pepper, egg plant, tomato, cucurbits, and ornamentals including roses. Peppers and roses seem to be particularly vulnerable.

Florida Department of Agriculture and University of Florida have been active in preparing management responses to this new threat. University of Florida researchers have worked on the island of St. Vincent to evaluate insecticides for control. A few products now available to the horticultural industry, including Spintor®, seem to be useful management tools.

Additional information on the chilli thrips provided by University of Florida Center for Tropical Agriculture can be found at http://cta.ufl.edu/thrips.htm.

Chilli thrips, *Scirtothrips dorsalis*. *Credit—Dr. Dakshina Seal, TREC*

GCREC Strawberry Field Day 2006

There will be a strawberry field day at the University of Florida's new Gulf Coast Research and Education Center (GCREC) on Monday, February 6th, from 1:30 pm to 4:00 pm. Several important field trials will be highlighted and new soil fumigant and soil moisture monitoring technology will be demonstrated. The field day will also include the following:

- an update on the future availability of methyl bromide soil fumigant
- a display of fruit from the newest varieties in the GCREC strawberry breeding program
- the latest results on disease, pest, and nitrogen fertilizer management studies

Field Day Participants

Dr. Larry Arrington, Dean for Extension and Director of the Florida Cooperative Extension Service

Dr. Jack Rechcigl, Director of GCREC and Professor of Soil and Water Science

Ms. Alicia Whidden, strawberry and vegetable extension agent, Hillsborough County

Dr. Craig Stanley, Associate Director of GCREC and Professor of Soil and Water Science – Water sample collection and soil moisture determination procedures.

Dr. Craig Chandler, strawberry breeder and Professor of Horticultural Sciences

Dr. Jim Price, strawberry and ornamental entomologist and Associate Professor of Entomology

Dr. Natalia Peres, strawberry and ornamental plant pathologist and Assistant Professor of Plant Pathology—Experiments for control of diseases on annual winter strawberries.

Dr. Jim Mertely, strawberry pathologist and manager of the GCREC plant diagnostic clinic

Dr. Jim Gilreath, weed scientist and Professor of Horticultural Sciences—The difference in spray patterns and drift potential with various types of nozzles.

Dr. Joe Noling, strawberry and vegetable nematologist and Professor of Nematology

Dr. Bielinski Santos, fruit and vegetable horticulturist and Post Doctoral Associate—Reassessing IFAS irrigation and nitrogen fertilization rates for strawberry.

The new GCREC is located at 14625 County Road 672 in southern Hillsborough County. For more information about this event, call Christine Cooley at 813-634-0000 ext. 3101 or visit http://gcrec.ifas.ufl.edu.

GCREC Special Fact Sheet

Botrytis Fruit Rot (Gray Mold) and Flower Blight of Strawberry

D.E. Legard, J.C. Mertely, and N.A. Peres

Botrytis fruit rot (gray mold) is one of the most important diseases of strawberry worldwide. In Florida, this disease causes severe preharvest losses primarily due to infections of fruit and flowers, especially under humid conditions when daytime temperatures are between 60° to 75° F. Botrytis fruit rot is also a major cause of postharvest losses during storage and transit, since the fungus grows at refrigeration temperatures.

Casual Agent and Symptoms

Botrytis fruit rot is caused by the fungus *Botrytis cinerea.* This pathogen infects a wide range of plants including many fruit, vegetable, and weed species. On strawberry, infection begins at the flower stage but symptoms are observed on green or ripening fruit (Figure 1). Fruit lesions are typically found on the stem end of the berry and are frequently associated with infected stamens, or with dead petals that stick to the fruit or become trapped under the calyx (Figure 2). Lesions begin as small, firm, tan spots (Figure 3) that quickly enlarge and become covered with white fungal mycelia and gray to brown spores (Figure 4). *Botrytis* eventually consumes and mummifies fruit that are not harvested (Figure 5). When mummified and severely diseased fruit are disturbed, large numbers of spores can be released and are visible as gray puffs.

