AgriLIFE EXTENSION
Texas A&M System

Managing Seedling Diseases of Cotton

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Several species of fungi can infect cotton seeds or seedlings, causing a disease known as damping-off. These pathogens grow best under environmental conditions that are sub-optimal for the germination and growth of cotton seed. Disease is favored by cool, wet weather conditions during the first three weeks after planting that keep the soil temperature less than 68° F and the soil moisture at or near saturation. As seedlings develop, they become naturally resistant to infection as root systems become more extensive and root cells are lignified. Pre-emergence damping-off occurs when seeds are killed before germination or germinating seeds are killed prior to emergence from soil. Post-emergence damping-off occurs when the germinating seed has emerged from soil, but then dies (Figure 1).

Figure 1. Post-emergence damping-off.

Seedling Disease Pathogens

There are three major fungal pathogens causing seedling disease in Texas. The most prevelant pathogen is *Rhizoctonia solani*, which is a post-emergence pathogen. This fungus produces brown or black lesions on the stems. The lesions may be sunken, which is a symptom known as "soreshin" (Figure 2), or the lesions may girdle and pinch the stem at the soil surface, which is known as "wirestem". Although this pathogen usually causes disease under cool, wet conditions, it can also cause disease at higher soil temperatures favorable for cotton seed germination, if cotton is planted into soil containing freshly-incorporated organic matter, such as a cover crop killed by Round-Up herbicide one week prior to planting.

Figure 2. "Soreshin" symptoms caused by *Rhizoctonia solani.*

Several *Pythium* species cause seed decay and pre-emergent damping-off. The symptom on emerged seedlings is hypocotyl rotting below the soil surface. The hypocotyl has a water-soaked or light brown appearance.

Thielaviopsis basicola is a post-emergence pathogen that does not usually cause mortality, but may stunt plants and delay flowering. The fungus blackens the tap root and cortex (exterior) of the hypocotyl (Figure 3).

Figure 3. Symptoms of *Thielaviopsis basicola.*

Lateral roots are killed, particularly on older plants. This fungus is primarily a problem in the High Plains of

Texas. It has been occassionally observed on plants from other growing areas of Texas.

Other fungal species have been reported to cause seedling disease in cotton, but their occurrence is infrequent and their impact relative to the three major pathogens is slight, unless they interact with the major pathogens. These pathogens tend to cause disease in plants growing under severe environmental stress. A prevalent, minor seedling pathogen is *Fusarium* spp.

Management Approaches

The goal is to prevent losses occurring from a stand failure and the added expense and delay from replanting. A combination of approaches can be used to reduce the impact of seedling diseases:

- ★ Plant high-quality seed for faster germination and better vigor.
- ★ Plant when soil temperatures are greater than 68° F.
- ★ Plant on raised beds helps to increase soil temperatures and improve drainage.
- ★ Plant seed treated with fungicides.
- ★ Supplement seed treatments with in-furrow fungicides when there is a history of seedling disease or a previous stand failure or other factors that may increase the risk of seedling disease.

Seed Treatment Fungicides

Combinations of fungicides are used as seed treatments, as there is no one fungicide that adequately controls all pathogens. Fungicides are either systemic, i.e. they are absorbed by the plant and translocated within it, or non-systemic (also known as contact fungicides). Systemic fungicides can protect the growing seedling for a longer period of time than non-systemic fungicides, but they target one or two of the pathogens. Contact fungicides have a broader spectrum of activity, but they are only effective in the area near where they are applied. The two types of fungicides can serve a complementary role in protecting the seed and the seedling. These fungicides are listed in Tables 1 and 2.

Purchased seed is usually pretreated with fungicides. In some instances, when ordering seed, the grower has the option of specifying the fungicides to be applied to black seed. The grower may also choose to treat seed himself. Mixtures of the fungicides shown in Table 1 may be used, or commercial mixtures shown in Table 2 may be used, or some other combination of formulations from both tables. It should be emphasized that some of the commercial mixtures shown in Table 2 may not be sufficient by themselves to provide adequate protection against seedling disease. For example, while all the mixtures provide protection against *Rhizoctonia,* some mixtures do not protect against *Pythium* or *Thielaviopsis*. The range of protection can be increased by using additional seed treatments, or by applying fungicides at planting as an in-furrow application.

Which Seed Treatment to Use

To decide which fungicides to use, growers should try to determine which pathogens are present in their fields. This is most easily determined in the years that disease problems occur. Seedlings with damping-off symptoms should be sampled and sent to a plant disease diagnostic clinic to identify the pathogen. This is particularly useful to know if either *Pythium* or *Thielaviopsis* are present.

In the absence of such specific information about which pathogen is present in a field, the ideal preventative seed treatment mix includes systemic and protectant fungicides that are active against *Pythium* and *Rhizoctonia*. When *Thielaviopsis* is also present, the addition of triadimenol or myclobutanil (at the appropriate rate) is beneficial. Triadimenol has been reported to delay seedling emergence under cool, wet growing conditions.

The aim of using seed treatments is not to completely control damping-off, but to sufficiently suppress disease so that a good, uniform stand is obtained. The seed treatment is successful if there are no large gaps left within rows. In many years and locations, a seed treatment is sufficient for disease control.

