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Minimizing Diseases of Peanut in the Southeastern United States 2007 Peanut Disease Risk Index

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The Spotted Wilt Index and the Peanut Fungal Disease Risk Index were combined in 2005 to produce the Peanut Disease Risk Index for the southeast peanut region. The Risk Index has been fully reviewed and updated by the authors based upon data and observations made in 2006.

As in the previous versions of the Peanut Disease Index, growers will note the attention to variety selection, planting date, plant population, good crop rotation, tillage, and other factors, that often have a tremendous impact on disease outbreaks in peanut.

Spotted Wilt of Peanut

When tomato spotted wilt virus (TSWV) infects a host plant, it can cause a disease that severely weakens or kills that plant. This particular virus is capable of infecting an unusually large number of plants including several that are important crops in the southeastern United States. In recent years, peanut, tobacco, tomato and pepper have been seriously damaged by TSWV. The only known method of TSWV transmission is via certain species of thrips that have previously acquired the virus by feeding on infected plants. Factors leading to the rapid spread of this disease in the Southeast are very complicated and no single treatment or cultural practice gives consistently effective control. However, research continues to identify factors that influence the severity of TSWV in individual peanut fields.

Peanuts and Fungal Diseases: An Unavoidable Union

Successful peanut production in the Southeast requires that growers use a variety of tactics to minimize losses to disease. Weather patterns in Georgia and neighboring areas during the growing season, including high temperatures, high humidity and the potential for daily rainfall and thunder storms, create the near-perfect environmental conditions for outbreaks of fungal diseases. Damaging fungal diseases include early and late leaf spot, rust, Rhizoctonia limb rot, white mold, and Cylindrocladium black rot (CBR). If peanut growers do not take appropriate measures to manage fungal diseases, yield loss may exceed 50%.

Strategies for managing fungal diseases of peanut are typically depends on multiple fungicide applications during the growing season. Fungicide applications for leaf spot control should be begun about 30 to 40 days after planting, when crop growth and environmental conditions trigger disease development. The length of time in which a fungicide can protect peanuts from infection is dependent on the persistence of the fungicide residues on leaf surfaces and on rainfall patterns. To maintain the protective fungicide barrier on the leaves, applications need to be repeated every 14-days. Many growers begin treating for soilborne diseases approximately 60 days after planting. With attention to proper timing of applications and complete coverage of the peanut canopy, growers can expect good to excellent control of leaf spot and reasonable control of soilborne diseases. Although control of leaf spot may approach 90% with no associated yield loss, only 60-70% control of soilborne diseases with effective fungicide programs is seen.

Weather plays a major role in the potential for disease. Most fungal diseases will be more severe during periods of increased rainfall and of less concern during drier periods. When weather conditions are very favorable for disease, severe epidemics may occur in fields where disease was not thought to be a problem. When weather conditions are unfavorable for fungal growth, disease severity may be low even in fields where it has been common in the past. The AU-Pnuts leaf spot advisory that has been used to effectively manage diseases in peanut is based on this relationship between disease and weather. Even those growers who do not use AU-Pnuts recognize the need to shorten the time between fungicide applications in wet weather.

Factors Affecting the Severity of TSWV on Peanut

Peanut Variety

No peanut variety is immune to TSWV. A few varieties have consistently shown moderate to high levels of resistance to this disease. In addition to resistance, (reduced disease incidence), some varieties appear to have some tolerance (reduced severity in infected plants) as well. In the future, higher levels of resistance and/or tolerance are likely because TSWV is a key objective of all peanut breeding programs.

Peanut varieties can have a major impact on fungal diseases. Currently, ‘Georgia Green’ is planted on the majority of the peanut acreage in the Southeast. However, new varieties from breeding programs at the University of Georgia and the University of Florida not only have improved resistance to spotted wilt, but also to one or more fungal diseases as well. For example, ‘DP-1’ and ‘Georgia-01R’ have among the best leaf spot resistance available in a commercial peanut variety. ‘Georgia-02C’ and ‘Carver’ have superior resistance to Cylindrocladium black rot (CBR) than ‘Georgia Green’. Just as no current varieties are immune to spotted wilt, none are immune to any fungal diseases either. However, improved disease resistance will help reduce yield loss and possibly the need for some costly fungicide inputs. Resistance to one disease does not translate into resistance to all damaging diseases. For example, ‘DP-1’ and ‘Florida C99R’ have greater resistance to leaf spot than Georgia Green but ‘Georgia Green’ has better resistance to Rhizoctonia limb rot.

