Effect of Application Interval on the Control of Early Leaf Spot and White Mold on Peanut with Headline 2.09E Fungicide

Bulletin 665
January 2006

Alabama Agricultural Experiment Station
Richard Guthrie, Director
Auburn University, Alabama

CONTENTS

Web publication, January 2007

This research was supported in part by grants from the Alabama Peanut Producers Association and the National Peanut Board.

Effect of Application Interval on the Control of Early Leaf Spot and White Mold on Peanut with Headline 2.09E Fungicide

A. K. Hagan, K.L. Bowen, H.L. Campbell, and L. Wells

INTRODUCTION

Headline 2.09E is a broad-spectrum strobilurin fungicide (pyraclostrobin) that moves through the cell layers of a leaf but is not redistributed throughout the plant like a true systemic fungicide *(1,2,25).* In earlier trials, the level of control of early leaf spot (caused by the fungus *Cercospora arachidicola* Hori) and late leaf spot (caused by the fungus *Cercosporidium personatum* (Berk. & Curtis) Deighton) on peanut (*Arachis hypogaea* L.) that was obtained with three or more Headline 2.09E applications as part of a recommended seven-application calendar program was often superior to that obtained with other recommended fungicides *(11,15).* Hagan et al. *(15)* also noted that a program that included three or four applications of this fungicide controlled white mold [southern stem rot or SSR] (caused by the fungus *Sclerotium roflsii* Sacc.) as well as recommended Abound 2SC, Folicur 3.6F, and Moncut 70DF + Bravo Ultrex programs.

Due to its exceptional residual activity, Headline 2.09E, when applied at 9 to 15 fluid ounces per acre gave up to 3 weeks of control of early and late leaf spot compared to the 2 weeks for other recommended fungicides. At extended treatment intervals, multiple applications of Headline 2.09E were as effective in controlling early leaf spot as recommended 2-week Abound 2SC, Bravo Ultrex, or Folicur 3.6F programs *(11,15).* To comply with Fungicide Resistance Action Committee (FRAC) guidelines for strobilurin fungicides, however, no more than two applications of pyraclostrobin (Headline 2.09E) as part of a seven-application program may be made to a given peanut field per production season (www.frac.info/frac/index.htm).

Recommended seven-application calendar leaf spot and white mold control programs may account for more than 25 percent of the variable cost in the 2006 Alabama peanut production budget (http://www.ag.auburn.edu/agec//pubs/budgets/2006/RowCrops/pnut2006plan.pdf). Due to declining peanut profitability, emphasis on lowering production costs by eliminating some costly fungicide inputs has increased. Recent release of peanut cultivars with partial resistance to early and/or late leaf spot,

Hagan and Bowen are professors and Campbell is a research associate in the Department of Entomology and Plant Pathology. Pegues is superintendent at the Alabama Agricultural Experiment Station's Wiregrass Research and Extension Center.

(5,9,13,14,16) in addition to the availability of the highly effective fungicide Headline 2.09E *(15)* may allow application intervals to be extended from the recommended 2- to 3- or possibly 4-week intervals without jeopardizing disease control or yield.

However, late leaf spot severity increased on the partially late leaf spot-resistant Southern Runner peanut cultivar when application intervals were extended from 2 to 3 weeks with 1.4 pounds per acre of Bravo Ultrex *(6).* Also with extended treatment intervals, yields were sizably reduced and disease severity increased on partially leaf spot-resistant peanut cultivars in one of three years *(3,6).* Monfort et al. *(22)* also saw heavier leaf spot damage on partially leaf spot resistant peanuts treated at extended interval intervals, but yields for the recommended 2-week and extended interval programs for Abound 2SC and Folicur 3.6F, but not Bravo Ultrex, were similar. Similarly, Cantonwine et al. *(10)* reported considerable early leaf spot intensification when application intervals with Bravo Ultrex were lengthened from 2 to 4 weeks, yet yield response to the 2-, 3-, and 4-week treatment schedules was not appreciably different.

The AU-Pnuts leaf spot advisory targets fungicide applications when weather conditions favor the development of early and late leaf spot and delays applications when the weather patterns are too dry for infection of the leaves by the causal fungi *(20).* According to AU-Pnuts, fungicide applications are triggered by the number of accumulated rain events $\geq$ 0.10 inch of rain or irrigation water in a 24 hour period and the 5-day average rainfall forecast. At true ground cracking when seedlings first emerge, counting the number of rain events for the first fungicide application starts. Regardless of the 5-day average rainfall forecast, the first fungicide application must be made no later than the sixth rain event. Beginning 10 days after that and each additional fungicide application, treatments are triggered after (a) three rain events, (b) a 5-day average rainfall forecast of $\geq$ 50 percent, or (c) a combination of one or two rain events and the 5-day average rainfall forecast *(20).* Reductions of 1.25 and 2.5 fungicide applications per season on the leaf spot-susceptible Florunner *(20)* and partially late leaf spot-resistant Southern Runner *(19)* runner peanuts were obtained with the AU-Pnuts leaf spot advisory compared to the recommended 2-week calendar schedule. Brenneman and Culbreath *(6)* made two fewer fungicide applications using AU-Pnuts than a 2-week calendar schedule in two of three years. Similar reductions in applications numbers that were obtained with an AU-Pnuts Abound 2SC program were accompanied with a higher risk of early leaf spot damage and yield loss *(3).*

