SOYBEAN DISEASE AND NEMATODE CONTROL

(Bob Kemerait)

Disease and Nematode Outlook for 2015

Soybean producers in Georgia should be prepared to protect their crop against fungal diseases and nematodes in the upcoming season. Weather patterns during 2015 will have a significant impact on the severity of disease. As an example, Asian soybean rust was not an important disease for producers in 2014 in large part due to climate and weather patterns. First, the winter of 2013-2014 was unusually cold and low temperatures greatly reduced the chance that kudzu would survive the season. Without living kudzu, spores of the fungus causing Asian soybean rust could not survive to infect soybeans and kudzu in 2014. Such resulted in lower inoculum potential (spores available) to initiate disease. Second, the Southeast was generally spared from the effects of tropical storms last season. As tropical storms help to spread rust spores, reintroduction of Asian soybean rust was delayed. Finally, near-drought conditions over much of the 2014 growing season were unfavorable for the development and spread of rust and other fungal diseases affecting the leaves of the soybean plants. The climate in Georgia throughout the remainder of this winter and into the growing season will greatly affect the potential for disease.

In 2015, especially if rainfall is abundant, growers should remain vigilant and prepared to manage Asian soybean rust and other diseases like anthracnose and Phomopsis pod and stem blight. Because of dryer weather, soybean rust was insignificant in Georgia and the rest of the United States in 2010, 2011 and 2014. However, the disease was a problem in 2012 and 2013 and significant yields losses certainly occurred in some fields. The importance of rust during the 2012 season was likely the combined effects of a warm winter (soybean rust likely overwintered on kudzu not too far from Georgia), early tropical storms Beryl and Debbie that re-introduced the disease in Georgia by mid-June, and frequent rainfall that created near-perfect conditions for the development and spread of rust. Rainfall is a critical factor for many fungal diseases.

The Soybean Rust Sentinel Plots (www.sbrusa.net) will be funded again in 2015 through the Georgia Commodity Commission for Soybeans, the United Soybean Board, and the North Central Soybean Research Program. This program continues to provide an effective tool for early notice of the development and spread of ASR. By effectively managing rust, growers may achieve better control of other diseases as well, such as anthracnose, Phomopsis pod and stem blight, frogeye leaf spot, and Cercospora blight. A list of fungicides currently labeled for control of Asian soybean rust and other diseases of soybeans is presented later in this section.

Newer fungicides available for soybean producers include Aproach and Aproach Prima from DuPont, Fortix from Arysta LifeScience and Cheminova, Priaxor from BASF, Quadris TOP from Syngenta and Affiance from Gowan. More specific discussion on use of fungicides in soybeans will follow; however growers are reminded that best management practices for protecting the crop from disease include the following. 1) Follow reports from Soybean Rust Sentinel Plots at www.sbrusa.net and through your county agent. 2) Use the late-bloom-to-early pod development growth stages as a potential target for initial fungicide application. 3) Recognize that fungicides that include a mixture of products, e.g., SDHI, strobilurin and triazole chemistries, provide both a broader spectrum of activity against disease and a longer protective

window than do fungicides like propiconazole (Tilt, Bumber) and tebuconazole alone. Trivapro (propiconazole, azoxystrobin and solatenol) is likely to be labeled for use on corn and soybeans by Syngenta in 2015.

Azoxystrobin (the active ingredient in Quadris fungicide and a component of Quilt, Quilt Excel and Quadris TOP) went "off-patent" in June of 2014 and there will be an increase of generic "Quadris" products on the market. Despite the reduced price cost expected for such products, growers are reminded that it remains critically important to use these products carefully and according to label. Fungicide resistance occurs when a fungicide that was used to control a fungal pathogen becomes ineffective, often times from overuse. It is important that growers are careful with use of strobilurin fungicides. The pathogen causing frogeye leaf spot has already developed resistance to strobilurin fungicides in some areas of the United States.

Southern stem blight ("white mold" in Georgia) was severe in peanuts in 2010, 2011 and 2012; the disease was also commonly observed in fields planted to soybean. The unusually high soil temperatures throughout much of the 2010 and 2011 seasons were largely to blame for the outbreak of southern blight. Southern blight was less of a problem in 2013 when cooler temperatures were observed over much of the growing season. Though no research has been conducted at the University of Georgia on management of southern blight in soybeans using fungicides, fungicides may prove to be an effective management tool where the disease is severe. Fungicides labeled for use in management of southern blight on soybeans include Quadris, Headline, and EVITO.

