Southern Blight and Leafspot Control in Peanut Using Selected Fungicides

B. A. Besler*
W. James Grichar
A. J. Jaks
Texas Agricultural Experiment Station, Texas A&M University System, P.O. Box 755, Yoakum, TX 77995

ABSTRACT

New fungicides, evaluated from 1989 to 1992, compared favorably with standard treatments of pentachloronitrobenzene (PCNB) and chlorothalonil (Bravo) in controlling southern blight and leafspot. Tebuconazole (Folicur) significantly increased yields 13% to 77% and reduced leafspot infection 43% to 85% over the untreated check in a 3-year period. Southern blight control was obtained using tebuconazole, propiconazole (Tilt), flutolanil (Moncut) and fluazinam at both the Lavaca and Frio County test sites when applied foliar, banded or broadcasted. In 1992, flutolanil applied at flowering and mid-peg reduced disease incidence by 83% over the untreated check. In 1991, flutolanil and tebuconazole treatments significantly increased yields over the untreated check. In 1992, only tebuconazole applied 6 oz acre^{-1} significantly increased yield when compared to untreated check. However, most treatments numerically yielded better than the untreated check all four years.

KEY WORDS: disease incidence, *Sclerotium rolfsii*, early leafspot

Foliar diseases such as early leafspot (*Cercospora arachidicola* Hori), late leafspot [*Cercosporidium personatum* (Berk and Curt)] and soilborne diseases such as southern blight (*Sclerotium rolfsii* Sacc.) continue to be the most destructive peanut diseases facing producers today (Ashworth et al., 1961; Bridges et al., 1994). Cultural methods such as non-dirting cultivation, deep plowing and crop rotation can partially suppress southern blight (Boyle, 1956; and Garren, 1959). Although chlorothalonil has shown to be effective on leafspot when applied biweekly, it has no effect on soilborne diseases. Also, pentachloronitrobenzene (PCNB), a commonly used treatment, has shown partial success in controlling southern blight and increased yield response (Garren, 1961; Backman, 1984; Backman, 1985; and Filonow and Jackson, 1989). New fungicides have been superior to the standard fungicides used on southern blight and leafspot. Substitution of tebuconazole for chlorothalonil gave excellent control on early and late leafspot resulting in consistently higher yields (Brenneman and Culbreath, 1994). Fluazinam,

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when used in vitro, has no activity on leafspot, but has effectively suppressed southern blight (Smith et al., 1992). Flutolanil when banded over the row at flowering to mid peg has shown to have superior activity on southern blight and a positive yield response when compared to other standard treatments such as PCNB (Csinos et al., 1989; Jacobi and Backman, 1989; Hagan et al., 1991). Similar results also occurred with these fungicides on Rhizoctonia limb rot (Csinos, 1987; Brenneman and Sumner, 1989).

The objective of this study was to evaluate several fungicides for use on peanuts to determine what effect they have on southern blight, early and late leafspot diseases and yield response in the South Texas peanut growing region.

MATERIAL AND METHODS

Field tests were conducted from 1989 to 1992 at the Texas Agricultural Experiment Station near Yoakum in a field with a history of moderate to heavy southern blight. Producer fields in Frio County in South Texas were also included in the southern blight study. Leafspot tests were conducted from 1990 to 1992 at the Texas Agricultural Experiment Station near Yoakum in fields with natural infested levels of leafspot. The sites in Yoakum were a Tremona loamy fine sand (clayey, mixed, thermic, Aquic Arenic Paleutalfs) with less than 1% organic matter. The soil type in Frio County was a Duval loamy fine sand (fine-loamy, mixed, hyper-thermic Aridic Haplustalfs). To enhance southern blight pressure at the Yoakum site, *Sclerotium rolfsii* was cultured on autoclaved oats, air dried, screened over a 0.26 inch screen to break up large particles and then applied uniformly over each test plot at the rate of 0.07 lb per 50 ft of row approximately one month after planting of peanut. The Frio county location was naturally infested with high populations of *S. rolfsii* therefore inoculation was unnecessary.

The experimental design at each test was a randomized complete block with four or five replications. Plots consisted of four rows 25 ft long spaced on 36-inch centers. Data were taken from the middle two rows to minimize the effect of spray drift from adjacent plots. Chlorothalonil and tebuconazole were evaluated as foliar sprays for control of leafspot. Flutolanil, fluazinam, PCNB, propiconazole and tebuconazole were evaluated as band, broadcast and foliar sprays for control of southern blight.