The objective of this study was to compare the effectiveness of 2-, 3-, and 4-week calendar application schedules and the AU-Pnuts leaf spot advisory with Headline 2.09E applied according to label directions for the control of early leaf spot and SSR on three runner peanut cultivars.

METHODS

Production methods. Peanut cultivars were planted in a Dothan fine sandy loam ($\leq$ 1 percent organic matter) on May 16, 2003, May 25, 2004, and May 18, 2005 at a rate of six seed per foot of row in an irrigated field at the Wiregrass Research and Extension Center in Headland, Alabama. Runner peanut cultivars Andru II [matures 126 to 140 days after planting (DAP) (early)], Carver [matures 130 to 145 DAP (mid-

season)], and DP-1 or Florida C-99R [matures 140 to 165 DAP (late)] were planted. The cultivar DP-1, which was planted in 2003, was replaced with Florida C-99R in 2004 and 2005. Both of these peanut cultivars are partially resistant to early and late leaf spot and white mold *(9,13,14)*.

In late March, plot areas, which were maintained in a peanut–cotton–peanut rotation, were subsoiled, turned with a moldboard plow, and then prepared for planting with a disk harrow. Optimum soil fertility and pH were maintained according to the results of a soil fertility assay conducted by the Soil Testing Lab at Auburn University *(18)*.

In all three trials, 6.7 pounds per acre of Temik 15G was applied in-furrow for thrips control. In 2003 and 2004, 2.0 pints per acre of Sonolan HFP + 0.45 ounces per acre of Strongarm were broadcast in mid-April for pre-emergent weed control. In 2005, a May 16 broadcast application of a tank mixture of 2.0 pints per acre of Sonolan HFP + 0.45 ounces per acre of Strongarm was followed by a post-emergent broadcast application of 2.0 pints per acre of Prowl 3.3 on May 26. On June 23 and July 10, 2003, post-emergent grass control was obtained with a broadcast applications of 8 fluid ounces per acre of Select + 1.0 quart per acre of Prime Oil. On July 15, 2005, Cadre at 1.44 ounces per acre + 1.5 pints per acre of Storm were broadcast. In addition, escape weeds were pulled by hand or killed by cultivating the row middles with flat sweeps.

Due to frequent summer rains in 2003, the test area was not irrigated. In 2004, 1.0 acre inch of water was applied on July 30 and August 17. In the following year, the test received 0.7 and 0.9 acre inches of water on August 1 and September 13, respectively.

A split plot design with peanut cultivars as whole plots and fungicide treatments as subplots was used. Whole plots were randomized in four complete blocks. Individual subplots consisted of four 30-foot rows spaced 3 feet apart.

Fungicide programs. Applications of 9 and 15 fluid ounces per acre of Headline 2.09E, which were incorporated into 2-, 3-, and 4-week calendar, and AU-Pnuts advisory (2004 and 2005 only) treatment schedules, were made with a tractor-mounted boom sprayer with three TeeJet® TX-8 nozzles per row calibrated to deliver 15 gallons of spray volume per acre. For all Headline 2.09E programs, applications were scheduled approximately 60 and 90 days after planting. Applications of Bravo Ultrex at 1.4 pounds per acre filled the remaining treatment slots in the Headline 2.09E programs. In addition, a 2-week calendar program with Bravo Ultrex at 1.4 pounds per acre was included as a control. In all three years, the 2-, 3-, and 4-week calendar programs consisted of a total of seven, five, and four fungicide applications, while six total fungicide applications were triggered by the AU-Pnuts advisory in 2004 and 2005. Fungicide application dates for the calendar and advisory treatment schedules are listed in Table 1.

Disease assessment. Early leaf spot was rated using the 1 to 10 Florida peanut leaf spot scoring system where 1 = no disease, 2 = very few leaf spots on leaves in lower canopy, 3 = few lesions on leaves in lower and upper canopy, 4 = some leaf spots on leaves in lower and upper canopy with light defoliation (≤10 percent), 5 = leaf spots noticeable in upper canopy and some defoliation (≤25 percent), 6 = leaf spots numerous with significant defoliation (≤50 percent), 7 = leaf spots numerous with heavy defoliation (≤ 75 percent), 8 = numerous leaf spots on leaves with severe defoliation