Nematodes are an important threat to soybean production in Georgia. Soybean yields in the state are routinely compromised by root-knot, reniform, Columbia lance nematodes, and perhaps sting and cyst nematodes as well. From a survey of 107 soybean fields from across Georgia, root-knot nematodes were present in at least 36 fields, cysts nematodes in ten fields and reniform nematodes in five fields. The root-knot nematodes were found in fields across the state; cyst and reniform were found in much more localized areas. For example, cyst nematodes were found most commonly in Washington, Burke, and Screven Counties; reniform nematodes in Calhoun and Sumter Counties.

The first line of defense for protection from plant-parasitic nematodes is crop rotation; however crop rotation is difficult for management of nematodes that affect soybeans. This is because one or more of the important nematodes affecting soybeans will also affect most of our suitable rotation crops (e.g. cotton, corn, and peanuts). The second line of defense will be the use of soybean varieties with some level of nematode resistance. Though none of our soybean varieties are immune to nematodes, growers can plant varieties with improved resistance to the cyst and the southern root-knot nematodes. (Note: resistance to the peanut root-knot nematode and the reniform nematode is rare in our soybean varieties.) This resistance, as a part of an over-all nematode management plan, will help to minimize losses in yield and also reduce nematode populations in a field compared to populations when a susceptible variety is planted. The third line of defense in management of nematodes on soybeans is the use of appropriate nematicides. Growers have the opportunity to use the soil fumigant Telone II (3 gal/A). The seed-treatment nematicide AVICTA Complete Beans from Syngenta is also available to soybean producers.

Research continues on AVICTA Complete Beans to develop use recommendations through the University of Georgia Cooperative Extension.

Tebuconazole fungicide. Tebuconazole, the active ingredient in products such as Folicur, Orius, Muscle, Tebustar, Tebuzol, etc., remains a popular fungicide used on soybeans grown in Georgia. The popularity of this product is based on its proven efficacy in management of rust, its cost per application (3-4 fl oz/A), and because delays in natural defoliation are not attributed to this fungicide. There is no doubt that tebuconazole is an attractive choice of fungicide for these reasons. HOWEVER, growers must recognize that tebuconazole is NOT a perfect fungicide. Growers should consider other fungicides when deciding what to spray on their beans as a) there are better fungicides for management of soybean rust, b) there are more effective fungicides for the management of anthracnose and other important diseases, and c) there are fungicides, typically strobilurin fungicides, that offer a longer protective window, e.g. three weeks as opposed to two weeks.

Phomopsis pod and stem blight (*Diaporthe phaseolorum* var. *sojae*) and **anthracnose** (*Colletortrichum* spp.) have been devastating in some fields in Georgia in recent years, for example in Terrell and Marion Counties. In such fields, the effects of these two diseases were much more severe than losses to Asian soybean rust. Inoculum (spores) from these fungal pathogens can survive in the field amongst the crop debris and the pathogens can also be born on infected seed as well. Although little research has been conducted in Georgia to assess management of these diseases, timely applications of effective fungicides has been reported as an important control measure for at least anthracnose. Reports of these diseases were much more common in 2009 than in 2010 or 2011. This was likely due to the abundance of wet weather experience across much of the production region in 2009. Both diseases are easily spread by wind and splashing rain that helps to move the fungal spores within a field. CRITICAL POINT: Where fields have been affected by Phomopsis and/or anthracnose in the past, growers should choose a fungicide that is proven effective both in the management of these diseases and in control of Asian soybean rust. Also, growers should ensure that the timing of the fungicide application is appropriate for all of these diseases.

Cercospora blight. Late in the season growers often begin to observe that upper leaves exposed to the sun turn a purple color and is followed by significant defoliation. The petioles (leaf stems) on many plants also develop deep purple lesions and seed from these plants are frequently stained a purple color. The fungal pathogen *Cercospora kikuchii* is the likely causal organism for all of these symptoms and can lead to a reduction in yield and quality. In field studies at the University of Georgia, less Cercospora leaf blight is frequently observed in plots which have been treated with a fungicide to protect against soybean rust than in unsprayed plots.

