

# Cotton Seedling Disease Control

Seedling diseases cause serious losses to Mississippi's cotton producers each year. A Cotton Disease Council estimate reports Mississippi producers lose an average of 3 percent of their total crop to seedling diseases. The estimate does not include the cost of replanting.

Seedling diseases often occur as the result of a complex situation involving the interaction of several pathogenic, soilborne organisms and the environment. Moreover, some specific fungi that cause seedling disease can be carried either inside the embryonic seed tissue or on the surface of the seed itself. Some fungi have the ability to survive from season to season in the soil and can attack the germinating seed or developing seedling.

The organisms that cause seedling diseases are found in all cotton-producing areas of the United States, but populations differ geographically. Soilborne fungi most commonly involved in the seedling disease complex in Mississippi are several species of *Fusarium*, *Pythium*, and *Rhizoctonia solani*. To a lesser extent, *Thielaviopsis basicola* is present.

## Identifying Seedling Diseases

Seedling diseases may cause several different observable symptoms on cotton plants. However, these can generally be grouped into three main categories.

### *Seed Decay or Rot*

A number of organisms in the soil and on or within the seed can cause cotton seed to rot post-planting. Seed decay can occur as the result of poor seed handling during harvest or poor storage conditions post-harvest. Such seed tend to have reduced rates of germination and become easy prey for seed-rotting organisms caused by soilborne fungi.

### *Seedling Rot*

Pre-emergent seedling rot describes the loss of a seedling to disease between the time the seed germinates and emergence from the soil. The infection is usually observed as a soft rot or lesion on the expanding root and stem.

### *Damping-off*

There are two types of damping-off that can occur after a seed has been planted. Pre-emergent damping-off oc-

curs after the seed germinates but before the seedling breaks through the soil line.

Post-emergence damping-off is a phase of the disease occurring at any time during the first part of the growing season and after the seedling has emerged through the soil line. "Soreshin" is another name for this stage of the disease; however, the specific symptoms of soreshin can be attributed to infection only by *Rhizoctonia solani*.

At first, plants are stunted and appear lighter green than normal. As the disease progresses, the plants begin to show midday wilting, and lesions develop near the soil line. Lesions are light brown at first but turn progressively darker until the whole area develops a black "wire stem" appearance. The plants eventually die, leaving an uneven stand.

## Control

### *Seed Treatments*

All cotton seed used for planting in Mississippi should be treated with a fungicide. Seed-treatment fungicides are sold individually or in combinations of more than one fungicide under a single trade name. In combinations, typically one fungicide is active against *Rhizoctonia*, while the other is active against *Pythium*. Because several disease-causing organisms may be involved with the seedling disease complex, using more than one seed-applied fungicide is suggested.

In the past, the materials most commonly used in the Midsouth were Apron, Baytan 30, RTU-Baytan/Thiram, Thiram, Vivatax-PCNB, and the biological fungicide product Kodiak Concentrate. However, with the introduction of the strobilurin fungicides, many seed treatment formulations now include a preventive (strobilurin) and a curative (triazole) ingredient. In addition, most seed treatment fungicides are applied commercially and thus present on the seed upon delivery rather than applied on-farm. Follow label directions closely.

In general, seed treatment products are categorized as either protectants or systemic. Protectant products will provide surface protection on the seed from organisms carried on the seed or found nearby in the soil that can cause seed rot. The systemic products can be absorbed through the seed coat of a germinating seed and translocated by the young seedling. Systemic



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products can provide temporary protection from pre- and post-emergence damping-off.

Seed-applied fungicides help to prevent diseases caused by organisms carried on the seed surface and are the most important and economical method for controlling seed rot. Seed treatment is not a substitute

for high-quality seed but is a supplement. Under no circumstances can a seed treatment increase germination of low-quality seed.