TABLE 1. FUNGICIDE APPLICATION DATES FOR THE CALENDAR AND AU-PNUTS ADVISORY TREATMENTS

Treatment Schedule	Application Dates
2003[1]	
2 week	June 16, June 30, July 14, July 28, August 11, August 25, September 8
3 week	June 16, July 21, July 28, August 18, September 8
4 week	June 16, July 14, August 11, September 8
2004	
2 week	June 23, July 9, July 22, August 4, August 18, September 2, September 15
3 week	June 23, July 15, August 4, August 26, September 15
4 week	June 23, July 22, August 18, September 15
AU-Pnuts[2]	June 23, July 9, July 26, August 12, August 31, September 15
2005	
2 week	June 23, July 8, July 22, August 4, August 17, September 1, September 14
3 week	June 23, July 15, August 4, August 26, September 14
4 week	June 23, July 22, August 17, September 14
AU-Pnuts[2]	June 13, July 1, July 14, August 5, August 15, September 2

[1]An AU-Pnuts advisory treatments was not included in the 2003 study.
[2]Applications were triggered on the basis of the number of accumulated rain events, each with ≥0.1 inches of rain or irrigation within a 24-hour period, and the 5-day average rainfall forecast.

(≤90 percent), 9 = few remaining leaves covered with leaf spots with severe defoliation (≤95 percent), and 10 = plants defoliated or dead *(12)*. Final leaf spot ratings for the 2003 trial were recorded on September 17, September 25, and October 6 for Andru II, Carver, and DP-1, respectively. For the 2004 trial, leaf spot severity was rated for Andru II on September 21, for Carver on October 1, and for Florida C-99R on October 13. In 2005, early leaf spot ratings were logged on September 19 for Andru II, on September 27 for Carver, and on October 12 for Florida C-99R. The pod maturity hull scrape method was used to estimate the optimal inverting date for each cultivar *(26)*. In 2003, plots were inverted with a 2-row digger/inverter on September 19 for Andru II, September 29 for Carver, and October 14 for DP-1. Andru II, Carver, and Florida C-99R were inverted in 2004 on September 20, October 3, and October 17, respectively. Incidence of white mold is described as the number of loci or hits where 1 locus is defined as ≤ 1 foot of consecutively damaged plants per row *(24)*. Damage ratings for white mold were taken from the two center rows of each subplot immediately after they were dug. Yields, which were taken from the two center rows of each four-row subplot, are reported at 10 percent moisture.

RESULTS

Rainfall. For the 2003 trial, rainfall totals for the months of May, June, July, August, and September were at or above the historical average. Monthly rainfall totals

for 2004 were equal to or higher than average for May, June, and September and below average for July and August. In 2005, monthly rainfall totals were equal to or higher than the historical average for the months of June, July, and August but were below to well-below average for May, September, and October.

Early leaf spot. Disease severity significantly intensified in 2003 when application intervals were extended from 2 to 4 weeks (Table 2). The 2-week 9- and 15-fluid-ounce-per-acre Headline 2.09E treatments gave significantly better control of early leaf spot than the 3- and 4-week calendar schedule treatments with the same rates of this fungicide. At both rates of Headline 2.09E, disease incidence was also lower for the 3- than for the 4-week calendar schedule treatments. Both of the 2-week Headline 2.09E calendar schedule treatments, and the 3-week calendar schedule treatment with the 15-fluid-ounce-per-acre rate of the same fungicide gave better early leaf spot control than the standard 2-week Bravo Ultrex program.

In 2004, early leaf spot again was the most common leaf spot disease. The best season-long leaf spot control was given by the 2-week calendar and AU-Pnuts advisory treatments for both rates of Headline 2.09E (Table 2). A significant increase in early leaf spot severity occurred when application intervals were lengthened from 2 to 3 weeks. The level of early leaf spot control seen with the 3- and 4-week programs for 15-fluid-ounce-per-acre rate of Headline 2.09E was similar. In contrast, a further decline in disease control was seen when the application interval with Headline 2.09E at 9 fluid ounces per acre was lengthened from 3 to 4 weeks. In addition, leaf spot control with the 3-week calendar schedule of the 9-fluid-ounce-per-acre rate, and with the 3- and 4-week calendar schedule treatments with the higher rate of Headline 2.09E did not greatly differ from that obtained with the standard 2-week Bravo Ultrex program.

Headline 2.09E at 9 and 15 fluid ounces per acre in 2005 gave better early leaf spot control when applied at 2 and 3 weeks than on a 4-week calendar schedule or according to the AU-Pnuts advisory (Table 2). When applied at 2- and 3-week intervals, both rates of Headline 2.09E also controlled early leaf spot more effectively than the standard 2-week Bravo Ultrex program. Both rates of Headline 2.09E applied monthly were less effective in controlling early leaf spot than the standard 2-week Bravo Ultrex program. Early leaf spot control with the AU-Pnuts advisory treatments with both rates of Headline 2.09E were comparable to that obtained with the standard 2-week Bravo Ultrex program.