Crop rotation. If the acreage planted to soybeans increases in Georgia, the time between soybean crops in a field will likely decrease (i.e. shorter rotation) and also peanuts and soybeans are more likely to be planted in shorter rotations with each other. Should shorter rotations occur, growers can expect greater problems with Cylindrocladium black rot (CBR)/Red crown rot, as this disease affects both peanuts and soybeans, and possibly the peanut root-knot nematode. Increased plantings of soybeans may also increase problems with southern root-knot nematodes, reniform nematodes, and Columbia lance nematodes on future cotton crops.

Asian Soybean Rust

Asian soybean rust remains of important concern to soybean producers across Geogria. The extreme freezes in the winter of 2013-2014 will help to delay the start of this disease in the upcoming season

Growers should remember that if timely applications of fungicides to control Asian soybean rust are needed in 2014, these applications will also help to control other diseases as well, e.g. frogeye leaf spot, Cercospora blight, Phomopsis pod and stem blight, and anthracnose.

Bottom-line comments for managing Asian soybean rust in Georgia:

1. Asian soybean rust can (and does) limit yields in some soybean fields in Georgia most years.
2. Asian soybean rust has occurred in every county in the state at some time or another over the past 10 years. Soybean rust is most likely to be found on soybeans and kudzu.
3. Soybean producers are advised to protect their crop with a fungicide IF a) the crop has reached reproductive growth, b) Asian soybean rust has been detected locally or is likely to be found locally, c) environmental conditions are favorable for development and spread of rust, e.g. adequate rainfall or storms, and d) the grower's crop has the potential to make a satisfactory crop.
4. Asian soybean rust is less likely to be a problem in a field with poor growth and plants stunted by drought or other factor than in a field with good growth, heavy foliage, and a closed canopy of foliage.
5. Some growers plan to apply fungicides to their soybean crop automatically as the crop reaches the R3/pod formation growth stage. They reason that since they will already be applying Dimilin and boron during this time period and because the crop is susceptible to rust, it just makes sense to tank-mix the fungicide for good timing and to save a trip across the field later. **This is a good strategy**, especially when other diseases may occur during this time as well. However if soybean rust does not develop until much later, the R3 fungicide application may not have been needed.
6. In some studies, a single, well-timed application of an effective fungicide may be all that is needed to adequately protect a grower's crop from soybean rust. However, depending upon the timing of arrival of the soybean rust pathogen (earlier versus later) and the impact of weather, e.g. tropical storms, it may be necessary (an profitable) to make a second fungicide application 2-4 weeks after the first application.
7. To determine where soybean rust is known to be present in Georgia, growers should consult their county agent (University of Georgia Cooperative Extension) or consult the USDA-CREES website at **www.sbrusa.net**.

Spread of Asian Soybean Rust

Soybean rust is spread from infected plants to non-infected plants by spores. Spores germinate in approximately 6-7 hours with suitable leaf wetness and temperatures between 59 and 86ºF. Pustules form in 5-10 days and new spores are formed in 10-21 days. Spores are spread by wind-blown rain and can be carried great distances in upper air currents.

Resistant Soybean Varieties
Currently, we have no commercial varieties that are resistant to the soybean rust.

Alternative Hosts
Phakopsora pachyrhizi (the fungus that causes Asian soybean rust) infects other plants in addition to soybean. These include kudzu, snap beans, lima beans, cowpeas, and more than 90 other species of legumes (the bean family). In 2008 Asian soybean rust was confirmed on kudzu, Florida beggarweed, and iron clay pea in Georgia . **NOTE: peanut is NOT a host for the Asian soybean rust.** Alternative hosts are important because they allow the disease to survive and spread even in the absence of soybean. Thus, the disease may spread into regions where soybean does not occur and survive when soybean is not planted.

Survival of the Asian Soybean Rust
Survival of the rust pathogen is an important component in determining the threat of soybean rust in the coming season. The soybean rust pathogen does not survive for long without a living host. As most kudzu freezes back in Georgia each winter, it is very unlikely that soybean rust will survive in Georgia or in northern Florida to any appreciable amount during the winter. However, the rust pathogen will survive in central and southern Florida, provided that alternative hosts are present. The disease can then be reintroduced into Georgia as it is spread up the peninsula.