Florunner peanut seed was planted at the test sites all four years at 80 lb acre^{-1}. Prior to planting peanut seed at the Yoakum location, stubble from the ryegrass cover crop was shredded and lightly incorporated into the soil to provide a medium for *S. rolfsii*. At the Frio County location, stubble from the wheat cover crop was incorporated into the soil using a moldboard plow.

Foliar fungicides were applied at 15 gal acre^{-1} for foliar disease evaluation and 20 gal acre^{-1} for soilborne disease evaluations. A CO_2 pressurized backpack sprayer equipped with three D_2 tips, #13 cores and slotted strainers per row was used to apply foliar fungicides. Band applications were applied with one nozzle per row (SS8003E) mounted behind an A-sweep attachment, which opened the peanut canopy for better spray penetration or with a drop nozzle which lowered the spray pattern into the peanut canopy. Broadcast applications of flutolanil were applied with an air pressurized bicycle sprayer which delivered a spray volume of 20 gal acre^{-1} at 28 psi. Immediately after application of propiconazole into the pegging zone, 0.5 to

0.75 inch of irrigation was applied to move the fungicide into the pegging zone. A two-row gandy applicator was used to apply PCNB in a 12-14 inch band. Foliar sprays of chlorothalonil were applied to all treatments in the southern blight test to eliminate foliar diseases as a variable in soilborne disease and yield evaluations. Supplemental irrigation was applied throughout the growing season as needed.

Southern blight counts were taken upon inversion of the peanut plant within the 50 ft of row (1 locus was defined as $\leq$ to 1 ft of consecutive southern blight damaged in a row). In 1990 and 1991, percent leafspot and defoliation data were taken from the central stem of 5 plants per plot to assess infection (leaflets with one or more lesions). In 1992, visual leafspot ratings were made using the Florida leafspot scale where 1 = no leafspot and 10 = plants dead and completely defoliated by leafspot.

Peanuts were harvested 140 to 150 days after planting. Plants were field dried after digging and individual plots were threshed with a peanut combine. Samples were dried to 10% moisture. Weight of pods were recorded after soil and foreign matter were removed from plot samples. Grades were determined on a 0.44 lb pod sample from each plot. All data were subjected to an analysis of variance within years and means were separated with Duncan's Multiple Range Test (P = 0.05).

RESULTS AND DISCUSSION

Foliar leafspot diseases

Early leafspot was the predominant pathogen throughout the growing season. Late leafspot did occur later in the growing seasons, but was never uniform enough to evaluate. Tebuconazole provided leafspot control equivalent to or better than chlorothalonil in each test year (Table 1). This confirms the findings of Backman and Crawford (1985) in which they found tebuconazole provided excellent control of early and late leafspot. In 1990, leafspot infection was reduced 82% and 85% over the untreated check using tebuconazole and chlorothalonil. Using tebuconazole seven times at 6.7 oz acre^{-1} increased yields 77% over the untreated check while seven applications of chlorothalinil at 1.5 pt acre^{-1} increased yield 45%. Defoliation was also reduced substantially using chlorothalonil and tebuconazole (data not shown).

In 1991, test results again indicated less leafspot pressure using tebuconazole. No significant differences in foliar disease were observed with seven applications of tebuconazole applied alone throughout the season versus block spray applications of tebuconazole and chlorothalonil applied during the season. Both chlorothalonil and tebuconazole applied alone or in a block spray application significantly improved yields 51% to 68% over the untreated check. Block sprays of tebuconazole and chlorothalonil give the added benefit of not only reducing disease pressure, but eliminating the over use of one specific fungicide, therefore reducing the potential risk of resistance build-up. If used exclusively for disease control, dimethylation inhibitors (DMI) such as tebuconazole and propiconazole are likely to become ineffective after several years due to the adaptation by the fungi to the toxic effects of these fungicides. Unfortunately, resistance to one of the DMIs will result in resistance to all DMIs. This is because both are toxic in the same way even though they vary somewhat in the degree to which they are toxic (Grichar and Jaks, 1995).

Table 1. Effect of foliar applied tebuconazole and chlorothalonil upon leafspot disease development and peanut yield at Yoakum (Lavaca County), 1990-1992.