White mold. Incidence of white mold was not related to Headline 2.09E application rate or treatment interval (Table 2). For both the 9- and 15-fluid-ounce-per-acre rates of Headline 2.09E, similar levels of white mold damage were noted across all treatment schedules in 2003. Incidence of this disease for the 2-week Bravo Ultrex standard was often similar to that recorded for most Headline 2.09E treatments, regardless of the application interval. In 2004, white mold hit counts for the all of the 9- and 15-fluid-ounce-per-acre Headline 2.09E calendar treatments and the corresponding AU-Pnuts advisory treatments did not greatly differ. In the final trial, application interval and number with the high rate of Headline 2.09E did not have much impact on white mold incidence. At the lower 9-fluid-ounce-per-acre rate of Headline 2.09E, white mold incidence was higher for the 3-week calendar schedule compared with the 2- and 4-week calendar schedule and the AU-Pnuts advisory treatment.

TABLE 2. IMPACT OF APPLICATION SCHEDULE ON THE CONTROL OF EARLY LEAF SPOT AND WHITE MOLD AND THE YIELD OF PEANUT AT THE WIREGRASS RESEARCH AND EXTENSION CENTER, HEADLAND, AL

	Application			Early leaf spot			White mold[1]			Yield		
Fungicide	Rate	Interval	Number	2003	2004	2005	2003	2004	2005	2003	2004	2005
	amt/ac										*lb/ac*	
Bravo Ultrex	1.4 lb	2 wk	7	4.8	4.0	4.2	6.0	8.3	6.7	3571	3646	3142
Bravo Ultrex Headline 2.09E	1.4 lb 9 fl oz	2 wk	7	3.9	3.5	3.9	7.3	7.1	7.5	3749	3979	3434
Bravo Ultrex Headline 2.09E	1.4 lb 9 fl oz	3 wk	5	4.6	4.2	3.7	8.4	8.6	11.3	3606	3440	2996
Bravo Ultrex Headline 2.09E	1.4 lb 9 fl oz	4 wk	4	5.4	4.5	5.0	6.9	8.6	6.8	3112	3455	3031
Bravo Ultrex Headline 2.09E	1.4 lb 9 fl oz	AU-Pnuts[2]	6	—	3.8	4.7	—	8.9	8.0	—	3668	2851
Bravo Ultrex Headline 2.09E	1.4 lb 15 fl oz	2 wk	7	3.3	3.3	3.6	6.3	8.3	6.9	3775	3721	3366
Bravo Ultrex Headline 2.09E	1.4 lb 15 fl oz	3 wk	5	3.8	4.1	3.5	6.1	8.2	9.2	4134	3674	2965
Bravo Ultrex Headline 2.09E	1.4 lb 15 fl oz	4 wk	4	4.8	4.0	4.7	7.3	9.3	8.2	3352	3566	3085
Bravo Ultrex Headline 2.09E	1.4 lb 15 fl oz	AU-Pnuts	6	—	3.7	4.5	—	6.4	5.6	—	3864	3114

[1]White mold incidence is expressed as the number of disease loci or hits per 60 feet of row.

[2]AU-Pnuts advisory rules specify that the first fungicide application be made immediately after six or more rain events (> 0.10 inch) and second and subsequent applications immediately after three rain events.

TABLE 3. RATINGS FOR EARLY LEAF SPOT AND SOUTHERN STEM ROT AND YIELD OF PEANUT CULTIVARS EVALUATED AT THE WIREGRASS RESEARCH AND EXTENSION CENTER, HEADLAND, AL

Fungicide	Maturity group	—Early leaf spot —			——White mold[1]——			———Yield———		
		2003	2004	2005	2003	2004	2005	2003	2004	2005
									lb/ac	
Andru II	3	4.2	4.0	3.9	5.6	7.0	9.2	3627	3456	3180
Carver	4	4.4	3.9	4.0	6.5	8.4	15.4	3934	3711	2829
DP-1	5	4.6	—	—	8.6	—	—	3258	—	—
Florida C-99R	5	—	3.8	4.8	—	9.2	16.2	—	3837	3369

[1]White mold incidence is expressed as the number of hits per 60 feet of row.

Yield. Yield response with the 2-week calendar treatments for the 9- and 15-fluid-ounce-per-acre rate of Headline 2.09E was similar. At both rates of this fungicide, sizable yield reductions were seen in 2003 when application interval was lengthened from 3 to 4 weeks (Table 2). Among the 15-fluid-ounce-per-acre Headline 2.09E treatments, yield was higher for the 3- than for the 2-week calendar schedule treatments. Yield response obtained with the 2-week schedules for both rates of Headline 2.09E was similar to that recorded for the standard 2-week calendar Bravo Ultrex program.