Detection of Asian Soybean Rust
Early detection of symptoms of the soybean rust is an important tool in the management of this disease. The initial symptoms begin on the under surface of the leaves and as gray lesions that change to red or tan. These early symptoms can be quite difficult to detect because they are fairly non-descript; however, it is essential to find the disease as early as possible in order to most effectively treat it. Lesions can spread from the foliage to the petioles, stems, and pods. Spores are produced in the mature lesions on the undersides of the leaves. Once these spores are visible, it is very likely that many other infections also exist which have yet to form lesions.

Lessons from the field: It is very difficult to identify the very early infections of soybean rust in a field and early detection can be likened to “finding a needle in a haystack.” Based upon our efforts since 2004, effective detection of the earliest infections will require patience and use of a dissecting microscope. It is highly doubtful that growers, consultants, or county agents will find the earliest introductions of soybean rust in a field. **Therefore, soybean rust sentinel plots (funded by the Georgia Soybean Commission and the United Soybean Board) will be carefully monitored again in 2015 to provide advanced warning to growers.**

In 2015, growers, consultants, and agents should continue to monitor the soybean crop and kudzu carefully. Suspicious samples should be submitted to the Plant Disease Diagnostic Clinic in Tifton. Any finds of soybean rust in 2015 by researchers at the University of Georgia will be immediately passed along to the County Agents and also reported on the national USDA website at www.sbrusa.net.

Management of Asian Soybean Rust with Fungicides

There are currently a number of fungicides that are labeled for the management of Asian soybean rust. Those fungicides are likely effective in the management of other diseases of soybean as well. Fungicides labeled for the management of Asian soybean rust are presented in Table 1.

Strobilurins versus Triazoles

The most important classes of chemistries that growers will use to manage soybean rust are the strobilurins (azoxystrobin, pyraclostrobin, and trifloxystrobin) and the triazoles (tebuconazole, tetraconazole, flutriafol, flusilazole, metconazole, myclobutanil, propiconazole and cyproconazole). Here are some notes on these fungicides:

1. Strobilurin fungicides, unless tank-mixed with a triazole, are for use as protectants only and must be applied before rust infection occurs.
2. Strobilurin fungicides are reported to remain active in the field longer than triazole fungicides after application (3 weeks versus 2 weeks), though we do not have clear data on this.
3. Triazole fungicides have both protectant and limited curative properties. "Curative properties" refers to their ability to eliminate or reduce some infections that have happened in the very recent past.
4. Propiconazole (i.e. Tilt, PropiMax, and Bumper) is a weaker fungicide against rust than are other triazoles such as tebuconazole (Folicur et al.), myclobutanil (Laredo), tetraconazole (Domark) cyproconazole (Alto), flutriafol (Topguard), metconazole (Caramba) and flusilazole (Punch).

Lessons from the field: Based upon fungicide trials conducted in Georgia since 2005, we have learned the following lessons:

1. Asian soybean rust can be effectively managed with the fungicides currently available to soybean growers in Georgia.
2. Producers who protect their crop with timely applications of fungicides do not need to worry about spores coming to their fields from kudzu or a neighbor's field where fungicides were not applied. In field trials, rows of soybeans that were treated with fungicides remained nearly disease-free for extended periods of time despite devastated, unsprayed, plots next to them.
3. In UGA fungicide trials, chlorothalonil products were less effective than were other fungicides for the control of rust. Although chlorothalonil is labeled for the control of soybean rust, the University of Georgia's Cooperative Extension advises growers that the optimum timing for application of this fungicide to control rust is unclear and to use the product cautiously. Chlorothalonil remains an effective tool against diseases such as frogeye leaf spot.
4. **NOTE: Headline and likely other strobilurin fungicides such as Quadris, Quadris Xtra, Quilt, EVITO, Stratego, etc. produced what we refer to as a "greening" effect. Foliage in plots sprayed with these fungicides remained greener longer than in plots sprayed with other fungicides and took considerably longer to defoliate. This did**

not seem to affect the % moisture of the soybeans at harvest; however the delay in defoliation did make harvest more difficult. Some growers have used harvest-aides such as paraquat to defoliate the crop and hasten harvest. It should also be noted the greening effect seems to be more pronounced where some fungicides (e.g. Headline) have been used and less pronounced (sometimes much less pronounced) where other strobilurin fungicides mentioned above have been applied.

