EVALUATION ON METHODS TO IMPROVE CONTROL OF SCLEROTINIA BLIGHT IN PEANUT

Jason Woodward, Extension Plant Pathologist and Assistant Professor
Texas AgriLife Extension Service, Texas A&M System - Lubbock
Department of Plant & Soil Science, Texas Tech University - Lubbock

Todd Baughman, Agronomist
Texas AgriLife Extension Service - Vernon

Terry Wheeler, Research Plant Pathologist
Texas AgriLife Research - Lubbock

Scott Russell, Extension Agent - IPM
Texas AgriLife Extension Service - Brownfield

Introduction

Sclerotinia blight, caused by the soilborne fungus *Sclerotinia minor* Jagger, is a serious threat to peanut production in portions of Gaines and Collingsworth counties. Several factors contribute to the difficulty of managing the disease. While the biology of *S. minor* has been intensely studied, the development of Sclerotinia blight in West Texas is poorly understood. Over the past three growing seasons, the onset Sclerotinia epidemics have begun by the second week of July, resulting in as many as four fungicide applications being made. Preventative applications have been found to provide superior levels of control compared to curative applications indicating the importance of proper fungicide timing. Several advisory models, which utilize environmental conditions, have been developed to aid in properly timing fungicide applications in Oklahoma and the Virginia/Carolina region; however, these models have yet to be evaluated under West Texas conditions. An additional problem facing producers is the cost of fungicides labeled for control of Sclerotinia blight, thus more cost effective application methods need to be investigated. The objectives of this research were to i) evaluate forecasting models to predict the onset of Sclerotinia blight epidemics to aid in making timely fungicide applications, and ii) compare broadcast and banded applications of fungicides applied during the day or at night.

Sclerotinia forecasting trials: Three field trials were conducted in western Gaines County to evaluate forecasting models for control of Sclerotinia blight. The field chosen for these trials had a history of Sclerotinia related losses. Trials were planted to either Flavorrunner 458, Tamrun OL02 (susceptible cultivars), or Tamrun OL07 (a partially resistant cultivar). All trials were planted 20-Apr. Plots were 2-rows wide by 40 feet in length and planted on a 36-in row spacing. Environmental factors monitored for forecasting models included: soil temperature at a depth of 4 inches, rainfall or irrigation, and relative humidity within the canopy. Host plant growth factors including vine growth and canopy density were also monitored. Specific treatments were derived by weighing values on the aforementioned factors as they relate to Sclerotinia blight development. If the value of the factor had little impact on disease development, it was assigned a value of zero. The greater the factor's impact the higher the value assigned. These values were multiplied to provide a daily risk index and this value was summed over five days to calculate a "Five Day Risk Index" (FDI). The FDI was utilized as a trigger

(threshold) to initiate a fungicide spray application. Eight treatments were evaluated for the management of Sclerotinia blight of peanut. These treatments utilized several FDI values, calendar and curative treatments. When a fungicide application was made, the risk index was reset to zero until the 28th day following application at which time the summation began anew. Treatments were arranged in a randomized complete block design with four replications. Dates for specific fungicide applications are listed in Table 1. Final disease assessments were made prior to harvest. Plots were dug on 29-Oct and thrashed 6-Oct.

Despite the previous history of disease in this field and adjacent fields no appreciable levels of Sclerotinia blight were observed (Table 2). When averaged across all fungicide treatments, pod yields were 5635, 5524, 5782 for Flavorrunner 458, Tamrun OL02, and Tamrun OL07, respectively. Although statistical comparisons could not be made, field observations indicate that differences in pod rot incidence may exist between cultivars. Mean pod rot incidence was 8.1, 1.5, and 1.3% for the respective cultivars. Additional work is needed to better identify the environmental factors required for initial *S. minor* infections.

Preventative vs. curative fungicide applications: Additional trials were conducted at the Western Gaines County location to evaluate the performance of the fungicides Omega and Endura in preventative and curative spray programs when applied to Flavorrunner 458, Tamrun OL02, or Tamrun OL07. Treatments consisted of an untreated control, Omega at 1.0 pt/A, Omega at 1.5 pt/A, or Endura at 10 oz/A preventatively, as well as Omega at 1.5 pt/A, and Endura at 10 oz/A curatively. Treatments were arranged in a randomized complete block design with 4 replications. Initial preventative applications were made 6-Jul with a subsequent application made 10-Aug. Initial curative applications were made after the observation of disease symptoms (24-Jul), followed by a second application 29-Aug. All fungicide applications were made using a CO_2 pressurized backpack sprayer.