Planting Date

Thrips populations and peanut reaction to infection by TSWV peak in April. Timing of peanut emergence in relation to rapidly changing thrips populations can make a big difference in TSWV incidence for the remainder of the season. While optimum planting dates for avoiding TSWV vary from year to year, April-planted tend to have higher levels of TSWV than peanuts planted in mid- to late May. It is important for larger acreage peanut farmers to spread their harvest season. Some staggering of planting dates may be necessary, but to avoid

spotted wilt pressure, it may be more effective to plant varieties with different time-to-maturity requirements as closely as possible within a low-risk time period. If peanuts must be planted during a high-risk period, try to minimize the risk by choosing the most TSWV resistant peanut, planting on twin rows when appropriate, and switch from conventional to conservation tillage.

Planting date can affect the severity of fungal diseases. Earlier planted peanuts are likely to be exposed to longer periods of hot weather, favorable for white mold, than those planted in late May, which will mature in early fall. However, the threat from leaf spot is generally higher on peanuts planted later in the season.

Plant Population

An association between skippy stands and higher levels of TSWV was noted soon after the disease began to impact peanut production in Georgia. More recently, research has confirmed that lower plant populations increases TSWV incidence. Low and high plant populations may actually have the same number of infected plants, but the percentage of infected plants is greater in low plant populations. In other words, a higher plant population may not reduce the number of infected plants, but it will increase the number of healthy plants that can fill in and compensate for infected plants. In some cases, low plant populations may result in increased numbers of thrips per plant thereby increasing the probability of infection. When plant populations are as low as two plants per foot, severe losses to TSWV have been observed even when other factors would indicate a low level of risk. Getting a rapid, uniform stand with the desired plant population is a function of not only seeding rate but also seed quality, soil moisture, soil temperature and planting depth.

Plant population has less effect on fungal diseases than spotted wilt. However, the severity of white mold increases when the space between the crowns of individual plants decreases. Apparently the closer crown spacing allows for the faster spread of the white mold fungus, *Sclerotium rolfsii*. The importance of this observation is addressed in the Disease Index under “row spacing” as there is a shorter distance between plants in single rows than in twin rows when the same amount of seed is planted per acre.

Insecticide Usage

In general, the use of insecticides to control the thrips vector has been ineffective is slowing the spread of TSWV. In theory, lowering overall thrips populations with insecticides should effectively reduce in-field spread of TSWV. However, insecticides have failed to suppress early infections, which accounts for most virus transmission in peanut fields. Despite disappointing results with insecticides, phorate (Thimet 20G and Phorate 20G) has demonstrated consistent, low-level suppression of TSWV. The mechanism of phorate’s TSWV suppression is not known, but the level of thrips control obtained with phorate is not better than that obtained with other insecticides. Phorate may induce a defense response in the peanut plant that allows the plant to better resist infection or inhibits virus replication.

Row Pattern

Seven to ten-inch twin row spacing with the same seeding rate per acre as single row spacing, has become increasingly popular. Research on irrigated peanuts has shown a strong tendency for significantly higher yields, a one to two point increase in grade, and reductions in spotted wilt severity that have averaged 25-30%. The reason for this reduction in spotted wilt is not fully understood.

Row pattern, either single or twin row plantings, also has some effect on the potential for fungal diseases. Work done at the Coastal Plain Experiment Station showed that white mold is more severe in single rows (six seed per foot) than in twin rows (three seed per foot). White mold often develops in a field by infecting sequential plants within the same row. Planting the seed in twin rows rather than single rows increases the distance between the crowns of the peanut plants and delays the spread of white mold from plant to plant. The difference in leaf spot between single and twin row peanuts appears to be negligible.

