Response of Dryland Conservation Tillage Peanuts to Fungicides

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ABSTRACT

Due to the increase in acreage of conservation tillage peanuts, these trials were developed to determine the response of dryland conservation tillage peanuts to fungicide. For 3 years (1999-2001) chlorothalonil (Bravo WeatherStik applied at 1.1 lbs ai acre-1) and tebuconazole (Folicur 3.6F applied at 0.20 lbs ai acre-1) applications were made on scheduled intervals of 14 and 21 days, with the number of spray schedules ranging from 3-7. Treatments also included a non-treated control. Peanuts were planted into rye stubble, which had been harvested with a grain combine that included a straw spreader. During 2000 and 2001, leaf spot ratings using the Florida 1-10 scale were taken at least 135 days after planting. During 2000, leaf spot was significantly lower in treatments where 7 applications of chlorothalonil had been applied and where 4-7 applications of tebuconazole had been made. During 2001, leaf spot was significantly lower than the control in all applications and schedules of fungicides. In 2000 and 2001 leaf spot tended to be lower as the number of applications increased with both fungicides. During 1999 and 2000, there was no difference in yield between fungicides and spray schedules. However in 2001, yield was significantly higher than the control where 5 applications of tebuconazole had been applied. When combining all 3 years, tebuconazole tended to yield higher than chlorothalonil and the control.

KEYWORDS

No-till, leafspot

INTRODUCTION

Early leaf spot [*Cercospora arachidicola* S. Hori), late leaf spot (C*ercosporidium personatum* (Berk. & M. A. Curtis) Deighton], and southern stem rot (*Sclerotium rolfsii* Sacc.) are critical yield limiting diseases of peanut (*Arachis hypogaea* L.) in the southeastern U.S. as well as in most areas of the world where peanut is grown. These diseases account for combined losses and cost of control that may exceed $80 million in a single year in Georgia alone (Kemerait, 2000). Although crop rotation is effective for reducing the severity of all three, management of these diseases is largely dependent upon multiple applications of various fungicides. Since the mid-1970's, chlorothalonil has been the standard fungicide for leaf spot management. Additional options became available for leaf spot management in 1994 with the registration of the ergosterol biosynthesis inhibiting fungicide tebuconazole for use on peanut. This fungicide is effective against both leaf spot diseases and provides significant suppression of southern stem rot (*Sclerotium rolfsii*) and Rhizoctonia limb rot (*Rhizoctonia solani*). In 1997, azoxystrobin was also registered for use of two sprays on peanut for control of leaf spot diseases, southern stem rot and Rhizoctonia limb rot. All of these fungicides are recommended for use in spray regimes utilizing two or more fungicides with applications every 14 d beginning approximately 30 d after planting. In 2000, an estimated 55% of the peanut crop in Georgia was grown with some form of irrigation. Production on non-irrigated fields, commonly referred to as "rain-fed" or "dryland" production, still represents a huge acreage.

When a suitable host and inoculum are present, development of the leaf spot diseases is dependent largely upon available moisture. A rain-event based application timing schedule has been developed that can help ensure that fungicide applications are applied only when they are needed (Jacobi *et al*., 1995). Brenneman and Culbreath (1994) showed that AU-Pnuts was also effective for timing sprays of tebuconazole for management of southern stem rot. Most of the fungicide response work, however, has been conducted using irrigated fields under conventional tillage practices. In recent years, fungicide response in non-irrigated fields has not been characterized as well as that in irrigated fields. In addition, in recent years the percentage of peanut grown using some form of conservation tillage has

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risen to approximately 20% of the Georgia peanut crop. Monfort *et al*. (2001) showed that strip-tillage practices in irrigated fields delayed or suppressed epidemics of early leaf spot and could reduce the number of fungicides required for leaf spot management from 7 in conventional tillage to 4 in strip-tillage. However, fungicide response in dryland conservation tillage peanut has not been characterized. The objective of these experiments was to determine the leaf spot and yield response of dry-land conservation tillage peanuts to varying numbers of applications and timing regimes of standard labeled fungicides, chlorothalonil and tebuconazole.

