

Strawberry Plasticulture Plug Planting: Ways to Increase Chances for Success

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The plant material used to make strawberry plug plants is usually well-traveled by the time it gets to your fruit production farm. Chances are it has been in situations where it could “pick up some unwanted things” along the way.

The propagation process involves growing mother plants in open fields or nurseries to multiply them and/or produce tips through runnering. During this time plants are exposed to pests and diseases from the surrounding environment. The step where plugs are produced from tips/cuttings is relatively short, requiring 4-6 weeks. Harvested runner tips are placed in clean plug trays filled with a soilless planting mix, and trays are then placed under intermittent mist, usually on the ground outdoors after covering it with horticultural landscape fabric. While new infection during the plug production stage is possible, the likelihood is relatively low. Thus, if the tips are pest and disease-free, plug plants are likely to be healthy, too. The plants are exposed to even more pests and pathogens after they get to your fruit production farm, not only from the soil in your field, but also from the surrounding landscape and crops and for an extended period of time. So, what can you do to help get your plantings off to a good start, and keep them as healthy as possible?

First, check your plants when you first get them to identify any problem plants. If any plants appear to be weak, cut through a few of them, and look for signs of discoloration in the crown. If crowns are still solid white, chances are that the problem was just drought stress. Reddish or reddish-brown tissue is an indication of anthracnose crown rot, phytophthora crown rot, or a Pestalotiopsis, a new “warm-weather” disease that we need to watch for, which can cause fruit to rot or leaf spots/blight in addition to crown rot.

For most of us, it is difficult to tell these diseases apart, but other symptoms may be present that can provide additional clues to assist in diagnosis. Keep in mind that if you are checking crowns in the spring, you will need to add “winter injury” to the list of the possibilities. Look for the presence of dark elongated sunken lesions on petioles and runner stems, which may indicate plants have an infection from the anthracnose fruit rot-causing fungus. If that infection spreads to the crown, you may see blackening of the crown after making a longitudinal cut. With Phytophthora, entire outer leaves are likely to turn brown and die as they would with severe drought stress. With Pestalotiopsis, which can also kill plants, rather non-descript leaf spots may be present; these leaf symptoms can easily be confused with leaf blotch or Phomopsis leaf blight, but in general are less acutely V-shaped. This publication from the University of FL provides much more info along with photos of symptoms:

https://www.researchgate.net/publication/336813040_Is_Pestalotiopsis_a_new_threat_to_Florida_strawberry_production

Cultivar can also provide a clue as to which of the above diseases is most likely. ‘Chandler’ is especially susceptible to both anthracnose fruit rot and crown rot. If you have both ‘Chandler’ and ‘Sweet Charlie’, and ‘Sweet Charlie’ is more severely affected, consider Phytophthora as the likely culprit, as ‘Sweet Charlie’ is very susceptible if conditions are right for infection. Phytophthora has also been isolated from

'Flavorfest' crowns in the past. 'Sweet Charlie' was affected by Pestalotiopsis in other states, but we don't know the relative susceptibility of various cultivars.

All of this info together is not enough to serve as proof of which of these three crown-rotting diseases is present, but can provide a direction for stop-gap treatments you can take (see below) while you contact your supplier or an extension educator, or send a sample to a disease clinic for a more definite diagnosis. Due to the cryptic (asymptomatic) nature of anthracnose infections, your plant supplier may be unaware of any potentially infected plants; however, early communication may be helpful to both of you, and your supplier may have some suggestions for preventative measures you can take.

Second, avoid planting suspicious plants as much as possible. Often, it is a good idea to order 10% or so more plants than you actually need to avoid feeling the pressure to plant everything. Otherwise, you may pause and question whether you should put suspicious plants in the ground, and then plant them anyway. You can use any healthy extra plants later as replacements if needed. If you must use plants of questionable health, planting them in one corner of the field may facilitate taking special care of them. This is also less detrimental than having questionable plants scattered throughout the field where they can serve as potential sources of infection for surrounding healthy plants.

Third, while planting, make sure the planting depth is correct and soil is firmed around the crown. Make sure that anyone involved in planting understands this and its importance. The soil level should be at mid-crown. If the plant is too shallow and roots are showing, the roots will dry out and the plant won't grow well. If too deep, soil will cover the growing point and rots will set in. Have someone check plants that were set and correct any issues. Plants at the wrong depth or without good root-to-soil contact simply will not grow as well as they should.

Fourth, either immediately before or right after planting, trim off any dead or dying leaves or runners. Take note of any dark sunken lesions that may be present especially on runners and leaf petioles since this may be a sign of anthracnose organism(s). There are other causes of tissue death including leaves just getting shaded out while in trays, or runners or petioles getting pinched between trays or cooked if on the edge of a tray. However, if you notice these symptoms on plants in the center of a tray, a disease organism is a more likely cause.

Fifth, make any fungicide applications that are needed. In the past, we generally hadn't recommended Fall fungicide applications. However, the very hot temperatures this summer combined with the need to mist plants frequently resulted in conditions that were perfect for development of certain diseases. If phytophthora has been a problem in the past on your farm, or if you are growing varieties that may be susceptible to phytophthora, an application of mefenoxam (Ridomil Gold SL and others) or metalaxyl (MetaStar 2E) through the drip system 15 days after planting is warranted, as are follow-up foliar applications of fosetyl-Al (Aliette WDG) or a phosphite product (Phostrol, Prophyte, etc.) 2 to 3 weeks later.