**Table 1** lists recommended seed-applied fungicides.

**Table 1. Recommended seed-applied fungicides.**

Fungicide	Producer	Active ingredient(s)	Rate/cwt
Acceleron Insecticide Seed Treatment	Monsanto	imidacloprid + pyraclostrobin	See label <sup>1</sup>
Acceleron Nematicide and Insecticide	Monsanto	abamectin + imidacloprid + pyraclostrobin	See label <sup>1</sup>
Acquire	BASF	metalaxyl 2.99%	0.75–1.5 fl oz
AgriStar Metalaxyl 265 ST	Albaugh, Inc.	metalaxyl 28.35%	0.75–1.5 fl oz
Allegiance FL	Bayer CropScience	metalaxyl 28.35%	0.75–1.5 fl oz
Apron XL	Syngenta	mefenoxam 33.3%	0.32–0.64 fl oz
Apron XL LS	Syngenta	mefenoxam 33.3%	0.32–0.64 fl oz
Avicta Complete Cotton	Syngenta	dynasty (see below) + thiamethoxam + abamectin	See label
Baytan 30	Bayer CropScience	triadimenol 30%	0.25–3.0 fl oz
Bion 500FS	Syngenta	acibenzolar-s-methyl 42.0%	150–450 <sup>2</sup> mg
Captan 4Flowable	Drexel	captan 37.68%	5 fl oz
Catapult XL	Agrisolutions	chloroneb 30.00% + mefenoxam 1.95%	11.75 fl oz
Dithane F-45	Dow	mancozeb 37%	4.8 fl oz
Dithane M45	Dow	mancozeb 80%	3 fl oz
Dividend Extreme	Syngenta	difenoconazole 7.73% + mefenoxam 1.93%	2.0–5.8 fl oz <sup>3</sup>
Dyna-Shield Metalaxyl	Loveland Products	metalaxyl 28.35%	0.75–1.07 fl oz
Dyna-Shield Metalaxyl 318 FS	Loveland Products	metalaxyl 30.14%	0.75–1.5 fl oz
Dynasty CST	Syngenta	azoxystrobin 6.64% + fludioxinil 1.11% + mefenoxam 4.60%	3.1–3.95 fl oz
Maxim 4FS	Syngenta	fludioxinil 40.3%	0.08–0.16 fl oz
Maxim XL	Syngenta	mefenoxam 8.4% + fludioxinil 21.0%	0.167–0.334 fl oz <sup>4</sup>
Nu-Flow F	Wilbur-Ellis	flutalonil 40%	2.0–4.0 fl oz
Nu-Flow M-HF	Wilbur-Ellis	myclobutanil 25%	1.25–4.0 fl oz
Nusan 30 E.C.	Wilbur-Ellis	TCMTB 30%	1.25–4.0 fl oz
Seed Shield	Helena Chemical	azoxystrobin 5.24% + fludioxinil 0.87% + mefenoxam 2.62% + difenoconazole	4 oz/cwt
Thiram Technical	Tamirco	thiram 98.5%	See label
Trilex Advanced	Bayer CropScience	trifloxystrobin 8.55% + metalaxyl 12.82% + tradimenol 4.27%	1.6 fl oz
Trilex Advanced System	Bayer CropScience	trifloxystrobin 22% + metalaxyl 28.35% + tradimenol 30%	0.64 + 0.75 + 0.25 fl oz
Trio eXtra	Loveland Products	azoxystrobin 6.64% + fludioxinil 1.11% + mefenoxam 4.60%	3.5 fl oz
Vitavax-34	Chemtura Corporation	carboxin 34%	4–8 fl oz
Vortex	Bayer CropScience	ipconazole 40.7%	0.085–0.51 fl oz

<sup>1</sup>Acceleron seed treatment products may change on an annual basis. To verify the specific product(s) available continue to check <https://www.acceleronsts.com/Pages/Home.aspx>.