Treatment	Rate	Application		Infection†			Peanut yield		
	prod acre^{-1}	method	timing‡	1990§	1991§	1992¶	1990	1991	1992
				%			lb acre^{-1}		
Check				46.2 a	15.9 a	4.6 a	2700 b	2434 b	3374 c
Chlorothalinil	1.5 pt	Foliar(F)	1-7	6.7 b	11.9 ab	2.6 b	3918 a	4018 a	3910 ab
Tebuconazole	6.7 oz	F	1-7	8.3 b	8.1 b	2.0 c	4772 a	3848 a	4135 a
Tebuconazole +	6.0 oz	F	3,4,5,6	--	11.5 ab	2.0 c	--	3671 a	3816 a
chlorothalinil	1.5 pt	F	1,2,7						
Tebuconazole +	8.0 oz	F	3,4,5,6	--	11.7 ab	2.3 bc	--	4079 a	4144 a
chlorothalinil	1.5 pt	F	1,2,7						

† Within a column means followed by the same letter are not significantly different at $P=0.05$ according to Duncan's multiple range test

‡ Applications based on a 14-day spray schedule (i.e. 2=second scheduled foliar spray)

§ Percent leafspot taken from the central stem of 5 plants per plot in 1990 and 1991

¶ Florida leafspot rating scale, where 1=no leafspots and 10=completely defoliated and killed by leafspot

Due to lack of rainfall later in the growing season, foliar disease pressure was light in 1992. Tebuconazole provided better leafspot control than chlorothalonil despite low disease pressure. In 1992, yields significantly increased over the untreated check 13% to 23% using chlorothalonil and tebuconazole applied alone or in combination.

Soilborne diseases

Southern blight disease pressure was severe three out of the four growing seasons. Moderate disease pressure occurred at the test site in South Texas in 1992. Rhizoctonia pod rot (*Rhizoctonia solani* Kuhn) was present in both test locations all four years but not at levels deemed high enough to evaluate.

In 1989, in Lavaca County (Table 2), propiconazole applied at 4 oz in 20 gal $acre^{-1}$ and 60 gal $acre^{-1}$, significantly reduced southern blight disease incidence by 23% and 36% when compared to the standard treatment of PCNB applied in a band at 10 or 50 lbs $acre^{-1}$. Propiconazole also provided favorable control to that of flutolanil. This conflicts with results found by Hagen et al., (1991) in which they concluded that propiconazole was less likely to control southern blight effectively compared to flutolanil and tebuconazole. The increased southern blight control with propiconazole was the result of irrigation within four hours of application which moved the fungicide into the pegging zone (authors' opinion). Propiconazole also increased yields by as much as 10% over the untreated check. Flutolanil, applied in a band or as a foliar treatment, significantly reduced disease pressure 24% to 33%. However, despite substantial reductions in disease incidence, yields were 18% to 34% lower than the untreated check. No explanation could be found for the reduction in yield. Csinos (1987) reported similar reductions in disease incidence using flutolanil but with significant increases in yield.

In 1990, propiconazole at 4.0 oz in 60 gal applied foliar or in a band compared favorably with PCNB at 100 lb $acre^{-1}$ applied at peanut pegging. Disease incidence was significantly reduced 28% to 31% over the untreated check with these fungicide treatments. Flutolanil applied twice as a foliar spray significantly increased yields by 49% over the untreated check.

In 1991 (Table 3), tebuconazole effectively reduced disease loci 39% to 53% over the untreated check while flutolanil, fluazinam and PCNB failed to substantially reduce disease pressure. Flutolanil and tebuconazole at 8.0 oz $acre^{-1}$ treatments significantly increased yields over the untreated check. However, all other fungicides provided yields numerically higher than the untreated check.

In 1992, all treatments significantly reduced disease incidence over the untreated check. In Alabama, Jacobi and Backman (1989) and Hagen et al. (1991) found that two mid pegging applications of flutolanil effectively managed southern blight disease pressure. Similar results were found in this study using flutolanil at 1.0 lb $acre^{-1}$ applied at flowering and again at mid-peg in which disease incidence was reduced by 83% over the untreated check. Tebuconazole applied four times at the 8 oz $acre^{-1}$ rate reduced disease loci 76% over the untreated check compared to four applications of tebuconazole applied at the 6 oz $acre^{-1}$ rate which reduced disease incidence by 62%. Significant reductions in disease incidence also resulted in higher yields with all treatments (20% to 66%) when compared to the untreated check.

In the 1991 Frio County study (Table 4), under heavy disease pressure a single application of fluazinam or multiple applications of tebuconazole reduced disease

Table 2. Southern blight disease incidence and peanut yield at Yoakum (Lavaca County), 1989-1990.