Results similar to those obtained in the Sclerotinia forecasting trials were observed in these trials. The lack of Sclerotinia blight developing impeded our ability to compare fungicide treatments. Pod yield in these studies were similar for the three cultivars ranging from 5392 to 5445 lb/A (Table 3). Again differences in pod rot were observed with Flavorruner 458 having higher levels of pod rot than Tamrun OL02 or Tamrun OL07, 13.8, 2.5, and 1.5%, respectively. Additional observations on the response of peanut cultivars to pod rot are desperately needed. While, application timing is critical for optimal management of Sclerotinia blight, previous studies have shown that routine scouting, and timely applications (generally the first week in July) can effectively minimize losses associated with this disease.

Application timing and method trials: Prior studies conducted in Georgia have shown that the folding of peanut leaflets during the night allows for improved penetration of fungicides into the lower canopy, thus, improving control of Southern blight. Furthermore, banding fungicides over the crown are believed to direct more fungicides over the crown of the plant, where initial *S. minor* infections occur. To address this, three field trials (utilizing Flavorrunner 458, Tamrun OL02, and Tamrun OL07) were conducted at the Texas AgriLife research and Extension Center located in Stephenville in a field naturally infested with *S. minor*. Plots were 2-rows wide by 25 feet in length on a 36-in row spacing. Treatments, consisting of banded and broadcast applications of Omega and Endura, were arranged in a randomized complete block design with three replications. The trial was planted on 2-Jun and fungicide applications were made on 18-

Aug and 24-Sept. Banded applications used a total volume of 10 gallons per acre; broadcast applications used 22 gallons per acre. A full description of the treatments evaluated is presented in Table 4. Final disease assessments were made prior to digging. Plots were thrashed 17-Nov.

Overall, the applications of Omega or Endura reduced the incidence of Sclerotinia blight compared to the non-treated controls (Table 4). As in other trials, disease incidence was lower for Tamrun OL07 (23.8%) compared to Flavorrunner 458 (43.5%) and Tamrun OL02 (42.8%). When comparing like application timings and/or methods yields were higher for Endura treated plots than Omega. The use of Omega at either 1.0 or 1.5 pt/A did not improve yields over the non-treated controls, nor did banding Omega (1.5 pt/A) during the daytime. Yields were similar when comparing applications made during the day vs. night. Additional studies evaluating aspects of these approaches are needed.

Cultivar x fungicide efficacy trials: A field trial was conducted to evaluate the response of the cultivars Flavorrunner 458, Tamrun OL02, and Tamrun OL07 to calendar applications of Omega, Endura, and two rates of an experimental fungicide (LEM). Plots were arranged in a randomized complete block design with four replications. Fungicides were applied on 14-Aug and 18-Sept. using a CO_2 pressurized backpack sprayer described above. Sclerotinia blight ratings were made prior to harvest. Plots were dug and harvested as described previously.

All fungicides effectively reduced Sclerotinia blight incidence compared to the non-treated control (Table 5). Yields were increased by729 to 949 lb/A for all except at LEM at 1.0 pt/A, which did not differ from the non-treated control. When averaged across fungicide treatments, yields were highest for Tamrun OL07 (2906 lb/A) followed by Flavorrunner 458 (2254 lb/A) and Tamrun OL02 (2233 lb/A).

Genotype x fungicide efficacy trials: An additional field trial was conducted to evaluate the response of the advanced breeding lines TX-55305, TX-55306, TX-55307, and TX-55308 and cultivars Flavorrunner 458 and Tamrun OL07 to calendar applications of the fungicide Omega. The experimental design was a split-plot, where fungicide treatment (Omega vs. non-treated control) served as whole-plots, and genotypes served as sub-plots. There were a total of four replications in this trial. Omega was applied on 14-Aug and 18-Sept. Applications, ratings and harvest coincided with dates mentioned previously.

The application of Omega (1.5 pt/A) lead to a significant reduction in disease incidence compared to the non-treated control (Table 6). This in turn resulted in a yield increase of approximately 1800 lb/A. Significant differences were also observed between the cultivars evaluated. Yields were lowest for Flavorunner 458 at 2435 lb/A. A yield increase of 608 lb/A was observed for Tamrun OL07. Yields for all breeding lines were equal to or greater than that of Tamrun OL07, with TX-55308 yielding 4475 lb/A. The yield increases of advanced breeding lines over Tamrun OL07 are encouraging from the aspect of future disease management options. Additional studies are slated for 2010 to further evaluate the response of these and other breeding line to fungicide inputs.

