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2000 Florida Cotton Production Guidelines: Disease Control for Cotton in Florida[1]

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Diseases can adversely affect the production of cotton in Florida. The primary types of diseases prevalent on cotton in Florida are seedling diseases, the nematode-Fusarium wilt complex and the boll rot complex.

Seedling Blights

The complex of organisms that cause seedling diseases are *Pythium* spp., *Rhizoctonia solani*, *Fusarium* spp., and other soilborne fungi. Limited observations in Florida cotton indicate that *Pythium* spp. and *Rhizoctonia solani* are the predominant pathogens. Symptoms of diseases caused by these fungi include decay of seed before emergence, lesions on and/or girdling of the seedling at or near the soil surface, and rotting of the root tips. Such diseases may cause significant losses of stand and when severe could result in the expense of replanting. When replanting is necessary losses may include the cost of seed, increased labor, lost time, additional fungicide costs, and loss of soil moisture. There may be unnoticed losses from seedling diseases even if stands are not reduced enough to warrant replanting. Some plants may not be killed outright by seedling diseases but may exhibit a soreshin' condition (lesions on the stem) that result in weak, spindly plants that may be killed later by other organisms or adverse conditions. Such plants are incapable of full production. Other plants may survive but have their taproots girdled below ground. These plants develop a shallow root system that may be inadequate if midsummer droughts occur. When seedling diseases result in skippy' stands they complicate crop management and increase the potential for weed competition.

Several practices can reduce losses to seedling diseases. These include the use of high quality treated seed, timely planting, and when necessary the use of additional fungicides. High quality seed is evidenced by high germination and seedling vigor. The germination percentage printed on the seed tag indicates warm germination at 86 oF or alternating day/night temperatures of 86/68 ^{o}F. The minimal acceptable germination under these conditions is 80%. Planting should be delayed until the soil temperature will promote rapid germination of seed and plant emergence. A minimum soil temperature of 68 F, at the 4-inch depth around 8:00 A.M. for 3-5 days prior to planting, is preferred. Do not plant if soil temperatures below 50 ^{o}F are expected any time within the first five days after planting. Seed may germinate under warm soil temperatures but still have low vigor evidenced by slow germination under cool

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temperatures. If early planting under cool conditions is necessary, have a cool germination test run by a reliable seed laboratory. Cool-germinated seed should have 65-70% normal seedlings with a hypocotyl to shoot length of 1.5 inches after seven days at 64.4 ^{o}F.

Ideally seed should be placed from 0.75 to 1.5 inches deep in a warm, moist seedbed with firm seed-to-soil contact on the lower half of the seed. There should be approximately 1.5 inches of loose soil above the seed. Good seed-to-soil contact is important for germination to begin. A key to establishing good contact is to have a clean, well-aligned, free-rolling press wheel. Careful attention to all of these aspects of planting cotton seed will help to achieve optimum planting conditions, minimize damage from seedling diseases, and increase the probability of a healthy stand. It is also important to avoid depositing soil on stems and damage to stems and roots when cultivating.

Plant in fields that are well drained as high moisture levels from rain or irrigation may promote seedling diseases. Planting on raised beds, even if it is a slight elevation promotes drainage and reduces the probability of having seedling diseases. The type of land preparation used prior to planting will have a major influence on amounts of seedling diseases. A field that is bottom-plowed so that prior crop and weed debris are buried is less likely to have moderate to severe seedling disease than if the field is disked. When using conventional tillage the land should be plowed 30 days or more in advance of planting to decrease the potential for seedling disease. Crop rotation should be used, but the fungi that cause seedling diseases have a wide host range which includes grasses as well as broadleaf crops. Therefore, crop rotation should not be expected to provide major reductions in seedling diseases and Rhizoctonia-induced seedling diseases can be severe where legumes and corn are used in the rotation scheme.

Seed Treatment is necessary because of the high degree of susceptibility of cotton to seedling diseases and the achievement of only partial control with the non-chemical methods. It is best to use a combination of seed treatments because many of the seed treatment fungicides are pathogen specific. It is common for more than one fungal pathogen to be present in infected seedlings. Also, some of the combination treatments contain an insecticide which can be beneficial.

Two types of seed treatment fungicides are available, systemic and non-systemic. In general, systemic fungicides are more specific in the fungi they suppress. The non-systemic fungicides suppress a broader range of fungi, but the degree of suppression is generally less when compared to some of the systemic types. The ideal strategy would be to determine the fungi likely to be involved in a given field. Since this is usually impractical, use high quality seed treated with a broad spectrum fungicide, such as Baytan, Thiram or Captan, in combination with an appropriate, more specific, fungicide, such as Apron, Chloroneb, PCNB or Vitavax. Apron (metalaxyl) has a high degree of activity against Pythium spp. Chloroneb and Vitavax have strong activity against Rhizoctonia spp. and PCNB has moderate activity against Rhizoctonia spp. These fungicides are often marketed in combinations and commercial cotton seed are usually treated with one or more of the fungicides. In fields where seedling diseases are known to be a problem use of an additional fungicide treatment may be warranted.

Hopper-Box Treatments. If additional fungicide is needed for fields with a history of seedling diseases and equipment is not available for in-furrow applications, the hopper-box or planter-box method of application may be used. When using this method the soil fungicides must be layered in the hopper box with the seed for best results. Some fungicide will fall out with each seed to treat the soil around it and this may decrease the seeding rate about 10-20 percent. If fungicides are to be used in the hopper box the planter should be calibrated with the fungicide and the seed to get the proper seeding rate. Hopper box treatments are considered to be less effective than in-furrow applications of fungicide.