Treatment	Rate	Application		Disease loci per 50 ft†		Peanut yield	
	prod acre^{-1}	method	timing‡	1989	1990	1989	1990
						------------lb acre^{-1}----------	
Check				18.4 a	19.2 a	3486 a	1981 b
PCNB	10 lb	Band(B)	2	17.5 ab	14.0 ab	2571 ab	2692 b
PCNB	50 lb	B	peg + 3 wk	15.2 abc	--	3509 a	--
PCNB	100 lb	B	peg	14.0 bcd	13.2 d	2760 a	2245 b
Flutolanil	1 lb	Foliar(F)	1,2	13.9 bcd	15.2 ab	2809 ab	2947 a
Flutolanil	1 lb	Band	1,2	12.2 bcd	16.0 ab	2309 b	2823 ab
Flutolanil	1 lb	Broadcast	1,2	14.5 abc	14.6 ab	2837 ab	2895 ab
Propiconazole	4.0 oz/60 gal	B (4 inch)	1-4	--	13.8 cd	--	2811 ab
Propiconazole	4.0 oz/20 gal	F	1-4	11.1 d	--	3810 a	--
Propiconazole	4.0 oz/60 gal	F	1-4	8.6 d	13.6 d	3833 a	1763 b

† Within a column means followed by the same letter are not significantly different at P=0.05 according to Duncan's Multiple Range Test

‡ Applications based on a 14-day spray schedule (i.e. 2=second scheduled foliar spray)

Table 3. Southern blight disease incidence and peanut yield at Yoakum (Lavaca County), 1991-1992.

Treatment	Rate	Application		Disease loci per 50 ft†		Peanut yield	
	prod acre^{-1}	method	timing‡	1991	1992	1991	1992
						-----------lb acre^{-1}-----------	
Check				25.4 a	13.8 a	2769 c	1724 b
Tebuconazole	6.0 oz	Foliar(F)	3-6	12.4 de	5.3 bcd	3621 abc	2868 a
Tebuconazole	8.0 oz	F	3-6	15.4 bcde	3.3 cd	3868 ab	2423 ab
Flutolanil	1.0 lb	F	2	19.6 abcd	4.5 cd	3127 ab	2447 ab
Flutolanil	1.0 lb	F	2,4	17.6 abcde	2.3 d	3927 ab	2223 ab
Fluazinam	1.0 pt	F	2,4	22.4 abc	4.0 cd	3530 abc	2069 ab
PCNB	10.0 lb	Band	2	22.8 ab	6.0 bcd	3060 bc	2532 ab

† Within a column means followed by the same letter are not significantly different at P=0.05 according to Duncan's Multiple Range Test

‡ Applications based on a 14-day spray schedule (i.e. 2=second scheduled foliar spray)

Table 4. Effect of selected fungicides upon southern blight development and peanut yield at Frio County, 1991-1992.

Treatment	Rate prod acre^{-1}	Application method	Application timing‡	Disease loci per 50 ft† 1991	Disease loci per 50 ft† 1992	Peanut yield 1991	Peanut yield 1992
						----------lb acre^{-1}----------	
Check				20.6 a	7.0 a	2229 b	3674 c
Tebuconazole	6.0 oz	Foliar(F)	3-5	13.1 a	5.3 ab	2650 ab	3761 c
Fluazinam	0.5 pt	F	2,4	16.5 a	6.3 ab	2831 ab	4378 ab
Fluazinam	1.0 pt	F	2,4	15.6 a	7.8 a	3165 a	3833 bc
Fluazinam	1.0 pt	F	2	13.2 a	4.0 ab	2556 ab	3827 bc
PCNB	50 lb	Band	2	10.4 a	--	3180 a	--

† Within a column means followed by the same letter are not significantly different at P=0.05 according to Duncan's Multiple Range Test

‡ Applications based on a 14-day spray schedule (i.e. 2=second scheduled foliar spray)

incidence by 36% while the standard treatment of PCNB reduced disease incidence by 50% when compared to the untreated check (although not statistically different from the untreated check). Significant increases in yield over the untreated check were seen with two applications of fluazinam applied at 1.0 pt acre^{-1} (42%) and one application of PCNB applied at 50 lb acre^{-1} (43%).

In 1992, southern blight disease pressure in Frio County was light and therefore significant differences in disease control were not noticeable (Table 4). Although disease incidence was low, fluazinam applied twice at 0.5 pt acre^{-1} reduced disease 43% when compared with the untreated check. Fluazinam applied twice at 0.5 pt acre^{-1} significantly increased yields by 19%.

The results from this study indicate that suppression of leafspot and southern blight can be obtained using these fungicides applied at lower rates compared to the standard treatments of chlorothalonil and PCNB. Results also indicate that disease suppression can be obtained with fewer applications using these fungicides.

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