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FOCUS on South Plains Agriculture

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Cotton Diseases

Seedling disease complex

Seedling diseases occur every year in west Texas; however, substantial losses are seldom experienced. Several fungi are capable of causing seedling disease. *Rhizoctonia solani* and *Pythium* spp. are the predominant causes of seedling disease in the region. Both *R. solani* and *Pythium* spp. can occur as seed decay (which occurs prior to germination), pre-mergence damping-off (which occurs between germination and emergence), and post-emergence damping-off or sore shin (which typically occurs on older plants). Symptoms associated with *R. solani* and *Pythium* spp. are similar, and can be observed on young seedlings. Initial symptoms consist of sunken lesions at the soil level, resulting in girdling and collapse of the stem (Fig. 1).

In addition, black root rot (caused by *Thielaviopsis basicola*) can be experienced on the Southern High Plains. Plants infected with *T. basicola* may also exhibit severe necrosis on roots, severe stunting and swelling of the cortex; however, plants are rarely killed (**Figure. 2**). Black root rot is most commonly found in heavier soils, and is more severe in the presence of the root-knot nematode. Infections are restricted to feeder roots in older plants. While seedling disease-associated losses reduce yield <5%, cool/wet soil conditions, poor quality or low vigor seed, phytotoxicity, fertilizer damage, or sand blasting may result in the need to replant. Because of the nature of the pathogens involved, varietal resistance is not an option for managing seedling disease. Losses can be minimized by delaying planting until soil temperature (at the 4 inch depth) is above 65 °F for three consecutive days, and using high quality,

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fungicide treated seed. All commercially available seed is treated with fungicides; however, various combinations are available for the aforementioned seeding diseases (see Table 1 in this issue and our publication, Management of Seedling Diseases of Cotton).

Figure 1. Symptoms associated with R. solani and Pythium spp

Bacterial blight

Bacterial blight, while sporadic in nature, is a potentially devastating disease. Cotton plants are susceptible to infection at all developmental stages. Stand losses and reduced vigor can be experienced if infections occur during the seedling stage. Symptoms include small, dark green, water-soaked spots that are first visible on the underside of leaves (Fig. 3). These lesions, which have an angular appearance and are delimited by the veins, later become present on the upper leaf surface.

Figure 3. Symptoms of bacterial blight

As the disease progresses, a second leaf symptom (referred to as 'Black arm') can be observed along the main vein (Fig. 4). As individual lesions coalesce and become necrotic, infected leaves will defoliate prematurely. In addition, water-soaked lesions can develop on infected bolls. These infections often result in a boll rot (Fig. 5). There are no chemical management options available for Bacterial blight. The disease is currently managed through the use of resistant or immune varieties. Bacterial blight recommendations are available in this publication.

Figure 4. Black arm

Figure 5. Boll rot

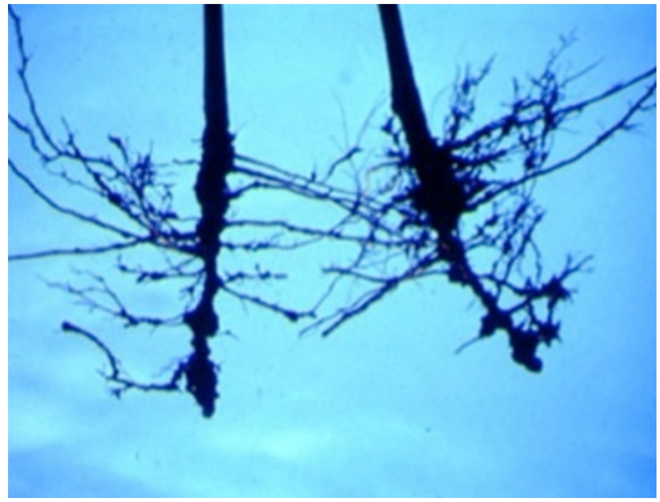

Figure 6. Root galls caused by nematodes

Plant parasitic nematodes

Two species of nematodes, Root-knot (*Meloidogyne incognita*) and Reniform (*Rotylenchulus reniformis*) have been identified on the Southern High Plains. The Root-knot nematode is the predominant species found in the region. Symptoms of nematode damage are characterized by stunting, reduced vigor, and chlorosis (resembling nutrient deficiency symptoms). Diagnostic features of Root-knot nematodes are rapid proliferation of roots and the presence of spherical galls on the roots (Fig. 6). Symptoms associated with Reniform are similar to those of Root-knot; however, galls are not present. Management options for Root-knot is dependant upon soil populations of the nematode, where higher populations are capable of causing greater yield loss (Table 2). Historically, Root-knot has been managed primarily via nematicides being applied in furrow. Seed applied nematicides are commercially available; however, these products are less effective in fields determined as being moderate or high risk. Several varieties with partial resistance (or improved tolerance) to root-knot nematode have been released. In-season applications of Vydate have also been effective at increasing yields in fields severely infested with Root-knot nematodes. Rotation with non- or poor hosts may help to suppress nematode populations for future cotton crops. Management options are more limited for Reniform nematode.