In 2004, yield was higher for peanuts treated at 2-week intervals with the lower rate of Headline 2.09E than at either the 3- and 4-week intervals or the AU-Pnuts advisory (Table 2). Despite differences in leaf spot control, yield response at the higher rate of Headline 2.09E for all calendar and advisory treatments did not greatly differ. A yield gain over that of the standard 2-week Bravo Ulterx program was obtained with the 9- but not the 15-fluid-ounce-per-acre rate of Headline 2.09E.

At the low rate of Headline 2.09E, yield was higher in 2005 for the 2-week calendar schedule than the yields obtained with the 3- and 4-week schedule and with the AU-Pnuts advisory (Table 2). Yield response with the 2-week calendar schedule for the high rate of Headline 2.09E was higher than that for the 3-week calendar schedule. In contrast, yield was similar for all calendar and advisory treatments with the 15-fluid-ounce-per-acre rate of Headline 2.09E. With one exception, yield for the Bravo Ultrex calendar standard was similar to that of the Headline 2.09EC programs.

Peanut cultivars. Among peanut cultivars planted in 2003, the least early leaf spot damage was seen on Andru II (Table 3). As indicated by a leaf spot rating of 4.2, symptoms on this cultivar were limited to light to moderate leaf spotting and some premature leaf shed. The early leaf spot rating for DP-1 was significantly higher than that recorded for Andru II, while that for Carver was intermediate between those of DP-1 and Andru II. While early leaf spot severity was similar on Andru II, Carver, and Florida C-99R in 2004, disease ratings for Florida C-99R were higher in 2005 than those recorded for the other two cultivars. In 2005, premature defoliation levels for Andru II and Carver were in the range of 10 percent compared with nearly 20 percent for Florida C-99R.

In 2003, white mold incidence was higher for the late maturing DP-1 than for the early maturing Andru II (Table 3). In the next two years, Andru II suffered less white mold damage than the late maturing Florida C-99R. White mold incidence on Andru II and Carver was similar in two of three years of this study.

Carver yielded higher in 2003 than Andru II and DP-1 (Table 3). Andru II had a higher pod yield than DP-1. In the 2004 trial, Florida C-99R and Carver had higher yields compared with Andru II. For 2005, yields of Andru II and Florida C-99R, which were similar, were higher than those for the Carver peanut.

DISCUSSION

Portillo et al. *(23),* Culbreath et al. *(11),* and Hagan et al. *(15)* had previously showed that Headline 2.09E often controlled early and late leaf spot on peanut better

than most other recommended fungicides. While the application rates were similar in these studies, treatment programs in the above trials included one to five more applications than the two specified on the current Headline 2.09E label. In this study, 2-week calendar programs that included two Headline 2.09E applications at 9 or 15 fluid ounces per acre consistently gave better control of early leaf spot than the standard 2-week Bravo Ultrex program. Symptoms on the Headline 2.09E-treated peanuts were restricted to light leaf spotting in the lower to mid-canopy and a very low level of premature leaf loss. When compared with the Bravo Ultrex program, superior leaf spot control obtained with both rates of Headline 2.09E applied at 2-week intervals often did not translate into higher yields. Sizable yield gains were obtained with the 9-fluid-ounce-per-acre rate of Headline 2.09E in only 2004. In all three trials, yield response with the high rate of Headline 2.09E applied at 2-week intervals was similar to that reported for the standard Bravo Ultrex program.

When application interval was lengthened to 3 weeks, the 9-fluid-ounce-per-acre Headline 2.09E program was at least as effective as the 2-week Bravo Ultrex program in controlling early leaf spot. In two of three trials, yield responses with the 3-week, 9-fluid-ounce-per-acre rate Headline 2.09E and standard Bravo Ultrex programs were similar. While better early leaf spot control was obtained with the 3-week, 15-fluid-ounce-per-acre Headline 2.09E program compared with the Bravo Ultrex standard in two of three trials, yields for these treatments also did not greatly differ. Consistently poorer leaf spot control obtained with the monthly 9-fluid-ounce-per-acre Headline 2.09E program often translated into lower pod yields when compared with the standard Bravo Ultrex program. When compared with the standard Bravo Ultrex program, the monthly 15-fluid-ounce-per-acre Headline 2.09E program gave better early leaf spot control in two of three trials and had similar yields in all three trials.

As was previously noted *(15)*, control of early leaf spot on peanut with Headline 2.09E declined when application intervals were extended beyond the current standard of 2 weeks. At both rates of Headline 2.09E, better early leaf spot control was also seen in two of three trials with the 2-week than with the 3-week calendar schedule treatments. However, the decline in early leaf spot control that was observed between the 2- and 3-week pyraclostrobin (Headline 2.09E) programs was not catastrophic. Early leaf spot ratings for the 3-week, 9-fluid-ounce-per-acre Headline 2.09E treatments indicated that leaf spotting in the mid-canopy was light to moderate and premature leaf loss never reached 20 percent. At the 15-fluid-ounce-per-acre rate, the level of early leaf spot control obtained with the 3-week Headline 2.09E program was comparable in two of three trials to that maintained with the 2-week, 9-fluid-ounce-per-acre Headline 2.09E treatment. Early leaf spot ratings for the 3-week, 9-fluid-ounce-per-acre Headline 2.09E program were below those recorded for the 4-week calendar schedule treatment with the same rate of this fungicide. At the high rate of Headline 2.09E, better leaf spot control was obtained with the 3- than with the 4-week calendar schedule treatments in 2003 and 2005.

