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Symptom Identification and Management of Cotton Seedling Diseases

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Introduction

Seedling diseases, also known as damping-off (seedling death), are caused by several common soil-inhabiting fungi acting alone or collectively during pre-emergence and postemergence of cotton seedlings. Pre-emergent damping-off refers to rot and death of germinating seeds prior to emergence from the soil. Post-emergent damping-off refers to seedling death after emergence from the soil. Seedling diseases are common but often a minor problem in cotton production areas of Arizona in most years. However, significant stand loss to seedling diseases can occur sporadically in some fields without good crop rotation history, especially when cool, wet weather conditions exist during the first weeks after planting that allow soil temperatures to drop below 65°F. Consequently, growers may have to replant parts or whole fields incurring substantial costs including seed, fuel, labor, additional costs of late season pest control as well as experience yield reductions due to late planting.

Post-emergence damping-off

Pathogen

The most prevalent post-emergence fungus is *Rhizoctonia solani*. *Pythium* spp. (oomycete, fungus-like microorganism or water mold) is a rare pathogen of pre-emergent and post-emergent cotton in Arizona; *Thielaviopsis basicola* is a post-emergence fungus; *Fusarium* spp. can be a fungal pathogen of both pre-emergent and post-emergent cotton.

Host Range

Each fungus has a broad host range including weeds and many economically important crops.

Disease Cycle

Seedling disease pathogens are ubiquitous soil saprobes that survive from year to year on decomposing crop residues or remain indefinitely in soils as resistant structures. They are spread by movement of soil and crop

residues via wind, water or equipment. They attack seeds causing seed decay or penetrate roots of seedlings that cause root damage or death of small plants. The disease is favored by many factors that slow down seed germination, emergence, and seedling growth. Risk factors include cool, wet weather conditions, poor soil conditions (compacted soil, heavy soil, poorly formed seedbed), planting too deep, soil salinity, excessive herbicide residue, poor fertilizer placement, high inoculum populations in the soil (poor crop rotation practices), and low seed quality.

Symptoms And Diagnosis

Rhizoctonia solani is a post-emergence pathogen that causes sunken, reddish-brown lesions on the stem ("Soreshin") near the soil line. These lesions may girdle the stem causing the seedling to collapse. Infected plants may appear stunted. In poorly drained or heavy soils, several *Pythium* species can cause not only seed decay, but also root rotting that is associated with chlorosis, stunting and seedling death. *Thielaviopsis basicola* is a post-emergence fungus that causes black root rot. The typical symptoms include darkening of the tap root or lateral roots, stunting and delayed development. It often weakens, but in most cases does not result in seedling death. *Fusarium* species often interact with other damping-off pathogens and are found on diseased seedlings under physiological or environmental stresses.

Conditions Can Be Confused With

It is difficult to determine exactly which pathogen alone or in combination may be causing symptoms associated with seedling diseases. Stunting associated with rook-knot nematode can be confused with seedling disease symptomology and can be determined by soil or seedling