5. Where Folicur 3.6F and other tebuconazole products were applied in our studies, we sometimes observed striking foliar symptoms described as "interveinal chlorosis". This effect was more severe in 2005 than in later years. The foliage on these plants looked like plants that have been affected by nematodes or by sudden death syndrome. NOTE: We did not find any yield reductions associated with these symptoms; tebuconazole provides excellent control of Asian soybean rust.

Application Timing

The timing for application of fungicides to manage soybean rust is **critical**. It is unlikely that growers in Georgia can afford to spray fungicides on soybean without the imminent threat of Asian soybean rust or some other disease such as frogeye leaf spot. However, we have learned that soybean rust can be a very unforgiving disease if fungicide applications are delayed too long once it threatens. Where applications were delayed in our fungicide trials, significant reductions in yields often occurred.

Based on field studies conducted in Georgia, it appears that early reproductive growth (for example early bloom (R1-R2) through early pod (R3) stages) is an important time for rust management. To date, we have never detected rust in plots or fields prior to early bloom and typically began to find rust as the soybean crop reached early pod set and beyond. However, based upon a variety trial in the fall of 2005, **we know that soybean rust can infect soybeans prior to bloom!**

Lessons from the field: Listed below thoughts about the timing of fungicides applications for management of soybean rust.

1. Timing fungicide applications ahead of introduction of Asian soybean rust into a field is critical in the successful management of the disease.

2. From field observations, it appears that early reproductive growth is a critical period in the management of soybean rust. From both seasons, it appears that a well-time fungicide application with an appropriate fungicide during this period is CRITICAL for maximum rust control IF the disease is threatening.

3. **If rust has not been detected in the local region (as assessed with sentinel plots and careful scouting)**, it is recommended that soybean growers delay application of a fungicide for control of soybean rust until the threat from the disease is more imminent, UNLESS the grower is protecting against some other disease, such as frogeye leaf spot, anthracnose, or Phomopsis blight. **If growers want to take a more conservative approach, they may choose to apply their first fungicide at the same time as a Dimilin application timed at the R2-R3 growth stage.**

4. **If rust has been detected in the local area, or is thought to be likely,** growers are advised to initiate fungicide applications once the crop reaches first bloom.

5. **A second fungicide application should be considered within 2-4 weeks after the first application UNLESS the crop has reached harvest maturity or weather has been unfavorable for disease spread.**
6. From field studies, it is clear that the **FIRST** fungicide application is more important than the second. In 2006, a single, well-timed application of our best fungicides was at times as effective as two fungicide applications, and sometimes better than two applications of a lesser effective fungicide. Growers should not miss the opportunity to achieve excellent control of rust by using a less effective product in the first application, if rust threatens.

"Plant Health Benefits" of Fungicides

Many soybean growers in Georgia are aware that at least one fungicide, Headline, is noted not only for its fungicidal qualities, but also for its reported "plant health" benefits. There is no question that applications of Headline on soybeans keep the leaves greener longer and delays natural defoliation. However, it is not clear that this "greening" effect actually improves yields consistently enough, in the absence of disease, to justify the expense. In Georgia we have not seen an increase in yield where Headline was used in the absence of disease. Growers who wish to apply Headline with anticipation of improved yields simply from better "plant health" should do so with caution.

Steps to manage Soybean Rust in 2015

1. Early detection is critical. Agents, consultants, and growers will be trained in the winter of 2012-2013 to recognize early symptoms of the disease. Once a grower or consultant finds a sample that could be Asian soybean rust, they should take it to their local county Extension agent. The agent will send it immediately to Mr. Jason Brock at the Disease Diagnostic Lab at 4604 Research Way, Tifton, GA, 31793. The phone number at the Diagnostic Lab is 229-386-7495.
2. Sentinel crops. Sentinel soybean plots will be planted in April and monitored around the state to provide a means for early detection and warnings of the disease to the growers. Kudzu sentinel plots will also be monitored.
3. Fungicide programs to effectively manage rust will be developed and disseminated through the Cooperative Extension Service to the growers.
4. In using a fungicide program, growers must recognize that improper use of fungicides will increase the risk for the development of fungicide resistance by the pathogen.
5. Fungicides currently labeled for management of foliar diseases of soybean are included below in Table 1.