Tillage

The tillage method that a grower utilizes can make a big difference in peanut yields. There are many different methods to choose from, each with its own merits and disadvantages for a given situation. Strip tillage has been shown to have some advantages (including reduced soil erosion and reduced time and labor required for planting), but in some situations, yields have been disappointing. Unbiased tillage research is difficult to accomplish, but studies have consistently shown that peanuts grown in strip till systems have less thrips damage and slightly less spotted wilt. On-farm observations have confirmed these results, but more studies are needed in order to characterize the magnitude of the reduction. We do not suggest that growers should change their tillage method just to reduce spotted wilt, but we have included tillage in the risk index in an attempt to better identify total risks.

Conservation tillage, such as strip tillage, can reduce the amount of disease in peanut. For years spotted wilt has been shown to be less severe in strip-tilled than conventional tilled peanut. In addition, leaf spot diseases are also less severe in strip-tilled than in conventionally tilled peanuts, so long as peanut don't follow peanuts. Although the exact mechanism is currently unknown, the appearance of leaf spot is delayed and severity reduced in strip-tilled peanuts. Use of conservation tillage, however, does not eliminate the need for fungicides to control leaf spot, but helps to insure added disease control from a fungicide program. Additional studies have found that white mold was not increased in strip tillage above conventional tillage when peanut was grown in rotation with cotton. Rhizoctonia limb rot was not evaluated; however cotton is a host for *Rhizoctonia solani* and the cotton debris would likely serve as a bridge between crops. Disease management is only one of many factors that a grower must consider when choosing to practice either conventional or conservation tillage. However, if a grower decides to practice conservation tillage with peanut production, he can expect lower levels of leaf spot in many instances.

Classic® Herbicide

Research and field observations over the past several years have confirmed that the use of Classic® (chlorimuron) may increase the expression of spotted wilt symptoms in peanut. However, the effects of Classic® on spotted wilt cannot be consistently linked to a specific application timing. Consequently, the impacts of Classic® use on the TSWV risk index are less predictable in comparison to other management factors. Additionally, the increases in spotted wilt associated with Classic® applications have not always resulted in significant peanut yield losses.

If Florida beggarweed escapes early-season control strategies, the use of Classic® remains the only alternative for the late-season management of this weed. To date, other peanut herbicides have not been shown to have an influence on spotted wilt.

Crop Rotation

Crop rotation is one of the most important strategies for minimizing disease severity in peanuts. Increasing the number of years between successive peanut crops in the same field will reduce disease levels and increase yield. Causal fungi of leaf spot diseases, Rhizoctonia limb rot, and white mold survive between peanut crops on debris, as survival structures in the soil, and on volunteer peanuts. The more years between peanut crops, the more likely that disease causing fungal pathogens die out. Peanuts in well rotated fields suffer less damage leaf spot diseases, Rhizoctonia limb rot, white mold, and perhaps CBR, than fields in shorter rotations, or continuous peanut production. In Georgia, the Cooperative Extension Service recommends at least two years between peanut crops to help manage diseases as well as root knot nematode.

Choice of rotation crops, along with the length of the rotation, will have an impact on the potential for damaging disease outbreaks in a particular field. Rotation of peanut with ANY other crop will reduce the potential for early leaf spot and late leaf spot. The pathogens that cause these diseases do not attack any

other crops other than peanut. Rotation of peanuts with cotton, or a grass crop such as corn, sorghum, or bahiagrass, will reduce the potential for white mold because these crops are not good hosts for the causal fungus. Rotation of peanut with a grass crop will reduce the risk of Rhizoctonia limb rot. However, because cotton is also infected by *Rhizoctonia solani*, rotation with this crop may not help suppress Rhizoctonia limb rot. Other crops, such as tobacco and many vegetables are quite susceptible to diseases caused by *Rhizoctonia solani* and possibly the white mold fungus *Sclerotium rolfsii*.

Field History

The disease history on previous peanut crops can be an important hint at the possibility of disease in the future. Fields where growers have had difficulty managing diseases in the past, despite the implementation of a good fungicide program, are more likely to have disease problems in the future than are fields with a history of few damaging disease outbreaks.