When to Supplement Seed Treatments

When there is an increased risk of seedling disease, seed treatments need to be augmented with fungicides applied as a hopper (planter) box treatment, or as granules or liquid sprays applied to the soil surrounding the planted seed. Both systemic and contact (non-systemic) fungicides are labeled for cotton and these supplemental fungicides are listed in Table 3. In-furrow liquid fungicides typically have a more uniform distribution in the soil around the seed than in-furrow granular fungicides.

Risk factors for increased seedling disease include: an early planting date, planting in soils with a frequent history of seedling disease problems, replanting a field with a stand failure, planting into a field previously cropped to cotton, or, in some growing areas, planting into a no-till or reduced tillage field.

Table 1. Seed Treatment Fungicides Available for Seedling Disease Control.

Target Pathogen*	Chemical Name	Systemic	Trade Name(s)	Company
R	pyraclostrobin	Yes	Acceleron DX-109	Monsanto
R	fluxapyroxad	Yes	Acceleron DX-612	Monsanto
T, R	triadimenol	Yes	Baytan 30 Flowable**	Bayer CropScience
P, R, F, G	TCMTB (benzothiazole)	Yes	Nusan 30 EC	Wilbur-Ellis
G	ipconazole	Yes	Vortex Acceleron DX509	Bayer CropScience Monsanto
R G	trifloxystrobin	Yes	Trilex Flowable Acceleron DX-709	Bayer CropScience Monsanto
G	mancozeb	No	Dithane M-45	Dow AgroSciences
R, F, G	fludioxonil	No	Maxim 4 FS	Syngenta
T, R	myclobutanil	Yes	Nu-Flow CT Acceleron DT-510	Wilbur-Ellis Monsanto
P	metalaxyl “ ” “ mefenoxam (metalaxyl-m)	Yes	Allegiance FL Allegiance LS Acceleron DX-309 Acquire Apron XL-LS	Bayer CropScience Bayer CropScience Monsanto BASF Syngenta
G	thiram	No	Thiram 42-S Thiram 480 DP	Bayer CropScience Arysta LifeScience
R	carboxin	Yes	Vitavax 34	Arysta LifeScience
R,F	tolclofos-methyl	No	Rizolex Fungicide	Valent

*T = *Thielaviopsis basicola*; R = *Rhizoctonia solani*; P = *Pythium* spp.; F = *Fusarium* spp.; G = General damping-off pathogens.
**Effective against *Thielaviopsis basicola* when used at the higher label rate.

Table 2. Mixtures of Seed Treatment Fungicides Available for Seedling Disease Control.

Target Pathogen*	Chemical Name	Systemic	Trade Name(s)	Company
R, P	trifloxystrobin + metalaxyl	Yes + Yes	Trilex 2000	Bayer CropScience
R,G	pyraclostrobin + boscalid	Yes + Yes	Coronet	BASF
P, R, T	metalaxyl + triadimenol + trifloxystrobin	Yes + Yes +Yes	Trilex Advanced	Bayer CropScience
R,P,F	azoxystrobin + fludioxonil + mefenoxam + difenconazole	Yes + No + Yes + Yes	Seed Shield Cotton	Helena
R, F, G, P	azoxstrobin + fludioxonil + mefenoxam	Yes + No + Yes	Dynasty CST	Syngenta

*T = *Thielaviopsis basicola*; R = *Rhizoctonia solani*; P = *Pythium* spp.; F = *Fusarium* spp.; G = General damping-off pathogens.
**Effective against *Thielaviopsis basicola* when used at the higher label rate.

Table 3. Fungicides Available to Supplement Seed Treatment Fungicides for Seedling Disease Control.

Target Pathogen*	Chemical Name	Systemic	Trade Name(s)	Company
In-furrow Granule Formulations				
P	mefenoxam (metalaxyl-m)	Yes	Ridomil Gold GR	Syngenta
R, P	PCNB + mefenoxam (metalaxyl-m)	No + Yes	Ridomil Gold PC GR	Syngenta
In-furrow Liquid Formulations				
P	fenamidone	Yes	Reason 500 SC	Bayer CropScience
R	iprodione	Yes	Iprodione 4L AG Rovral Brand 4 F	Arysta FMC
P	mefenoxam (metalaxyl-m)	Yes	Ridomil Gold EC; Ridomil Gold SL	Syngenta
R, P	azoxystrobin	Yes	Quadris Flowable	Syngenta
R, P	azoxystrobin + mefenoxam	Yes + Yes	Quadris Ridomil Gold; Uniform	Syngenta
F**	fluopyram + imidacloprid (insecticide/nematicide only)	Yes + not applicable	Velum Total	Bayer CropScience
P	etridiazole	Yes	Terramaster 4 EC	Arysta LifeScience
R	pyraclostrobin	Yes	Headline Headline SC	BASF
Post-emergence Liquid Formulation				
R	azoystrobin + benzovindiflupyr	Yes + Yes	Elatus	Syngenta

*R = *Rhizoctonia solani*; P = *Pythium* spp.; G = general damping-off pathogens

**Suppression, may suppress foliar *Corynespora*.

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