Heaviest defoliation recorded for the monthly program with both rates of Headline 2.09E of approximately 35 and 20 percent, respectively, were noted in 2003. At both rates of Headline 2.09E, yield for the 2- and 3-week schedule treatments was similar in 2003 and 2004. Yield responses for both of the monthly Headline 2.09E

treatments were lower than those reported for the 2- and 3-week calendar schedule treatments of the same fungicide.

The AU-Pnuts leaf spot advisory was designed to eliminate one or more fungicide applications without an appreciable decline in the control of leaf spot diseases or peanut yield *(6,19,20).* Bowen et al. *(3)* recently noted similar control of early leaf spot and yield response in two of three years with the recommended 2-week calendar and AU-Pnuts Abound 2SC programs along with a reduction of two to three fungicide applications with the standard 6/3 advisory rules on the partially leaf spot resistant peanut cultivar Florida C-99R. At the 9-fluid-ounce-per-acre rate of Headline 2.09E, early leaf spot ratings were lower and yield higher for the 2-week program compared with the AU-Pnuts advisory treatment. While better early leaf spot control was again obtained with the 2-week than with the AU-Pnuts advisory treatments with the high rate of Headline 2.09E, yield responses for both treatments in 2004 and 2005 weresimilar. When applied according to the AU-Pnuts advisory, the levels of early leaf spot control obtained with the 9- and 15-fluid-ounces-per-acre Headline 2.09E programs were similar in one and two of three years, respectively, to that noted with the Bravo Ultrex standard. In addition, yields were higher in one of two years for the AU-Pnuts advisory treatment for the 15- but not the 9-fluid-ounce-per-acre rate of Headline 2.09E. Better early leaf spot control and higher yields were recorded for the AU-Pnuts advisory than for the 3- and 4-week calendar treatments for both rates of Headline 2.09E in 2004 but not in 2005.

The 2-, 3-, and 4-week calendar schedule treatments for rates of Headline 2.09E failed to appreciably reduce white mold incidence when compared with Bravo Ultrex alone, a fungicide that has little if any activity against the causal fungus *S. rolfsii (9, 15, 16).* Differences in white mold control provided by Headline 2.09E in this and a previous study *(15)* may be related to the number of applications of this fungicide included in a five- or seven-application calendar treatment program. Hagan et al. *(15)* noted that white mold incidence on peanut receiving three applications of Headline 2.09E at 6.4 or 12 fluid ounces per acre was lower compared with the standard 2-week calendar Bravo Ultrex program. In addition, the same three-application Headline 2.09E programs were as effective in controlling white mold as recommended Abound 2SC, Folicur 3.6F, and Moncut 70DF programs *(15).* In a concurrent Alabama study *(16),* however, a white mold control program that included three applications of Headline 2.09E at 6 fluid ounces per acre failed to reduce the incidence of this disease below that noted on peanut treated with Bravo Ultrex alone. Yields for these two treatments also were similar. Finally, white mold control and yield response were far superior for Abound 2SC and Moncut 70DF programs than for the above Headline 2.09E program *(16).* Overall Headline 2.09E, even at the highest label rate of 15 fluid ounces per acre, does not appear to be the optimum choice for preventing destructive outbreaks of white mold on peanut.

When applied according to label directions and FRAC guidelines, both 2-week Headline 2.09 programs gave superior control of early leaf spot. In addition, efficacy of the 3-week Headline 2.09E programs for the control of early leaf spot and

yield response was usually comparable to that obtained with the standard Bravo Ultrex program. Regardless of the Headline 2.09E application rate, yield response with the 3-week treatments, however, may fall below that of the 2-week treatments in one of three years. A similar pattern of yield declines at extended application intervals with calendar and advisory schedules has previously been reported for Bravo *(6,19)* and Folicur 3.6F *(6)* but not Abound 2SC *(3)* on peanut cultivars with partial resistance to leaf spot diseases. Declining leaf spot control obtained with the monthly Headline 2.09E treatment resulted in sizable yield loss in two of three years. As a result, the application interval guidelines on the Headline 2.09E label should be followed to insure effective disease control and optimum yield response. Performance of the AU-Pnuts Headline treatments was intermediate between that of the 2- and 3-week calendar treatments in 2004 but was inferior to both in the following year. Additional trials need to be conducted to clarify the efficacy of Headline 2.09E for the control of early and late leaf spot when applied according to the AU-Pnuts leaf spot advisory.