Experimental fungicide trial: A final study was conducted to evaluate the performance of experimental fungicides. LEM (1.0 and 1.0 pt/A) and two other experimental fungicides were compared to Omega (1.5 pt/A) and a non-treated control. These plots were established in a field

planted to Flavorrunner 458. Plots were 2-rows wide by 25 feet in length on a 36-in row spacing. Treatments were arranged in a randomized complete block design with five replications. All other aspects of the trial were handled as previously described.

Sclerotinia blight incidence was greatest in the non-treated control, and the application of fungicides lead to significantly lower levels of disease (Table 7). Disease incidence was lowest for Omega at 15.5%. Disease incidence ratings for the other experimental fungicides were intermediate. While yields were generally higher than the non-treated control, no significant differences were observed. Additional studies evaluating these products are needed to see how they compare to commercially available products such as Omega.

Summary and Conclusions

Sclerotinia blight is a destructive disease of peanut with limited management options. Currently management strategies consist of using partially resistant cultivars and multiple applications of fungicides. Results from these studies indicate that Tamrun OL07 consistently out performs the commercial standard Flavorrunner 458. Initial results indicate that advanced breeding lines perform as well, or better than Flavorrunner 458. The use of the fungicides Omega and Endura have lead to substantial yield increases over the past several years. There are several experimental fungicides with potential activity towards Sclerotinia blight; however, regional efficacy data is limited. Various aspects of Sclerotinia blight management will remain the focus of future research.

Table 1. Dates of fungicide applications and model reset for the Sclerotinia forecasting model trials (Gaines County)

Treatment	1st application	Reset date	2nd application
Non-treated control	n/a†	n/a†	n/a†
Calendar	6-Jul	3-Aug	7-Aug
Curative	24-Jul	21-Aug	20-Aug
FDI=16	22-Jul	19-Aug	20-Aug
FDI=24	22-Jul	19-Aug	20-Aug
FDI=32	24-Jul	21-Aug	22-Aug
FDI=40	1-Aug	29-Aug	22-Aug
FDI=48	3-Aug	31-Aug	22-Aug

† n/a = not applicable.

Table 2. Effect of calendar, curative, and forecasted fungicide applications on Sclerotinia blight, pod yield, and grades in three trials (Gaines County)

Trial, treatment	Sclerotinia blight (%)	Pod yield (lb/A)	Pod rot (%)
Flavorunner 458			
Non-treated control	0	5646	9.3
Calendar	0	5550	7.0
Curative	0	5437	8.3
FDI=16	0	5776	7.5
FDI=24	0	5518	8.0
FDI=32	0	5695	8.5
FDI=40	0	5872	7.5
FDI=48	0	5582	8.5
LSD ($P \leq 0.05$)	-----	ns†	ns†
Cultivar mean‡	-----	**5635**	**8.1**
Tamrun OL02			
Non-treated control	0	5576	1.5
Calendar	0	5227	1.8
Curative	0	5614	1.8
FDI=16	0	5760	2.8
FDI=24	0	5746	0.8
FDI=32	0	5695	0.5
FDI=40	0	5501	1.5
FDI=48	0	4872	1.3
LSD ($P \leq 0.05$)	-----	ns†	ns†
Cultivar mean‡	-----	**5524**	**1.5**
Tamrun OL07			
Non-treated control	0	5760	0.0
Calendar	0	6066	2.8
Curative	0	5824	3.0
FDI=16	0	6163	1.3
FDI=24	0	5259	0.0
FDI=32	0	5727	1.3
FDI=40	0	5598	0.8
FDI=48	0	5865	1.5
LSD ($P \leq 0.05$)	-----	ns†	ns†
Cultivar mean‡	-----	**5782**	**1.3**

† ns = not significantly different.

‡ Statistical analysis could not be conducted because of how these studies were conducted. Means within the row are merely for observational.

Table 3. Effect of preventative (Prev.) and curative (Cur.) Sclerotinia blight fungicide programs on pod rot and pod yields (Gaines County)

Treatment, rate and timing	Pod rot (%)[a]			Pod yield (lb/A)		
	FR 458	TR OL02	TR OL07	FR 458	TR OL02	TR OL07
Non-treated control	10.3 a	3.8 a	0.0 a	5248 a	5337 a	5518 a
Omega (1.0 pt/A Prev.)	17.0 a	1.5 a	1.5 a	5518 a	5595 a	5635 a
Omega (1.5 pt/A Prev.)	12.3 a	1.5 a	1.0 a	5401 a	5619 a	5235 a
Endura (10 oz/A Prev.)	21.0 a	2.0 a	0.8 a	5639 a	5119 a	5227 a
Omega (1.5 pt/A Cur.)	9.0 a	1.0 a	1.0 a	5340 a	5902 a	5316 a
Endura (10 oz/A Cur.)	13.3 a	2.5 a	1.5 a	5345 a	5095 a	5421 a
LSD (P≤0.05)	ns†	ns†	ns†	ns†	ns†	ns†
Mean‡	**13.8**	**2.5**	**1.5**	**5415**	**5445**	**5392**

† ns = not significantly different.