<sup>2</sup>Bion rate is based on 5,000 seed per pound (rate is generally considered to be 0.0003–0.0009 mg a.i./seed)

<sup>3</sup>Apply Dividend Extreme in combination with Apron XL LS for situations that might include *Pythium* spp.

<sup>4</sup>Apply the high rate of Maxim XL in the event of a high level of damping-off due to *Pythium* spp. Also, this can be applied in conjunction with Apron XL LS at rates of 0.278–0.553 fl oz.

## Soil Treatments

### 1. Planter-box

Planter-box treatments are the least effective of the soil treatments, but it is better than no additional treatment. If equipment is not available for in-the-furrow fungicide applications, use a planter-box treatment. Planter-box seed treatments can also be applied by the distributor. Typically these fungicides have activity against diseases caused by *Pythium* and *Rhizoctonia* as well as more general fungal seed rots. **Table 2** lists the most common materials used in the Midsouth.

### Method of Application

Soil fungicides cannot be applied well by the hopper-box method with acid-delinted seed unless the seed and fungicide are properly layered in the planter-box.

When mixed well with seed, some fungicide will fall out with each seed to treat the soil surrounding the seed. Fungicides may reduce the seedling rate by 10–20 percent, so you must calibrate the planter with the seed and fungicide mixture to achieve the desired seeding rate.

The planter-box method is less expensive than in-furrow granules or spray applications, but it is also less

effective. However, when used properly, this method gives better results than do seed treatments alone.

### 2. In-the-furrow granules at planting

In-furrow granular fungicides give about the same degree of seedling disease control as in-furrow spray applications. **Table 3** lists specific granular fungicides that are recommended.

### 3. In-furrow sprays

In-furrow sprays are considered the best way to apply soil fungicides and are recommended for use in fields with a history of seedling disease. The process mixes more fungicide with the soil to give a greater zone of protection around the germinating seed and developing young seedling. See **Table 4** for recommendations.

For best results, apply the fungicide through two cone-type nozzle tips. Mount the front cone-type nozzle just behind the seed-drop outlet to treat the soil around the seed. Direct the rear nozzle to spray soil as it is tumbled into the seed furrow, with a small amount of spray striking the top of the covered row.

**Table 2. Most common planter-box seed treatment materials used in the Midsouth.**

Fungicide	Producer	Active ingredient(s)	Rates/100 lb seed
Catapult XL	Agrilliance, LLC	chloroneb 30.00% + mefenoxam 1.95%	See label
Dyna-Shield Metalaxyl 318 FS	Loveland	metalaxyl 30.14%	0.75–1.5 fl oz
Kodiak HB	Chemtura Corporation	<i>Bacillus subtilis</i> GB03 0.3%	1.8–2.0 oz
Nu-Flow M-HF	Wilbur-Ellis	myclobutanil 25%	1.25–4.0 fl oz*
Prevail	Chemtura Corporation	metalaxyl 3.12% + PCNB 15.00% + carboxin 15.00%	16 fl oz
System 3	Helena Chemical	metalaxyl 4.25% + PCNB 16.67% + <i>Bacillus subtilis</i> (Kodiak Fl) 0.10%	12 fl oz

\*Dilute with 7–10 fl oz of water and apply to 100 lb of seed.

**Table 3. Recommended granular fungicides for in-furrow treatments.**

Fungicide	Producer	Active ingredient(s)	Amount per acre (40-in row spacing)
Quadris Flowable	Syngenta	azoxystrobin 22.9%	5.2–7.8 fl oz
Ridomil Gold GR	Syngenta	mefenoxam 2.5%	1.25–2.5 lb
Ridomil Gold PC GR	Syngenta	PCNB 10.0% + mefenoxam 0.50%	7–10 lb
Ridomil Gold SL	Syngenta	mefenoxam 45.3%	0.9–1.9 fl oz
Terraclor 15 G	Chemtura	PCNB 15%	5–10 lb
Terraclor Super X 18.8G	Chemtura	PCNB 15% + etridiazole 3.8%	3.0–12.5 lb (see label for specifics)
Terraclor Super X + Di-Syston EC	Chemtura	PCNB 17.5% + etridiazole 4.3%+ disulfoton 17.5%	4–5.5 pt
Terraclor Super X with D-Syston	Chemtura	PCNB 6.5% + etridiazole 1.63% + disulfoton 6.5%	4–5 lb (hill-drop planting) 12–15 lb (drill planting)
Terraclor 6.5% + Dis-Syston 6.5%	Chemtura	PCNB 6.5% + disulfoton 6.5%	4–5 lb (hill-drop planting) 12–15 lb (drill planting)