There are some differences between white mold and Rhizoctonia limb rot with regards to field history. Fields where peanuts were previously damaged by white mold probably will see destructive outbreaks in the future. Without effective crop rotation, outbreaks of white mold can be expected to become increasingly severe each season. Rhizoctonia limb rot is a disease that is more sensitive to environmental conditions, especially rainfall and irrigation, than white mold. Therefore, the severity of Rhizoctonia limb rot is likely to be more variable than white mold from year to year based upon the abundance of moisture during the season.

Irrigation

Irrigation is a critical component of a production system and can sharply increase peanut yields. However, the water applied to a crop with irrigation may also increase the risk of damaging outbreaks of leaf spot, rust, Rhizoctonia limb rot, and white mold. While Rhizoctonia limb rot is likely to be more severe in irrigated fields with heavy vine growth, the impact on white mold development may be less obvious. High soil temperatures as well as high soil moisture levels are usually needed to trigger damaging white mold outbreaks in peanut.

Fungi causing leaf spot diseases need water for several important reasons, including growth, spore germination and infection of the peanut plant, and in some cases, spread of the fungal spores. Use of irrigation may extend the period of leaf wetness and the time of conditions favorable for leaf spot diseases beyond favorable conditions in a non-irrigated field. In two otherwise similar fields, the potential for disease is greater in the irrigated field.

Measuring TSWV Risk

Many factors combine to influence the risk of TSWV-related yield loss in peanut. Some factors are more important than others, but none will give complete control of TSWV. However, research data and on-farm observations indicate that when several factors are considered, the risk of damaging TSWV outbreaks in a given field can be estimated. There is no way to predict with total accuracy how much TSWV will occur in a given situation or how the disease will affect yield, but by identifying high risk factors, growers can avoid those production practices that favor big yield losses. The University of Georgia Tomato Spotted Wilt Risk Index for Peanuts was developed as a tool for evaluation of risk associated with individual peanut production situations. When high-risk factors are identified, growers should modify to their production plan (i.e. variety, planting date, seeding rate, etc.) to reduce TSWV risk. Preventative measures must be implemented before planting. After the crop is planted, there are no known controls for TSWV.

The index combines what is known about individual risk factors into a comprehensive, but simple, estimate of TSWV risk for a given field. It assigns a relative importance to each factor so that an overall level of risk can be estimated. In research plots where this index was validated, as little as 5% of the total row feet were severely affected by TSWV compared to over 60% in high-risk situations. Yield differences were over 2000 lbs. per acre in some cases. Results of these and other validation studies have been used to make modifications in all subsequent versions of the index. Future changes are expected as we learn more about TSWV.

Keep in mind that the risk levels assigned by this index are relative. In other words, if this index predicts a low level of risk, we would expect that field to be less likely to suffer major losses due to TSWV than a field that is rated with a higher level of risk. A low index value does not imply that a field is immune from TSWV losses. Losses due to TSWV vary from year to year. In a year where incidence is high statewide, even fields with a low risk level may experience significant losses.

Measuring Risk to Fungal Diseases of Peanut

The index presented here is based upon better understanding of factors that affect disease incidence and severity. It is designed to help growers approximate the magnitude of the risk that they face from foliar and soil-borne diseases in the coming season. More importantly, it should serve as an educational tool that allows the grower to predict the benefits of different management practices he makes in hopes of producing a better crop.

The risks associated with leaf spot, white mold and Rhizoctonia limb rot diseases are to be determined independently in the index system to be presented here. The magnitude of points associated with each variable is not linked between soil-borne and foliar disease categories. However, the points allotted to each variable in the Peanut Disease Risk Index are weighted within a disease category according to the importance of the variable (such as variety or field history) to another variable (such as planting date). For example, within the category for leaf spot diseases, a maximum of 35 points is allotted to the variable “variety” while 0 points is allotted to the variable “row pattern”. The magnitude of points assigned within each category and to each variable has been checked to insure that the total number of points assigned to a field is consistent with research and experience. For example, while it would be possible for a non-irrigated field planted to ‘Georgia Green’ to fall in the lowest risk category, a field of irrigated ‘Georgia Green’ could be in a category of “medium risk” but not “low risk”.