In-Furrow Sprays are the best method to apply soil fungicides. Under good planting conditions in-furrow treatments are expected to provide little benefit in most years in Florida. However, when cotton is planted in a field that has had consistent problems with seedling diseases and when planting conditions are less than optimum (soil too cold and/or

too wet), an in-furrow fungicide might prevent the need for replanting. In-furrow sprays result in more fungicide being mixed with the soil and a greater zone of protection for emerging plants than is possible with seed treatment alone. For best results two cone-type nozzles should be mounted on the planter. One nozzle should placed just behind the seed-drop outlet to treat the soil around the seed. The second nozzle, to the rear of the first, should be directed to treat the soil as it is tumbled back into the seed furrow. Fungicides labeled for in-furrow applications include metalaxyl (Ridomil 2E, Ridomil PC, or Ridomil Gold), Mancozeb (Dithane DF, Dithane F-45, or Penncozeb), iprodione (Rovral WG), PCNB (Terraclor 2E, Terraclor Super-X, or Terraclor Super-X + Disyston). Several of these formulations are mixes of more than one fungicide to broaden the spectrum of control. For example, Ridomil-PC contains metalaxyl and PCNB to give control of water molds (Pythium spp.) as well as Rhizoctonia spp. Likewise, Terraclor Super-X contains two different fungicides to give it a similar spectrum of control. Several of these fungicides are also available as granular formulations for in-furrow application. As with any pesticide always use labeled rates when applying any in-furrow treatment on cotton.

A cotton seedling disease point system has been developed as part of the Beltwide Seedling Disease Program of the Cotton Disease Council. This system is a decision model that could prove useful in determining whether an in-furrow fungicide is likely to improve stands. It has not been tested in Florida and there are no guarantees that its use will prevent stand losses. It is presented here only as a guideline to give a logical basis for making a decision on whether to add an input that costs a few dollars but could save more if it prevents the need for replanting.

COTTON SEEDLING DISEASE POINT SYSTEM

The Beltwide Seedling Disease Program has been developed by the Cotton Disease Council as an aid in determining whether an in-furrow-applied fungicide is likely to improve seedling stands, vigor, and yields.

1. SOIL TEMPERATURE. Based on 3-day average soil temperature at 4 inches._____

a. <65 F 8

b. 65-68 F 6

c. 69-72 F 1

d. >72 F 0

2. 5-DAY FORECAST. Based on National Weather Service forecast of air temperatures_____ (above or below the upper 60's) and precipitation (50% chance of precipitation).

a. Colder and wetter 8

b. Colder 6

c. Wetter 4

d. Warmer 0

3. SEED QUALITY. Based on cold germination value. _____

a. Poor (<59) 2

b. Good (60-69) 1

c. Excellent (> 70) 0

4. FIELD HISTORY. Based on incidence of seedling DISEASE in previous years._____

a. Severe 3

b. Moderate 1

c. Low 0

5. TILLAGE. Based on field preparation. _____

a. No-till 2

b. Minimal tillage 1

c. Conventional 0

6. SEEDING RATE. Based on state-recommended seeding rate. _____

a. Lower than recommended 1

b. Higher than recommended 0

7. INSECTICIDE/NEMATICIDE APPLIED. Temik, DiSyston, and/or Thimet to be_____ applied in the furrow.

a. Yes 1

b. No 0

Fusarium Wilt

Fusarium wilt is caused by the fungus *Fusarium oxysporum* f. sp. *vasinfectum*. It has not been a major problem in Florida because many varieties have resistance to this organism. Fusarium wilt is closely associated with damage from root knot nematodes. Therefore, resistance to this fungus/nematode complex is identified as such. Use a recommended variety that has moderate to good "tolerance" to this complex. For example, Deltapine 90' and Stoneville KC 311' are classified as having good tolerance. Use crop rotation to prevent the buildup of root knot nematodes.

Boll Rots

Boll rots are caused by numerous fungi. Some of the fungi that cause boll rots are *Diplodia* spp., *Aspergillus* spp., *Fusarium* spp., *Sclerotium rolfsii*, *Colletotrichum* spp. and others. For Florida, we lack specific documentation as to what organisms cause boll rot. Boll rot is likely to be most severe when wet weather occurs during boll development.

Control of boll rot is most effective if several cultural methods are used sequentially, because chemical control is not available. Avoid practices that promote rank growth such as use of excess nitrogen. Use recommended practices for insect control since insect damage to cotton bolls may provide a portal of entry for boll-rotting organisms. Avoid mechanical damage to plants so that entry points for fungal pathogens are reduced. Control weeds so that air circulation within the canopy is promoted. Later planting can be used so that boll opening is delayed until after periods which are typically wet (after August). The use of Pix growth regulator has been shown to limit vegetative growth which in turn increases air movement within the canopy.

The effects of ultra-narrow-row (narrow rows 7-10 inches apart with plant populations of 130,000 - 150,000) planting of cotton in Florida are unknown at the present time. Since this type of culture forces boll development to the top of the plant its effect on boll rot may not be as detrimental as would be expected. However, until more is known about these effects we cannot recommend this practice. Research on this issue is underway.