Disease Development and Spread

Botrytis fruit rot epidemics are typically started by spores produced on dead strawberry leaves within the field. Young expanding strawberry leaves are colonized by the fungus without producing any symptoms. As the leaf senesces, the pathogen spreads quickly through the dying tissue and sporulates. Spores are dispersed by air, water or harvesting and ultimately infect different floral parts including stamens and petals. After infecting the flower, the fungus eventually invades maturing fruit and causes rot. Direct infection of fruit by spores is not considered important. The fungus can also spread to adjacent fruit by direct contact (Figure 6). As the epidemic progresses, the pathogen sporulates on diseased flowers and fruit, and these become important sources of inoculum. The fruit rot phase of the disease can be particularly severe in west central Florida where plants produce flowers and fruit over several months.

Control

Control of *Botrytis* fruit rot and blossom blight requires a combination of chemical, cultural, and genetic control methods. Although no strawberry cultivars are highly resistant to *Botrytis* fruit rot, cultivars with large clasping calyxes are often more susceptible, because moisture collects between the calyx and the receptacle and encourages the spread of the pathogen from stamens and petals to the developing fruit.

Fungicides dramatically reduce Botrytis fruit rot by protecting the flowers and leaves. Effective control of Botrytis fruit rot involves protecting the flowers and leaves from infection, or preventing sporulation of the fungus. Effective disease management involves regular applications of a general protective fungicide combined with timed applications of specific fungicides during peak bloom periods. Fungicides labeled for application in Florida are listed in the current issue of the Florida Plant Disease Management Guide (University of Florida, IFAS Publications). Weekly applications of protectant fungicides should begin immediately after overhead

irrigation for plant establishment is over, and continue throughout the season. Additional applications of protectant fungicides may be made during periods of rainy or humid weather.
Timed applications of fungicides specifically labeled for Botrytis should be made during peak flowering periods. The first two applications can be made at 10% bloom and again 7 days later. It may be best to apply 3 to 4 bloom applications 7 days apart during the second peak bloom period when disease pressure is more severe and large numbers of flowers and fruit are produced. Combine these bloom applications with the standard weekly fungicide applications. The removal of all diseased and unmarketable fruit from within the plant canopy is critical for effective management of Botrytis fruit rot, as this fruit is an important source of inoculum that directly infects nearby flowers and fruit. The removal of senescent foliage also reduces inoculum but provides only limited control of Botrytis fruit rot.

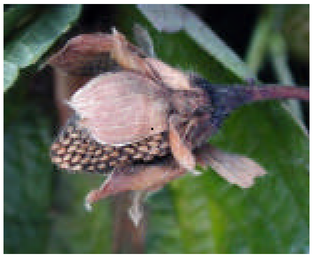

Figure 1. Symptoms on immature fruit.

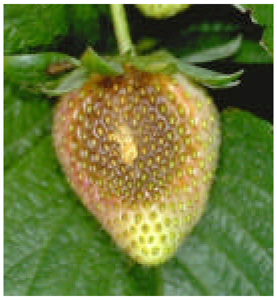

Figure 2. Botrytis infection that started with the petal in the middle of the lesion.

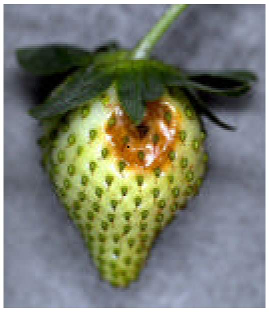

Figure 3. Young Botrytis lesion on immature fruit.

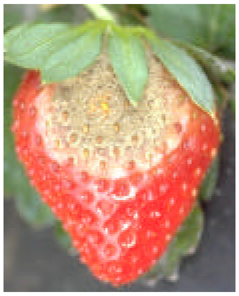

Figure 4. Sporulating lesions on mature fruit.

Figure 5. Mummified fruit consumed by Botrytis.

Figure 6. Spread of Botrytis by fruit-to-fruit contact.