While the Carver and Andru II peanuts are considered among the runner peanut cultivars most susceptible to leaf spot diseases *(14,21)*, early leaf spot ratings for these cultivars were similar to those recorded for DP-1 and Florida C-99R in 2003 and 2004, respectively, and were below those reported for the latter cultivar in 2005. In previous Alabama *(16)* and Georgia *(9,22)* studies, Florida C-99R was less susceptible to early leaf spot than Georgia Green. In contrast to our results, Cantonwine et al. *(9)* also noted that DP-1 was among the most early leaf spot resistant of commercial peanut lines. The early maturing (maturity group 3) cultivar Andru II typically suffered less white mold than the later maturing Carver, DP-1, or Florida C-99R. As previously noted by Hagan et al. *(14)*, Andru II may avoid some white mold damage by maturing before considerable colonization of the pods and stems occurs. In contrast, a late maturing (maturity group 5) cultivar like DP-1 and Florida C-99R, which are exposed to attack by the causal fungus *S. rolfsii* for an additional 20 to 30 days beyond the optimum maturity date for Andru II, may suffer additional white mold damage. Incidence of white mold on Carver was similar to levels noted on Florida C-99R in 2004 and 2005 but lower than that observed on DP-1. Lower white mold damage levels for Andru II did not translate into higher yield. In 2004 and 2005, yield for Florida C-99R was significantly higher compared with Andru II and Carver. In the first year, Carver outyielded both Andru II and DP-1.

In summary, extending fungicide application intervals may not be the best option for reducing production inputs or for maximizing peanut yield. Peanut producers need to carefully consider the increased risk of sizable yield loses against the cost savings from eliminating one or two fungicide applications before adopting an extended application program with any recommended fungicide on their peanut crop.

REFERENCES

1. Bardinelli, T. R., J. S. Barnes, and H. L. Ypema. 2001. Pyraclostrobin (BAS 500F): Update on BASF's broad-spectrum strobilurin fungicide. Phytopathology 91:S5 (abstr.).

2. Bartlett, D. W., J. M. Clough, J. R. Godwin, A. A. Hall, M. Hamer, and R. Parr-Dobrzanski. 2002. The strobilurin fungicides. Pest Manag. Sci. 58:649-662.

3. Bowen, K. L., A. K. Hagan, H. L. Campbell, and L. Wells. 2006. Comparison of calendar and AU-Pnuts advisory programs with azoxystrobin for the control of leaf spot and southern stem rot of peanut. Peanut Sci. 33: (accepted).

4. Bowen, K. L., A. K. Hagan, and J. R. Weeks. 1996. Soil-borne pests of peanut in growers' fields with different cropping histories in Alabama. Peanut Sci. 23:36-42.

5. Branch W. D. and T. B. Brenneman. 1996. Pod yield and stem rot evaluation of peanut cultivars treated with tebuconazole. Agron. J. 88:933-936.

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

7. Brenneman, T. B. and A. P. Murphy. 1991. Activity of tebuconazole on *Cercosporidium personatum*, a foliar pathogen on peanut. Plant Dis. 75:699-703.

8. Brenneman, T. B., A. P. Murphy, and A. S. Csinos. 1991. Activity of tebuconazole on *Sclerotium rolfsii* and *Rhizoctonia solani*, two soillborne pathogens of peanut. Plant Dis. 75:744-747.

9. Cantowine, E. G., A. K. Culbreath, C. C. Holbrook, and D. W. Gorbet. 2002. Response of moderately resistant peanut breeding lines and cultivars to chlorothalonil for management of early leaf spot. Proc. Amer. Peanut Res. Educ. Soc. 34:92-93 (abstr.).

10. Cantowine, E. G., A. K. Culbreath, K. L. Stevenson, R. C. Kemerait, Jr., T. B. Brenneman, N. B. Smith, and B. G. Mullenix, Jr. 2006. Integrated disease management of leaf spot and spotted wilt of peanut. Plant Dis. 90:493-500.

11. Culbreath, A. K., T. B. Brenneman, and R. C. Kemerait, Jr. 2002. Management of early leaf spot of peanut with pyraclostrobin as affected by rate and treatment interval. Online. Plant Health Progress doi:10.1094/PHP-2002-1018-01-RS.

12. 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.

13. Gorbet, D. W. and F. M. Shokes. 2002. Registration of 'C99R' Peanut. Crop Sci. 42:2207.

14. Hagan, A. K., H. L. Campbell, and K. L. Bowen. 2005. Resistance of commercial runner peanut lines to early leaf spot, tomato spotted wilt, and southern stem rot. Phytopathology 95:839(abstr).

15. Hagan, A. K., H. L. Campbell, K. L. Bowen, and L. Wells. 2003. Impact of application rate and treatment interval on the efficacy of pyraclostrobin in fungicide programs for the control of early leaf spot and southern stem rot on peanut. Peanut Sci. 30:27-34.