Verticillium wilt

Verticillium wilt, caused by the soilborne fungus *Verticillium dahliae*, is the most economically important disease on the High Plains. The fungus infects plants through the roots early in the season, grows through the vascular system, eventually clogging the plants water conducting channels (xylem), which results in the development of wilt symptoms (Fig. 7). As the disease develops severe stunting and defoliation may occur (Fig. 8). Increasing disease incidence can negatively impact yield and fiber quality. To further complicate issues, the fungus is capable of surviving in the soil for extremely long periods of time. Variety selection has been the primary option for management of Verticillium wilt; however, recent studies have indicated that other cultural practices such as seeding rate, irrigation level and crop rotation may adversely affect *V. dahliae*, thus leading to a reduction in disease. Results from research trials evaluating these factors have recently been summarized and made available in an Extension Guide. Verticillium wilt management will remain the focus of research efforts for the next several years.

Figure 7. Verticillium wilt symptoms

Figure 8. Stunting from Verticillium wilt

Fusarium wilt

Fusarium wilt, caused by the soilborne fungus *Fusarium oxysporum* f. sp. *vasinfectum*, is another potentially devastating disease that affects cotton on the Southern High Plains. Foliar symptoms can potentially be confused with Verticillium wilt (Fig. 9); therefore, proper disease diagnosis is required. For more information regarding diagnosis see the bulletin 'Diagnosis and Management of Vascular Wilts of Cotton'. One subtle difference is that seedling mortality may be observed with Fusarium wilt (Fig, 10) Distribution of this pathogen is more restricted than that of *V. dahliae*. Where Verticillium wilt is wide spread throughout the region, Fusarium wilt is generally limited to the south and west of Lubbock. Alone *Fov* is a week pathogen, and damage caused by the Root-knot nematode is needed to induce this disease. Therefore, management options that are employed to minimize nematode damage are often integrated into Fusarium wilt management strategies. For example, the use of nematicides results in higher stands, lower disease incidence, and greater yields. While nematicides have no direct effect on *Fov* the benefit comes from reducing damage caused by the nematode. Furthermore, results from trials conducted in fields infested with *Fov* have found that varieties which posses partial resistance or improved tolerance to Root-knot nematode consistently perform well. In addition, varieties with no known nematode resistance also perform well. Results from the 2008 and 2009 Fusarium wilt trial results are available. JW

Figures 9 (Verticillium wilt) and 10 (Fusarium wilt)

Preplant Weed Control in Cotton

The discovery of Roundup-resistant weeds was a dominant topic at the Beltwide Cotton Conferences – Weed Science Conference in New Orleans in January and continues to be written about in newletters and popular press articles. Roundup resistant Palmer amaranth (carelessweed) even made the ABC World News by Charles Gibson last fall in a segment called "Killer Pig Weeds Threaten Crops in the South". The show claimed that these weeds are no longer susceptible to pesticides. Is this true? We have Palmer amaranth and we can control them. Why? We don't rely on a single herbicide to control our weeds. But is resistance real? Yes! To date, we have 346 resistant weed biotypes, 195 weed species (115 dicots and 80 monocots) in over 330,000 fields worldwide (http://www.weedscience.org/in.asp). There are 17 different weeds worldwide that have been confirmed to be resistant to Roundup. Most recently, Kansas is reporting that they have kochia that is resistant to Roundup. One of the main reasons for the selection of herbicide-resistant weeds is the sole reliance on a single herbicide to control weeds over the course of several years. Growers on the Texas High Plains have done a good job of using several weed management strategies to control weeds and not relying on Roundup as the only tool. Although the amount of cultivation has declined for understandable reasons, we still see plowing and cultivation as an effective strategy against the development of herbicide resistant weeds. We also see the benefit of using other "mode-of-action" herbicides as an important part of successful weed management and as an effective weed-resistance strategy, although the amount of preplant and preemergence herbicides has declined over the past few years as well.

One of the key herbicide timings with an alternative mode-of-action is the use of preplant herbicides. In the previous FOCUS on South Plains Agriculture article (Vol. 49, No. 3), preplant control of winter and spring annual weeds using 2,4-D and Sharpen was discussed. In this article, we will discuss the use the dinitroaniline herbicides and a few other herbicides that provide good soil residual weed control until planting.