MATERIALS AND METHODS

The plot area for these experiments was a Tifton loamy sand located at the Coastal Plain Experiment Station, University of Georgia in Tifton, Georgia. The objective of these experiments was to determine the response of dryland conservation tillage peanuts to fungicides. Two adjacent plots under sustainable/no-till practices were selected to set up the trials that used rye (cereal rye) and grain sorghum as rotational crops for peanuts. In the spring of 1999 one plot was planted with peanuts while the other was planted with grain sorghum. The plots were rotated each year developing a rye-grain sorghum- rye-peanut rotation in which the seed was harvested from the rye (25 bu acre^{-1} avg.) and grain sorghum 50 (bu acre^{-1} avg.). Each year 600 lbss of 10-10-10 analysis fertilizer was applied to the rye while 150 pounds of ammonium nitrate (34% N) was applied to the grain sorghum. A Tye no-till drill was used each year to plant 2 bushels of rye per acre. A Monosem no-till drill retrofitted with a 12" in-row subsoiler between the fluted coulter and Yetter row cleaner was used to plant the grain sorghum (6 seed/ft) and peanuts on a 36" row pattern.

'Georgia Green' peanuts were used for the trial in which a randomized complete block design with 6 replications was used for fungicide applications of chlorothalonil (Bravo WeatherStik) applied at 1.1 lbs ai acre-1, and tebuconazole (Folicur 3.6 F) was applied at 0.20 lbs ai acre^{-1} with differing intervals and schedules (Table 1). Fungicide applications started 40 days after planting with leaf spot ratings using the Florida 1-10 scale, where 1 = no leaf spot and 10 = plants completely defoliated and killed by leaf spot (Chiteka *et al*., 1988) taken 135 days after planting. The harvesting date was determined by using a hull scrape test (Williams and Drexler, 1981).

During 1999, 'Georgia Green' peanuts were no-tilled 6 seeds foot^{-1} into rye stubble on May 31st. Peanuts were fertilized with 300 pounds per acre of 0-7-28, which was split into 2 applications applied in an 8" band in July. 1000 pounds per acre of gypsum was broadcast on July 20th. Although no insecticides were applied, post emergence herbicides were selectively applied throughout the growing season for weed control. Fungicides were applied according to protocol beginning on July 10th. Rainfall totaling 16.54 inches was received from June through October. Peanuts were dug on November 2nd, harvested November 8th, dried, cleaned, and weighed.

During 2000, 'Georgia Green peanuts were no-tilled 6 seeds foot^{-1} into rye stubble on May 26th. On June 20th, 300 pounds per acre of 0-7-28 was applied on the surface in an 8" band. 1000 pounds per acre of Gypsum was broadcast to the surface on August 8th. Although no insecticides were applied, herbicides were selectively applied post-emergence throughout the growing season for weed control. Fungicides were applied according to protocol beginning on July 6th. Leaf spot ratings were taken on October 6th using the Florida 1-10 scale. Rainfall totaling 18.20 inches was received from June through October. Peanuts were dug on October 12th, harvested October 20th, dried, cleaned and weighed.

During 2001, after applying 1000 pounds per acre of limestone in February, 'Georgia Green' peanuts were no-tilled 6 seeds foot^{-1} into rye stubble on June 1st. Gypsum was broadcast at 1000 pounds per acre on July 18th. Although no insecticides were applied, herbicides were selectively applied post-emergence throughout the growing season for weed control. Fungicides were applied according to the protocol beginning on July 10th. Leaf spot ratings were taken on October 12th using the Florida 1-10 scale. Rainfall totaling 17.86 inches was received from June through October. Peanuts were dug on October 23rd, harvested October 30th, dried, cleaned and weighed.

RESULTS AND DISCUSSION

During 2000 leaf spot was significantly higher in non-treated peanuts than in treated peanuts (Table 2). Chlorothalonil with 4 applications and tebuconazole with 3 applications had significantly higher leaf spot than all other fungicide application schedules. Chlorothalonil with 3 applications was significantly higher in leaf spot than chlorothalonil with 7 applications and tebuconazole, which was applied in 4 to 7 scheduled applications. During 2001 leaf spot was also significantly higher in non-treated peanuts than in treated peanuts. Chlorothalonil with 3 and 4 applications along with tebuconazole in 3 applications was significantly higher in leaf spot than other application schedules. Chlorothalonil with 5 to 7 applications and tebuconazole with 4 to 7 applications had significantly lower leaf spot than other application schedules. When averaging both years, leaf spot was higher in the non-treated peanuts than where fungicides were applied. Leaf spot was significantly reduced when chlorothalonil was applied in 5 to 7 applications and tebuconazole was applied in 4 to 7 applications.