"Soreshin" caused by *Rhizoctonia solani*


Pythium root rot

Black root rot caused by *Thielaviopsis basicola*


Fusarium root rot

FUNGICIDE OPTIONS FOR CONTROLLING SEEDLING DISEASES OF COTTON IN ARIZONA

Name(s)of Compound(s)	Trade Name and Manufacturer		*Pythium*	*Rhizoctonia*	*Fusarium*	*Thielaviopsis*	Seed rots **	Risks
	Seed Treatment	In-Furrow						
Metalaxyl or Mefenoxam	Apron XL, LS (Syngenta), Allegiance FL, LS, Acceleron DX-309 (Bayer CropScience), Acquire (BASF)	Ridomil Gold EC, SL, GR (Syngenta)	√					Wildlife
Trifoxystrobin	Trilex Flowable, Acceleron DX-709 (Bayer CropScience)			√	√		√	Aquatic life
Pyraclostrobin	Acceleron DX-109 (Bayer CropScience)	Headline & Headline SC (BASF)		√				Aquatic life
Azoxystrobin		Quadris Flowable (Syngenta)	√	√				Aquatic life
Etridiazole		Terramaster 4EC(Arysta LifeScience)	√					Inhalation, wildlife
Fluxapyroxad	Acceleron DX-612 (Bayer CropScience)			√				Aquatic life
Fenamidone		Reason 500 SC (Bayer CropScience)	√	√				Aquatic life, inhalation
Ipconazole	Vortex, Acceleron DX-509 (Bayer CropScience)			√	√		√	Inhalation
Iprodione		Iprodione 4L AG (Arysta LifeScience), Rovral Brand 4F (FMC)		√				Wildlife
Triadimenol	Baytan 30 Flowable (Bayer CropScience)			√		√		Wildlife
Myclobutanil	Acceleron DT-510 (Bayer CropScience), Nu-Flow CT (Wilbur-Ellis), Spera 240 FS (Nufarm Americas)			√		√		Wildlife
Carboxin	Vitavax 34 (Arysta LifeScience)			√				Pollinators
Penflufen	EverGol Prime (Bayer CropScience)			√				Aquatic life
TCMTB	Nusan 30 EC (Wilbur-Ellis)		√	√	√		√	Aquatic life, inhalation
Thiram *	Thiram 42-S (Bayer CropScience), Thiram 480 DP (Arysta LifeScience)						√	Aquatic life, inhalation
Mancozeb *	Dithane M-45 (Corteva Agriscience)						√	Wildlife
Fludioxonil *	Maxim 4 FS (Syngenta)			√	√		√	Aquatic life, inhalation
Tolclofos-methyl *	Rizolex (Valent)			√	√		√	Aquatic life
FUNGICIDE MIXTURES								
Metalaxyl + Trifloxystrobin	Trilex 2000 (Bayer CropScience)		√	√	√		√	Wildlife, Aquatic life
Metalaxyl + Trifloxystrobin + Triadimenol	Trilex Advanced (Bayer CropScience)		√	√	√	√	√	Wildlife, Aquatic life
Mefenoxam + Azoxystrobin + Fludioxonil	Dynasty CST (Syngenta)		√	√	√		√	Wildlife, Aquatic life
Mefenoxam + Azoxystrobin + Fludioxonil + Sedaxane	Vibrance CST (Syngenta)		√	√	√		√	Wildlife, Aquatic life
Mefenoxam + Azoxystrobin		Uniform (Syngenta)	√	√				Wildlife, Aquatic life
Mefenoxam + PCNB *		Ridomil Gold PC, GR (Syngenta)	√	√				aquatic life, pollinators, inhalation
Pyraclostrobin + Boscalid	Coronet (BASF)			√			√	Aquatic life

* Compounds are contact fungicides and other unmarked compounds are systemic fungicides. Systemic fungicides can be taken up and redistribute inside a plant. They are target specific (one or a few pathogens) and can protect the plant for a longer period of time than contact fungicides (a.k.a. "protectant") with a broader spectrum of activity. While contact fungicides cannot penetrate plant tissues, they intercept the fungus in the area near where they are applied and prevent it from attacking or getting inside a seedling. Therefore, the two types of fungicides complement each other in protecting the seed and the seedling.

** Seed rot fungi include Alternaria, Aspergillus, Cladosporium, Penicillium, Mucor, Rhizopus. Velum Total (Fluopyram + Imidacloprid, insecticide/nematicide, Bayer CropScience) can be used in-furrow to suppress fungal diseases and nematodes; Elatus (Azoxystrobin + Benzovindiflupyr, Syngenta) can be used for controlling Rhizoctonia solani during post-emergence.

Efficacy is not guaranteed, and no product endorsements are made or implied. These lists may not include all registered seed treatment products. Always read and follow product label instructions and restrictions.

sampling for nematode analysis. Laboratory testing via microscopy, culture isolation, and molecular techniques are often required for definitive diagnosis. Symptomatic plants should be collected and wrapped in a dry paper towel, placed in a plastic bag, and shipped OVERNIGHT to the University of Arizona's extension plant pathology laboratory in Tucson. All submissions should be accompanied by a completed Plant Disease Diagnostic Form.

Management

The following measures can be taken to minimize the disease risk: 1) plant high quality seeds for establishing a good stand. Cotton producers that opt to save seeds from previous conventional varieties should verify seed quality by testing seed lots; 2) plant seeds in warm soil temperature (>65°F at 8:00am, 4-inch depth and a 3-day warm weather forecast are ideal conditions); 3) plant seeds on raised beds for better drainage and soil temperature; and 4) when disease conducive conditions are predicted at planting, plant seeds treated with fungicides. All commercial seeds are pretreated with two or more fungicides listed in the table below. Producers may opt to treat black seeds with their preferred choice of fungicide combinations when purchasing seeds or saving seeds from conventional varieties. An effective seed treatment contains 2 to 4 active ingredients that provide protection against *Pythium* and *Rhizoctonia* species as well as Thielaviopsis if known at a specific field site. An in-furrow fungicide application may provide extra protection, especially when conditions are favorable for disease development and if a field has a history of stand failure and poor crop rotation practices. The data from the National Cottonseed Treatment Trials conducted annually across the Cotton Belt did not indicate a consistent, significant increase in yield and economic benefit of additional fungicide treatments (seed treatment trial result). Consequently, a producer needs to make an assessment of the cost-benefit of additional fungicide use by carefully considering increased disease risk factors.

References

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