16. Hagan, A. K., M. E. Rivas-Davila, K. L. Bowen, and L. Wells. 2004. Comparison of fungicide programs for the control of early leaf spot and southern stem rot on selected peanut cultivars. Peanut Sci. 31:22-27.

17. Hagan, A. K., J. R. Weeks, and K. L. Bowen. 1991. Effect of application timing and method on control of southern stem rot of peanut with foliar-applied fungicides. Peanut Sci. 18:47-50.

18. Hartzog, D. L. and J. F. Adams. 1988. Soil fertility experiments with peanut in Alabama, 1973-1986. Alabama Agric. Exp. Sta. Bull. 594. Auburn, AL.

19. Jacobi, J. C. and P. A. Backman. 1995. AU-Pnuts Advisory II: Modification of the rule based leaf spot advisory for scheduling peanut leaf spot fungicide applications. Plant Dis. 79:672-676.

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

21. Kemerait, R. C., T. B. Brenneman, and A. K. Culbreath. 2006. Peanut disease update, pp 22-35. In E. P. Prostko (ed). 2006 Peanut Update, Georgia Coop. Ext. Sys. CSS-06-0112.

22. Monfort, W. S., A. K. Culbreath, K. L. Stevenson, T. B. Brenneman, D. W. Gorbet, and S. C Phatak. 2004. Effects of reduced tillage, resistant cultivars, and reduced fungicide inputs on progress of early leaf spot of peanut *(Arachis hypogaea).* Plant Dis. 88:858-864.

23. Portillo, H. E., R. R. Evans, J. S. Barnes, and R. E. Gold. 2001. F500, a new broad-spectrum fungicide for control of peanut diseases. Phytopathology 91: S202 (abstr.).

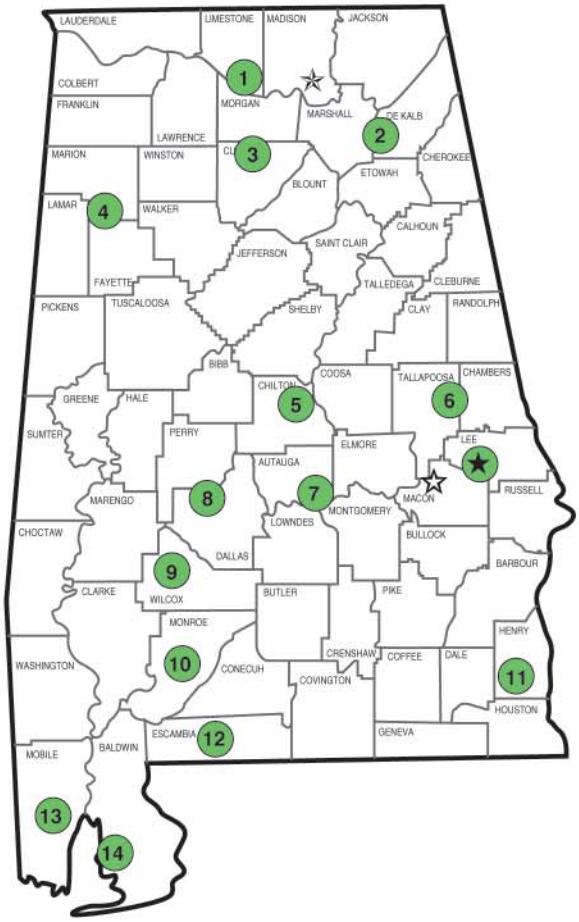
24. Rodriguez-Kabana, R., P. A. Backman, and J. C. Williams. 1975. Determination of yield losses to *Sclerotium rolfsii* in peanut fields. Plant Dis. Rep. 59:855-858.

25. Stierl, R. E. J. Butterfield, H. Koehle, and G. Lorenz. 2000. Biological characterization of the new strobilurin fungicide BAS 500F. Phytopathology 90:S74 (abstr.).

26. Williams, E., J. and J. S. Drexler. 1981. A non-destructive method for determining peanut pod maturity. Peanut Sci. 8:134-141.

Alabama's Agricultural Experiment Station
AUBURN UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the state has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.
⛤ Alabama A&M University.
☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Research and Extension Center, Belle Mina.
2. Sand Mountain Research and Extension Center, Crossville.
3. North Alabama Horticulture Research Center, Cullman.
4. Upper Coastal Plain Agricultural Research Center, Winfield.
5. Chilton Research and Extension Center, Clanton.
6. Piedmont Substation, Camp Hill.
7. Prattville Agricultural Research Unit, Prattville.
8. Black Belt Research and Extension Center, Marion Junction.
9. Lower Coastal Plain Substation, Camden.
10. Monroeville Agricultural Research Unit, Monroeville.
11. Wiregrass Research and Extension Center, Headland.
12. Brewton Agricultural Research Unit, Brewton.
13. Ornamental Horticulture Research Center, Spring Hill.
14. Gulf Coast Research and Extension Center, Fairhope.