‡ Statistical analysis could not be conducted because of how these studies were conducted. Means within the row are merely for observational.

Table 4. Effect of broadcast and banded applications of the fungicides Omega and Endura applied during the day or night on Sclerotinia blight development, pod yields, and grade (Stephenville)

Application timing, fungicide (rate)	Application method	Sclerotinia blight (%)	Pod yield (lb/A)
Day			
Endura (10 oz/A)	Broadcast	23.5 ef	3273 a
Endura (10 oz/A)	Banded	30.8 def	2481 bcd
Omega (1.5 pt/A)	Broadcast	35.8 cd	2505 bc
Omega (1.5 pt/A)	Banded	44.0 bc	1983 cde
Night			
Endura (10 oz/A)	Broadcast	19.8 f	2805 ab
Endura (10 oz/A)	Banded	21.8 ef	2757 ab
Omega (1.5 pt/A)	Broadcast	32.5 de	2637 b
Omega (1.5 pt/A)	Banded	41.5 bcd	2295 bcd
Omega (1.0 pt/A)	Broadcast	44.5 bc	1989 cde
Omega (1.0 pt/A)	Banded	48.3 b	1959 de
Non-treated control	- - - -	61.8 a	1515 e
LSD (P≤0.05)		11.3	525
Cultivar effects			
Flavorruner 458		43.5 a	2178.0b
Tamrun OL02		42.8 a	2189.3b
Tamrun OL07		23.8 b	2910.0a
LSD (P≤0.05)		5.8	276.7

† Percent of row feet exhibiting signs or symptoms of *S. minor*. ‡ Means within a column followed by the same letter are not significantly different according to Fisher's protected LSD.

Table 5. Effect of fungicides and peanut cultivars on final Sclerotinia blight incidence and pod yield (Stephenville)

Treatment (rate/A)	Sclerotinia blight incidence (%)†	Pod yield (lb/A)
Non-treated control	52.3 a‡	1882 c‡
Endura (10 oz)	32.5 b	2831 a
Omega (1.5 pt)	26.3 b	2611 ab
LEM (1.0 pt)	25.6 b	2299 bc
Exp (1.5 pt)	32.1 b	2698 ab
LSD (*P*≤0.05)	9.4	531
Cultivar		
FR 458	34.0 a‡	2254 b‡
TR OL02	43.3 a	2233 b
TR OL07	24.0 b	2906 a
LSD (*P*≤0.05)	8.3	488

† Percent of row feet exhibiting signs or symptoms of *S. minor*. ‡ Means within a column followed by the same letter are not significantly different according to Fisher's protected LSD.

Table 6. Effect of fungicides and peanut genotype (cultivars and advanced breeding lines) on final Sclerotinia blight incidence and pod yield (Stephenville)

Treatment (rate/A)	Sclerotinia blight incidence (%)†	Pod yield (lb/A)
Non-treated control	58.6 a	2852 b
Omega (1.5 pt)	21.3 b	4053 a
LSD (*P*≤0.05)	14.6	623
Genotype		
FR 458	38.6 a	2435 c
TR OL07	24.8 bc	3043 bc
TX-55305	26.8 b	3311 b
TX-55306	25.4 bc	3530 b
TX-55307	20.3 bc	3677 b
TX-55308	15.3 c	4475 a
LSD (*P*≤0.05)	11.3	636

† Percent of row feet exhibiting signs or symptoms of *S. minor*. ‡ Means within a column followed by the same letter are not significantly different according to Fisher's protected LSD.

Table 7. Effect of experimental fungicides on final Sclerotinia blight incidence and pod yield (Stephenville)

Treatment (rate/A)	Sclerotinia blight incidence (%)†	Pod yield (lb/A)
LEM (1.0 pt)	32.0 b	2454 a
LEM (1.5 pt)	26.0 bc	2287 a
EXP I (1.14 pt)	27.0 bc	2490 a
EXP II (1.5 pt)	22.0 cd	2723 a
Omega (1.5 pt)	15.5 d	2403 a
Non-treated control	39.5 a	2229 a
LSD (P≤0.05)	10.1	ns

† Percent of row feet exhibiting signs or symptoms of *S. minor*. ‡ Means within a column followed by the same letter are not significantly different according to Fisher's protected LSD.