If anthracnose crown rot or Pestalotiopsis is suspected, captan and Switch both have good efficacy, and should be applied 2 or 3 times during the fall being sure to get good coverage into the crown area. Quadris Top also has some efficacy on Pestalotiopsis. As we are seeing more resistance in anthracnose population against QoIs (category 11 fungicides), it is logical not to use QoI products in the Fall, but you may reconsider that depending on the risk relative to potential infection on your plug plants. It is more important than ever to select your fungicide sprays wisely and rotate among chemistries to avoid control failure. Follow your state's regulations regarding whether products can be used for diseases that are not

on the label as long as the use pattern is followed; some states (such as PA) allow this, while others do not.

Lastly, keep the plantings well-watered, and make sure your planting is protected from deer during the fall. Apparently 'Chandler' strawberry plants are one of the tastiest things around. In one of our variety trials, deer nibbled each of our 'Chandler' plots to nothing, passing by "eastern" varieties in the process.

With all of these steps in place (along with following other standard recommendations before and after planting), you will know you've done everything you could to get your planting off to a good start.



Caption: 'Chandler' plug plants in nursery just prior to shipment. Photo: K. Demchak, Penn State

Is Pestalotiopsis a new threat to Florida strawberry production?

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Pestalotiopsis is a fungus that causes diseases on different plants, including strawberries. Although a severe outbreak was observed in Florida fields this past season (Figure 1), Pestalotiopsis is not new to strawberry production. In fact, Drs. Charles Howard and Earl Albregt, former professors at the U.F. Strawberry Lab in Dover, reported for the first time a strawberry fruit rot caused by Pestalotia longisetula (or Pestalotiopsis) in 1972, causing severe losses in Florida fields.



Figure 1. Pestalotiopsis disease outbreak in Florida strawberry fields. Photo credits: James Mertely.

The fungus has also been reported to infect fruit (Figure 2A) and leaves (Figure 2B) in other strawberry producing areas worldwide, such as Brazil, Egypt, Iran, Israel, and Spain. Only recently, the fungus has been described causing root and crown rots in Florida, as well as Argentina, Bangladesh, Belgium, and Spain. Back in the 2012-13 Florida strawberry season, our group repeatedly isolated Pestalotiopsis from brown necrotic areas in crown and roots of weak and dying transplants in commercial fields. We suspected it could contribute to establishment difficulties, as plants were stunted (Figure 2C) and eventually collapsed. In some cases, the fungus is isolated along with other root pathogens such as *Colletotrichum acutatum* and crown rot pathogens such as *Colletotrichum gloeosporioides*, *Phytophthora cactorum*, and *Macrophoma phaseolina*.

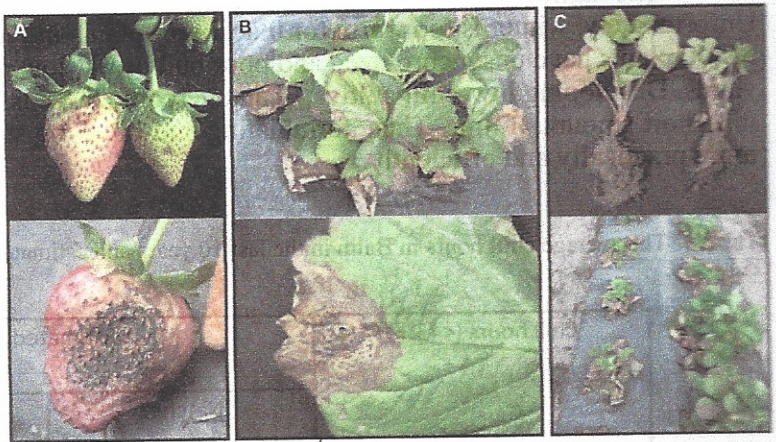


Figure 2. Symptoms caused by Pestalotiopsis: A) initial (upper) and late (bottom) on fruit; B) symptoms on leaves and fungus black structures (bottom); C) stunting of plants caused by root and/or crown infection. Photo credits: Juliana Baggio and James Mertely.

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The serious outbreak in Florida fields during this season was associated to a single nursery source in North Carolina and was considered a new threat to strawberry production by many growers, since there are no fungicides labeled to control this disease in the U.S. Our group is currently working on trials to understand the disease and figure out ways to manage it.

Among a collection of *Pestalotiopsis* isolates collected from Florida strawberry fields throughout the years, we found that, high temperatures (77 to 86°F) are favorable for the fungus development. The fungus produces spores on the surface of infected tissues that are spread by water. Therefore, the severe outbreak this season may be related to unusually heavy rains between December 19-21, followed by days of relatively hot weather after Christmas. Thus, limiting operations when plants are wet is important to minimize spread from field to field. Most isolates were able to infect and produce root and crown rot symptoms that ranged from wilting to stunting (Figure 2C), to collapse and death of the entire plant. We also screened isolates in the laboratory for their sensitivity to azoxystrobin (Abound), captan, fluopyram (Luna), penthiopyrad (Fontelis), flutriafol (Rhyme), tetraconazole (Mettle), fludioxonil (Switch), and thiophanate methyl (Topsin). Among these, only captan and fludioxonil (Switch) significantly inhibited growth of the fungus. Unfortunately, isolates were found to already have resistance to the strobilurin fungicides (Abound, Cabrio, Flint, etc).

We have recently started additional trials at GCREC to assess cultivars for disease resistance, and to evaluate the performance of fungicides in field conditions. We are also investigating possible alternative hosts. If you have any questions and want to know more about our findings, do not hesitate in contacting us (Juliana Baggio, jbaggio@ufl.edu, 813-419-6629, James Mertely, jcmert@ufl.edu 813-419-6599, or Natalia Peres, nperes@ufl.edu, 813- 419-6602).