Table 1. Fungicides labeled for management of foliar diseases of soybean**. NOTE: Always read and follow the official label for use of these fungicides.**

CHEMICAL AND FORMULATION	RATE PER ACRE	REMARKS AND PRECAUTIONS
Quadris 2.08F (azoxystrobin)	6.2-15.4 fl oz/A (to include frog eye leaf spot and soybean rust)	**Note 1**: Prior to the discovery of Aisan soybean rust in Georgia, foliar fungicides were not generally recommended on soybeans in the state. Result s of Georgia research on foliar fungicides have been extremely erratic. Before deciding to apply a fungicide, a grower should consider the current yield potential in the field and the potential for further disease spread. **Note 2:** The presence of the Asian soybean rust in Georgia has greatly affected disease control recommendations. **Note 3:** Asian soybean rust can develop vary rapidly in a field when enough spores are present and environmental conditions are favorable. Once a soybean crop reaches reproductive growth stages, growers should be prepared to treat with fungicides very quickly as soon as the disease is likely to be present in the area. **Note 4:** The key to successful management of Asian soybean rust is use of an effective fungicide in a timely manner before the disease becomes established in a field. **Note 5:** Higher rates of a product provide greater residual activity and may reduce the need for later sprays to manage rust. **Note 6:** Although, "Headline SBR" is no longer available commercially, growers can tank-mix3.1 fl oz tebuconazole with 4.7 fl oz Headline to create a similar product.
Quadris Xtra	4.0-6.8 fl oz for management of soybean rust; 5.0-6.8 fl oz for other foliar diseases.	
Quilt (azoxystrobin + propiconazole)	14-20 fl oz (for management of foliar diseases to include soybean rust.)	
Quadris TOP (azoxystrobin + difenoconazole)	8-14 fl oz/A (for management of foliar diseases to include soybean rust.)	
Alto (cyproconazole)	2.75-5.5 fl oz. For control of Soybean rust use 2.75-4.0 fl oz/A. For other foliar diseases use 4.0- 5.5 fl oz/A.	
Domark 230 ME (tetraconazole)	4.0-5.0 fl oz (for management of foliar disease to include soybean rust.)	
Affiace (azoxystrobin + tetraconzole)	10.0-14.0 fl oz/A (for management of foliar diseases to include rust.)	
Tebuconazole	3.0-4.0 fl oz (for management of foliar disease to include soybean rust.)	
Headline (pyraclostrobin)	6.0-12.0 fl oz (for management of foliar disease to include soybean rust.)	
Priaxor (pyraclostrobin +fluxapyroxad)	4.0-8.0 fl oz/A (for management of foliar diseases to include soybean rust and target spot)	
Propiconazole (Tilt or Bumper)	4.0-6.0 fl oz (for management of soybean rust and other foliar diseases.)	
Stratego (trifloxystrobin + propiconazole)	10.0 fl oz/A (for management of soybean rust and other foliar diseases.)	
Stratego YLD (trifloxystrobin + prothioconazole)	4.0-4.65 fl oz (for management of soybean rust and other foliar diseases.)	
FORTIX (fluoxastrobin + flutriafol)	4.0-6.0 fl oz/A (for management of soybean rust and other diseases of soybean.)	
EVITO (fluoxastrobin)	2.0-5.7 fl oz/A	
EVITO T (fluoxastrobin tebuconazole)	4.0-6.0 fl oz/A	
Topguard (flutriafol)	7.0-14.0 (for management of soybean rust and other foliar diseases).	
Aproach (picoxystrobin)	6.0-12.0 fl oz/A (for management of soybean rust and other foliar diseases.)	
Aproach Prima (picoxystrobin + cyproconazole)	5.0-6.8 fl oz/A (for management of soybean rust and other foliar diseases to include target spot.)	