Yield response of dry-land conservation tillage peanuts to fungicides are presented in Table 3. In 1999 and 2000 there was no significant difference in yield among the nontreated, chlorothalonil and tebuconazole treatments. Number of applications and schedules also did not provide any significant difference in yield. In 2001, yield for plots treated with 5 applications of tebuconazole was significantly higher than the non-treated, while there was no significant difference between the fungicides or application schedules. However when averaging all three years, yields from plots treated with tebuconazole were significantly higher than the control when 4, 5, and 7 applications were applied. No significant difference was seen between fungicides or application schedules. Yield response to chlorothalonil would be primarily due to effects of this fungicide on foliar diseases, primarily early leaf spot in this test. Yield response to tebuconazole could be due to effects on foliar diseases, soilborne diseases, such as southern stem rot, or a combination of both. Southern stem rot did not cause noticeable damage in these tests, and plots were not rated for this disease. Previous reports of the effects of tillage systems on southern stem rot indicate that reduced and conventional tillage practices have no consistent effect on this disease (Johnson *et al*., 2001). Relative yield response to applications of tebuconazole would be expected to be greater in conventional or conservation tillage fields in which southern stem rot would occur at higher incidence.

Decisions on fungicide applications may become increasingly difficult for producers of dryland conservation tillage peanuts. Fungicide applications significantly reduce leaf

Table 1. Fungicide application schedule.

Treatment	Application no. 1	2	3	4	5	6	7
	------------- No. of weeks after planting ----------						
Nontreated	--	--	--	--	--	--	--
Chlorothalonil (7 applications on a 14 day schedule)	5	7	9	11	13	15	17
Chlorothalonil (6 applications on a 14 day schedule)	5	7	9	11	13	15	--
Chlorothalonil (5 applications on a 14 day schedule)	5	7	9	11	13	--	--
Chlorothalonil (4 applications on a 21 day schedule)	5	8	11	14	--	--	--
Chlorothalonil (3 applications on a 21 day schedule)	5	8	14	--	--	--	--
Tebuconazole (7 applications on a 14 day schedule)	5	7	9	11	13	15	17
Tebuconazole (6 applications on a 14 day schedule)	5	7	9	11	13	15	--
Tebuconazole (5 applications on a 14 day schedule)	5	7	9	11	13	--	--
Tebuconazole (4 applications on a 21 day schedule)	5	8	11	14	--	--	--
Tebuconazole (3 applications on a 21 day schedule)	5	8	14	--	--	--	--
Chlorothalonil/Tebuconazole alternate (4 applications on a 21 day schedule)	5	8	11	14	--	--	--

Table 2. Effect of fungicides on peanut leaf spot disease in a dry-land conervation tillage system. Means within a column followed by the same letter are not significantly different based on Duncan's Multiple Range Test at $P = 0.05$.

Treatment	2000	2001	Average
Nontreated	5.2 A	6.6 A	5.9 A
Chlorothalonil (7 applications on a 14 day schedule)	2.2 D	2.6 E	2.4 D
Chlorothalonil (6 applications on a 14 day schedule)	2.5 CD	2.5 E	2.5 D
Chlorothalonil (5 applications on a 14 day schedule)	2.6 CD	2.4 E	2.5 D
Chlorothalonil (4 applications on a 21 day schedule)	4.0 B	4.9 B	4.4 B
Chlorothalonil (3 applications on a 21 day schedule)	3.1 C	4.9 B	4.0 BC
Tebuconazole (7 applications on a 14 day schedule)	2.4 D	3.0 DE	2.7 D
Tebuconazole (6 applications on a 14 day schedule)	2.2 D	2.2 E	2.2 D
Tebuconazole (5 applications on a 14 day schedule)	2.4 D	2.6 E	2.5 D
Tebuconazole (4 applications on a 21 day schedule)	2.5 D	2.6 E	2.5 D
Tebuconazole (3 applications on a 21 day schedule)	3.8 B	4.0 BC	3.9 BC
Chlorothalonil/tebuconazole (4 applications on a 21 day schedule)	---	3.7 CD	3.7 C