NOTE: When weather conditions are favorable for fungal diseases, especially when rainfall is abundant, even fields at initial “low risk” to fungal diseases may become “high risk”.

The Peanut Disease Risk Index

For each of the following factors that can influence the incidence of tomato spotted wilt or fungal diseases, identify which option best describes the situation for an individual peanut field. An option must be selected for each risk factor unless the information is reported as “unknown”. A score of “0” for any variable does not imply “no risk”, but that this practice does not increase the risk of disease as compared to the alternative. Add the index numbers associated with each choice to obtain an overall risk index value.

Compare that number to the risk scale provided and identify the projected level of risk.

Peanut Variety

Variety[1]	Spotted Wilt Points	Leaf Spot Points	Soilborne Disease Points	
			White mold	Limb rot
NC-V11	35	30	25	25
NC12C	35	unknown	unknown	unknown
Georgia Green	30	20	20	15
Virugard	30	20	20	unknown
Gregory	30	30	20	25
AT3081R	25	--	--	--
ANorden[2]	25	20	20	20
Andru II[2]	25	30	20	25
AT3085A	20	--	--	--
Attaboy	20	15	15	--
Florida C-99R[4]	20	15	15	25
McCloud	20	--	--	--
Carver[3]	20	30	20	25
GA03L[5]	15	15	10	20
GA02C[2,3,5]	15	20	10	20
GA05E	15	20	25	--
GA01R[3]	10	10	15	15
DP-1[4]	10	5	10	25
AP-3[4]	10	25	10	25
Florida 07	10	20	15	--
Tifrunner	10	15	25	25
York	10	10	10	--
Georganic	5	10	10	--

[1]Adequate research data is not available for all varieties with regards to all diseases. Additional varieties will be included as data to support the assignment of an index value are available.

[2]High oleic variety.

[3]Varieties Carver, GA-02C, and GA-01R have some resistance to Cylindrocladium black rot (CBR) compared with other varieties.

[4]Varieties AP3, DP-1, and C-99R are less resistant to CBR and are not recommended for fields where this disease is a problem.

[5]The malady referred to as “funky” or “irregular” leaf spot tends to be more severe in GA02C and GA03L than in other varieties. Although this condition can look like early leaf spot (*Cercospora arachidicola*), the cause “funky” leaf spot is unknown. Disease losses are not typically associated with funky leaf spot.

Planting Date

Planting Date	Spotted Wilt Points[1]	Leaf Spot Points	Soilborne Disease Points	
			White mold[2]	Limb rot[2]
Before May 1	30	0	5	0
May 1 to May 10	15	0	5	0
May 11 to May 31	5	5	0	0
June 1 to June 10	10	10	0	5
After June 10	15	10	0	5

[1]In those years when the normal date of planting for the first peanuts in your area is delayed due to inclement weather, these date ranges should be moved later by an equal amount. In most years, these date ranges will also vary slightly with latitude. Dates can be shifted five days earlier in the extreme southern counties and 5 days later in the extreme northern counties.
[2]Earlier planted peanuts will have a small increased risk for white mold. Later planted peanuts may have greater limb rot at the end of the season because soils will be cooler later in the year.

Plant Population (final stand, not seeding rate)

Plant stand:	Spotted Wilt Points[1]	Leaf Spot Points	Soilborne Disease Points	
			White mold[2]	Limb rot
Less than 3 plants per foot	25	None	None	None
3 to 4 plants per foot	15	None	None	None
More than 4 plants per foot	5	None	None	None

[1]Only plant when soil conditions favor rapid, uniform emergence. Less than optimum conditions at planting can result in poor stands or delayed, staggered emergence, both of which can contribute to increased spotted wilt. Note: a twin row is considered to be one row for purposes of determining number of plants per foot of row.
[2]Although no rating is given for the risk of white mold with plant population, it is known that closer planted peanuts tend to have an increased risk of this disease. This observation is evaluated in the category of "row spacing".