Table 1. Continued.	
Topsin-M 70WP (thiophanate methyl)	Rate: ½ -1 lb/A (controls frog eye leaf spot and other foliar diseases but NOT soybean rust)
Topsin-M 4.5 FL (thiophanate methyl)	10-20 fl oz/A (controls frog eye leaf spot and other foliar diseases but NOT soybean rust)
Bravo Weather Stik	1-2 ¼ pts/A (for management of foliar disease including suppression of rust)
Echo 720	Rate: 1-2 ¼ pts/A (for management of foliar disease including rust)
Equus 720	1-2 ¼ pts/A (for management of foliar diseases including rust).
Bravo Ultrex	0.9-2.2 lb/A (for management of foliar diseases including rust)
Equus DF	0.9-2.2 lb/A (for management of foliar diseases including rust)
Echo 90DF	0.875-2.0 lb/A ((for management of foliar diseases including rust)

Seedling Diseases and Seed Treatments

Over the years, seedling diseases have reduced soybean yields 0.5 to 1%. *Rhizoctonia* or *Pythium* are usually the pathogens responsible, but *Rhizoctonia* damage is far more common than *Pythium* damage in soybean fields. Non-uniform stands and/or death of plants soon after emergence are the problems caused by these diseases. Typical symptoms are reddish to dark brown lesions at the base of the stem or on the roots.

Seedling diseases are usually associated with poor quality seed and cool, wet soils. Seed rots and seedling diseases are rarely a problem if high quality seed are planted in well drained, warm soils. However, the increased incidence of seed-borne diseases such as anthracnose shows a need for general fungicide treatment of soybean seed. Commercial treatment of seed is the most effective, but on-farm treatment is acceptable. Rotation should be used in combination with seed treatment for control of these diseases.

A good stand is essential to ensure maximum production. See the "Cultural Practices" section of this guide for information about proper soybean stands.

Soybean Seed Treatments

Common Names (Compounds)	Remarks and Precautions
Dynasty (azoxystrobin, Syngenta) Trilex (trifloxystrobin, Bayer CropScience) Captan Thiram Thiabendazole Molybdenum Carboxin PCNB Metalaxyl *Bacillus subtilis*	Use according to label recommendations.

Fusarium Wilt

Symptoms: Fusarium wilt occurs in midseason during hot weather. The disease is rarely found in seedlings and is more common in sandy soils. Initial aboveground symptoms include a general wilting. The disease may progress rapidly with leaves becoming chlorotic (yellow) then withering. Unlike many soybean diseases, Fusarium wilt can kill plants. Fusarium wilt can be identified in the field by cutting into the stem just above the soil line to observe the condition of the vascular tissue: Fusarium wilt causes tan or brown discoloration in the vascular tissue whereas healthy tissue is white. Fusarium wilt is often exacerbated by root-knot nematode or soybean cyst nematode damage though the presence of the nematodes is not necessary for Fusarium wilt to occur. Drought can enhance disease development.

Control: In fields with a history of Fusarium wilt, crop rotation may help reduce disease pressure. If soybean cyst or root-knot nematodes are present, varieties resistant to those nematodes should be grown. Genetic resistance to Fusarium wilt has been documented, but varieties are not routinely screened and Fusarium wilt resistance information is rarely reported. If a variety is reported to have Fusarium wilt resistance, it should be grown in fields with a history of Fusarium wilt.

Stem Canker

Symptoms: Symptoms of stem canker are first evident when the soybean plant is in the early reproductive stage. Symptoms appear as small, reddish brown lesions at the base of a petiole on the lower stem. If conditions favor disease development, these lesions elongate laterally along the stem and may, or may not, girdle the stem. Generally, there is a distinct border between the lesion and healthy stem tissue. Foliar symptoms (similar to red crown rot and/or sudden death syndrome) can appear as the season progresses and are expressed as an interveinal chlorosis (yellowing) which becomes necrotic (brown with dead tissue). This disease can cause premature death of plants which significantly reduces yields.

Control: Use crop rotation, resistant varieties, and destruction (plowing under) of infected crop residue to reduce stem canker incidence and severity. Even in fields where stem canker has never occurred, resistant varieties should be grown. All Georgia recommended varieties have fair to good resistance to stem canker. Do not plant susceptible varieties (refer to the variety table in previous section). Some weeds can serve as hosts for the stem canker fungus, so when incorporating fallow into a rotation, it should be as "weed free" as possible.

Pod and Stem Blight

Symptoms: The fungal pathogen of pod and stem blight remains latent in the plant throughout most of the growing season, and symptoms are usually not evident until near harvest. There may be evidence of small black dots along the stems and pods as plants reach maturity. The dots are pycnidia (a fungal reproductive structure) of *Diaporthe phaseolorum* var. *sojae*, the causal agent of pod and stem blight. These pycnidia are more abundant during periods of wet weather.