spot but may not always significantly increase yield. The maximum amount of leaf spot acceptable and the application and cost of fungicides are major decisions with which producers will be faced. In the future, it will be more critical than ever for growers to be aware of the disease history of each field in planning disease management programs. Response to fungicide applications varies with water available for both infection by the pathogen and for the plant to produce yield. A rainfall-based decision tool such as AU-pnuts could be especially useful in dryland conservation tillage fields to help ensure that fungicide applications are needed and to increase the likelihood of economic yield response to the fungicide inputs.

LITERATURE CITED

Brenneman, T. B., and A.K. Culbreath. 1994. Utilizing a sterol demethylation inhibiting fungicide in an advisory to manage foliar and soilborne pathogens of peanut. Plant Disease 78:866-872.

Chiteka, Z. A., D. W. Gorbet, F. M. Shokes, T. A. Kucharek, and D. A. Knauft. 1988. Components of resistance to late leaf spot in peanut. I. Levels of variability-implications for selection. Peanut Sci. 15:25-30.

Jacobi, J. C., P.A. Backman, and D.P. Davis. 1995. AU-Pnuts Advisory I: Development of a rule-based system for scheduling peanut leaf spot fungicide applications. Plant Disease 79:666-671.

Table 3. Effects of fungicides on dry-land conservation tillage peanut yields. Means within a column followed by the same letter are not significantly different based on Duncan's Multiple Range Test at *P* = 0.05.

Treatment	1999	2000	2001	Average
	------------------- lbs acre^{-1} ----------------			
Nontreated	1210 A	1640 A	2683 B	1844 B
Chlorothalonil (7 applications on a 14 day schedule)	1389 A	1915 A	2887 AB	2064 AB
Chlorothalonil (6 applications on a 14 day schedule)	1416 A	1918 A	2768 AB	2034 AB
Chlorothalonil (5 applications on a 14 day schedule)	1404 A	1944 A	2952 AB	2100 AB
Chlorothalonil (4 applications on a 21 day schedule)	1370 A	1891 A	2827 AB	2029 AB
Chlorothalonil (3 applications on a 21 day schedule)	1322 A	1811 A	2821 AB	1984 AB
Tebuconazole (7 applications on a 14 day schedule)	1476 A	2051 A	2951 AB	2159 A
Tebuconazole (6 applications on a 14 day schedule)	1325 A	1786 A	3045 AB	2052 AB
Tebuconazole (5 applications on a 14 day schedule)	1328 A	2092 A	3244 A	2221 A
Tebuconazole (4 applications on a 21 day schedule)	1470 A	2036 A	3042 AB	2183 A
Tebuconazole (3 applications on a 21 day schedule)	1455 A	1906 A	2927 AB	2096 AB
Chlorothalonil/Tebuconazole alternate (4 applications on a 21 day schedule)	1325 A	-----	2913 AB	2119 AB

Johnson, W. C. III, T.B. Brenneman, S.H. Baker, A.W. Johnson, D.R. Sumner, and B.G. Mullinix, Jr. 2001. Tillage and pest management considerations in a peanut-cotton rotation in the southeastern coastal plain. Agron. J. 93:570-576.

Kemerait, R. 2000. Peanut disease losses. *IN* J. L. Williams-Woodward. 2000 Georgia Plant Disease Loss Estimates. University of Georgia Path 01-001. 19 pp.

Monfort, W. S., A. K. Culbreath, and T. B. Brenneman. 2001. Integration of strip-tillage, resistant cultivars, and reduced fungicide inputs for management of peanut leaf spot. Proceedings of the American Peanut Research and Education Society 33:68.

Williams, E. J., and S. Drexler. 1981. A nondestructive method of determining peanut pod maturity. Peanut Science 8:134-141.