At-Plant Insecticide

AP-Insecticide	Spotted Wilt Points*	Leaf Spot Points	Soilborne Disease Points	
			White mold	Limb rot
None	15	None	None	None
Temik 15G	15	None	None	None
Thimet 20G, Phorate 20G	5	None	None	None

*An insecticide's influence on the incidence of TSWV is only one factor among many to consider when making an insecticide selection. In a given field, nematode problems may overshadow spotted wilt concerns and decisions should be made accordingly.

Row Pattern

Peanuts are planted in:	Spotted Wilt Points	Leaf Spot Points	Soilborne Disease Points	
			White mold	Limb rot
Single rows	15	0	5	0
Twin rows	5	0	0	0

Tillage

Tillage System	Spotted Wilt Points	Leaf Spot Points	Soilborne Disease Points	
			White mold	Limb rot
conventional	15	10	0	0
reduced*	5	0	0	5

*For fungal diseases, this is does not apply for reduced tillage situations where peanut is following directly behind peanut in a rotation sequence. Limb rot can exist on some types of crop debris and use the organic matter as a bridge to the next peanut crop.
**"Funky" or "irregular" leaf spot tends to be more severe in conservation tillage than in conventional tillage, though this malady is not typically associated with yield losses.

Classic ® Herbicide

Use	Spotted Wilt Points	Leaf Spot Points	Soilborne Disease Points	
			White mold	Limb rot
Classic Applied	5	None	None	None
No Classic Applied	0	None	None	None

Rotation with a Non-Legume Crop.

Years Between Peanut Crops*	Spotted Wilt Points	Leaf Spot Points	Soilborne Disease Points	
			White mold	Limb rot
0	None	25	25	20
1	None	15	20	15
2	None	10	10	10
3 or more	None	5	5	5

*All crops other than peanut are acceptable in a rotation to reduce leaf spot. Cotton and grass crops will reduce the severity of white mold. Rhizoctonia limb rot can still be a significant problem, especially with cotton, under a longer rotation with favorable conditions, e.g. heavy vine growth & irrigation/ rainfall. Rotation with grass crops will decrease the potential risk of limb rot; tobacco and vegetables will not.

Field History

Previous disease problems in the field?*	Spotted Wilt Points	Leaf Spot Points	Soilborne Disease Points	
			White mold	Limb rot
NO	NA	0	0	0
YES	NA	10	15	10

* "YES" would be appropriate in fields where leaf spot and/or soilborne diseases were a problem in the field despite use of a good fungicide program.

Irrigation

Irrigation	Spotted Wilt Points	Leaf Spot Points	Soilborne Disease Points	
			White mold	Limb rot
NO	None	0	0	0
YES	None	10	5*	10

* Irrigation has a greater affect on Rhizoctonia limb rot than on southern stem rot (white mold) or Cylindrocladium black rot.

Calculate Your Risk

Add your index values from:

Factor	Spotted Wilt Points	Leaf Spot Points	White Mold Points	Limb Rot Points
Peanut Variety				
Planting Date				
Plant Population		----	----	----
At-Plant Insecticide		----	----	----
Row Pattern				
Tillage				
Classic ® Herbicide		----	----	----
Crop Rotation	----			
Field History	----			
Irrigation	----			
Your Total Index Value				

Interpreting Your Risk Total
Point total range for tomato spotted wilt = 35-155.
Point total range for leaf spot = 10-100.
Point total range for white mold = 10-85.
Point total range for Rhizoctonia limb rot = 15-75.

Risk Assessment

Risk	Spotted Wilt Points	Leaf Spot Points	Soilborne Disease Points	
			White Mold	Limb Rot
High Risk	115 or more	65-100	55-80	45-75
High Risk for fungal diseases: Growers should always use full fungicide input program in a high-risk situation.				
Medium Risk	70-110	40-60	30-50	30-40
Medium Risk for fungal diseases: Growers can expect better performance from standard fungicide programs. Reduced fungicide programs in research studies have been successfully implemented when conditions are not favorable for disease spread.				
Low Risk	Less than 65	10-35	10-25	15-25
Low Risk for fungal diseases: These fields are likely to have the least impact from fungal disease. Growers have made the management decisions which offer maximum benefit in reducing the potential for severe disease; these fields are strong candidates for modified disease management programs that require a reduced number of fungicide applications.				