Effective preplant weed control will conserve soil moisture, allow planting operations to occur without the interference of weeds, and help to provide the critical weed free periods for the first six to eight weeks after crop emergence. One of the major challenges of using herbicides preplant is to ensure that herbicide activity in soil will not reduce crop germination and emergence. A second challenge is to select the proper herbicide(s) for the weeds that need to be controlled. The use of Prowl (pendimethalin) or Treflan (trifluralin) is the first step towards successful weed management programs in cotton. The strength of these dinitroaniline (DNA) herbicides is annual grass control (barnyardgrass, crabgrass, foxtails, panicums, etc.) and control of small-seeded broadleaf weeds such as Palmer amaranth (carelessweed and other pigweed species), Russian thistle (tumbleweed), and kochia (ironweed). Most larger-seeded broadleaf weeds, like annual morningglories, cocklebur, and sunflowers, and perennial weeds are not controlled by these herbicides.

The rate of each DNA herbicide is dependent on soil type. The sandier the soil, the lower the recommended rate. If soil conditions are dry and large clods are present during mechanical incorporation, herbicide performance will be less effective. Keep in mind that when Treflan was first used over 35 years ago, farmers were diligent with two-pass incorporation prior to bedding and planting. This resulted in thorough mixing of the herbicide and excellent weed control. In recent years many farmers have cut back on incorporation to save time and money. Some have still achieved adequate weed control while others have observed that poor incorporation caused herbicide failures. In cotton, Prowl EC rates range from 1.2 to 3.6 pints per acre in conventional or minimal tillage and from 1.8 to 4.8 pints per acre in no-tillage. Rates for Treflan and other trifluralin products (formulated at 4 pounds per gallon) range from 1/2 to 1 pint per acre for sandy soils, and up to 2 pints per acre on other soils. The DNA herbicides may be incorporated by mechanical means or by irrigation. Incorporation methods vary widely across the High Plains and state. A double-pass method of incorporation is recommended and is most commonly used. Mechanical implements used to incorporate these herbicides include a springtooth harrow, a disk, a double or single stalkcutter, and a rolling cultivator to name a few. The better the implement mixes and uniformly distributes the herbicide in the upper 1- to 2-inches of soil, the better the weed control.

A typical DNA label will state: **Use incorporation equipment capable of mixing the herbicide uniformly into the top 2 to 3 inches of the final seedbed. Ground cover and crop residues, if excessive, should be reduced by appropriate soil tillage prior to application. Non-uniform application (equipment, speed of application, clods, …) may result in erratic weed control or crop injury. With most equipment and methods of application, a second incorporation is required before planting.** Treflan should be incorporated within 24 hours after application. Prowl must be incorporated within 7 days after application, but the sooner the better. Prowl EC may be surface applied and then incorporated by rainfall or irrigation. Three-quarters to one-inch of irrigation is necessary to incorporate (activate) these herbicides. Both Prowl EC and Treflan may be chemigated into the soil. These applications may not be the best way to incorporate Prowl or Treflan, but may be the only way to use these herbicides in a reduced tillage or no-tillage crop production system. When surface applications followed by irrigation or chemigation methods are used, herbicide rates are generally higher when compared to mechanically incorporated methods. Research conducted at the AG-CARES farm north of Lamesa by researchers with Texas AgriLIFE Research suggested that Prowl EC provided more consistent weed control when compared to Treflan when surface applied and watered in, but Treflan performed better than Prowl EC when chemigated.

Prowl H20 is the newest formulation of pendimethalin. One gallon of Prowl H20 contains 3.8 pounds of pendimethalin formulated as an aqueous capsule suspension. Since it formulated at a higher concentration than Prowl 3.3 EC, less product is needed on a per acre basis in general. In cotton, Prowl H20 may be applied in conventional, minimum, stale seedbed, or no-till systems as a preplant surface, preplant incorporated, preeemergence, or at layby. It may be applied by ground, air, or chemigation. Use rates vary from 1 to 3 pints per acre in conventional or minimal tillage and 2 to 4 pints in no-till depending on soil texture.

Valor is a new burndown option for use preplant in cotton. Valor may be used at 1 to 2 ounces per acre with labeled burndown herbicides like Roundup and 2,4-D to enhance the speed of burndown, widen the spectrum of weed control, and provide residual weed control. Do not till after application or the residual weed control may be reduced. A minimum of 30 days and 1 inch of rainfall/irrigation must pass between application and planting in conventionally tilled cotton. In no-till or strip-till cotton, a minimum of 14 days plus 1 inch of rainfall/irrigation must occur between application and planting when 1 ounce of Valor is used or 21 days must occur between application and planting when 1.5 to 2 ounces is used. Valor has soil residual activity on several broadleaf weeds including chickweed, dandelion, henbit, marestail, pigweed, primrose, mustard, and sheperdspurse. PD and WK

ALWAYS CAREFULLY READ AND FOLLOW LABEL RECOMMENDATIONS.

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