Control: Rotate with corn and plow down residues. Plant high quality, treated seed. Plant late or during a time that allows maturation during a dry period. Plant resistant varieties may be available. Do not delay harvesting. Maintain adequate potash to minimize moldy seed.

Anthracnose

Symptoms: The plant is susceptible to the fungus at all growth stages, but initial symptoms usually appear during the early reproductive stages. Symptoms are predominantly on the stems and pods in the form of brown to black blotches. As the disease progresses the lesions (blotches) contain black fruiting structures of the fungus. These structures (acervuli) produce minute spines that are easily seen with a hand lens and are very good diagnostic characteristics of this disease. Foliar symptoms are rare, but occur after prolonged periods of high humidity. They include necrosis (browning) of the laminar veins, leaf rolling, petiole cankering, and premature defoliation.

Control: Use disease-free seed and a fungicidal seed treatment. Plow under infected crop residue and rotate the field to something other than soybean.

Red Crown Rot

Symptoms: Symptoms of red crown rot usually appear during the early reproductive stage. The symptoms are expressed as an interveinal chlorosis in the foliage. Prior to harvest, a close examination of the base of the stem may reveal the presence of brick red perithecia, which are fungal fruiting structures that look like clusters of small, red balls. These structures allow the fungus to survive and spread.

Control: Red crown rot is caused by the same fungal pathogen responsible for Cylindrocladium black rot (CBR) in peanut. Therefore, DO NOT rotate soybean with peanut in fields that have problems with red crown rot. This disease is favored by moderate soil temperatures (70 to 85°F) and wet (field capacity) soil. Disease severity is often greater in heavy soils. Management practices reducing red crown rot are as follows: 1) rotate (3-5 years) with any crop except peanut (peanut is highly susceptible), and 2) delay planting. After working in fields infested with this fungus, remove soil from equipment before moving to another field.

Foliar Diseases other than Asian Soybean Rust

Grower complaints for Frogeye leaf spot and downy mildew are common in some years. Many growers who felt they had a good soybean crop were concerned about losses that could be associated with the foliar diseases and called the Extension Service for recommendations on fungicides for the control of this disease. Our recommendations are as follows:

1. In most situations, control of Frogeye leaf spot with a fungicide will not be economically justified. Growers should focus on using a resistant variety.
2. Currently, it is not economically justified to control downy mildew with fungicides.
3. Growers who want to use a fungicide for managing the disease should use the fungicide on irrigated land and only when they expect exceptional yields, typically 45 bu/A or greater.
4. Fungicide spays should begin when the symptoms first start to appear or in the range of the R3 (1/4 inch pod) to the R5 (1/8 inch seed) growth stages.
5. If a growers waits too long to begin spraying (i.e. the diseases is rampant in the field), the fungicides will not help him.
6. In addition to many of the fungicides that are labeled (Section 3) for the control of Asian soybean rust, Topsin-M (thiophanate methyl) is labeled for control of foliar diseases such as frogeye leaf spot.

Nematodes

Take soil samples prior to harvest (typically August or September) to determine if economically damaging nematodes are present. Nematode populations decline following harvest, so do not delay sampling or you may fail to identify nematode problems. Do not sample overly dry soil and protect samples to keep them from getting too hot or dry. Several species of nematode can damage soybean, but root-knot nematodes and soybean cyst nematode are the most common problems in Georgia. In some parts of Georgia, reniform and Columbia lance nematodes are common and cause significant damage to soybean. Sting nematodes are not common and are limited to very sandy sites, but they can be extremely damaging where they occur.

For some nematode species, damage can be determined by examining soybean roots prior to harvest. Root-knot nematode damage can be identified by the presence of root galls. Root galls differ from nitrogen nodules by the fact that galls are caused by swelling of the root tissue and cannot be removed from the root, but nodules are located on the side of the root and can easily be broken off. If roots are gently washed free of soil, soybean cyst nematodes can be seen as small white specks on the roots (they are much smaller than nodules). As cysts age, they get darker and may appear golden, tan, or brown.

Root-knot nematode is the most commonly occurring nematode problem in soybean in Georgia, and three different species (Southern, Peanut and Javanese root-knot) cause damage here. Many fields in the Coastal Plain region of Georgia are infested with one or more species of these nematodes, and heavy infestations can cause severe damage and, in extreme cases, even plant death. The most common and widespread is the Southern root-knot nematode, which is found in