NOTE: To convert 40-inch rates to 38-inch rows, multiply rate by 1.05. OR follow these guidelines for row spacing: 40 in = 13,068 row ft, 38 in = 13,754 row ft, 36 in = 14,520 row ft, 34 in = 15,374 row ft, 32 in = 16,315 row ft, 30 in = 17,424 row ft, 22 in = 23,760 row ft, and 20 in = 26,136 row ft/acre.

**Table 4. Recommended in-furrow fungicide sprays.**

Fungicide	Producer	Active ingredient(s)	Amount per acre (40-in row spacing)
Headline	BASF	pyraclostrobin 23.6%	5.4–10.8 fl oz
MetaStar 2E AG	Arysta LifeScience	metalaxyl 23.0%	0.24–0.5 pt
Quadris Flowable	Syngenta	azoxystrobin 22.9%	5.2–10.4 fl oz
Reason 500 SC	Bayer CropScience	fenamidone 44.4%	6 fl oz
Ridomil Gold SL	Syngenta	mefenoxam 45.3%	0.98–1.96 fl oz
Rovral	Bayer CropScience	iprodione 41.6%	3.2–6.5 fl oz
Terraclor Flowable	Chemtura	PCNB 40%	1.5–3.0 pt
Terraclor 2 Lb. Emulsifiable	Chemtura	PCNB 23.8%	2.99–5.98 pt
Terraclor Super X Emulsifiable	Crompton Uniroyal Chemical	PCNB 23.2% + etridiazole 5.8%	3–6 pt
Terramaster 4EC	Chemtura	etridiazole 44.3%	4–8 fl oz
Uniform	Syngenta	azoxystrobin 28.2% + mefenoxam 10.9%	4.2–6.3 fl oz

Note: To determine the amount of product for 38-inch rows, multiply by 1.05. Remember that soil fungicides are used in addition to regular seed treatments, not in place of them. Treated seeds cannot be used for oil, food, or other purposes.

## Summary of Seedling Disease Control

Seedling diseases of cotton can be controlled only through preventive measures. All of the preventive measures are taken before or at planting time.

### Cultural Control

A number of cultural practices lower the risk of seedling disease. Early cutting and shredding of stalks in the fall can help control seedling disease by cutting down on the amount of inoculum that carries over from year to year. Also, it is important to prepare a good seedbed for seedling disease control. Raised beds give some control of seedling diseases, especially in early-planted cotton.

### Soil pH

Maintain a soil pH of 6.0–6.5. Extremely low pH favors the development of some cotton seedling diseases. A pH of 6.0–6.5 not only encourages vigorous plant growth but also suppresses certain diseases.

### Soil Temperature

Avoid planting when soil temperatures are below 68 °F, when germination is slow and the seeds and seedlings are more vulnerable to infection.

### Seed Quality

Poor-quality seed sources with low germination rates are much more susceptible to seedling diseases than are high-quality seed. Seeds with high germination usually produce more vigorous, healthy seedlings even under adverse conditions.

### Seed Treatment

All cotton seed used for planting should be treated with a fungicide.

### Soil Treatment

Soil fungicides are good insurance for getting a good stand of cotton.

If the producer has a problem getting a stand (from seedling disease) one out of three years, an in-furrow granular or spray treatment may prove to be economical.



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