Comparison of Fungicide Programs for the Control of Early Leaf Spot and Southern Stem Rot on Selected Peanut Cultivars[1]

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ABSTRACT

Azoxystrobin, tebuconazole, pyraclostrobin, chlorothalonil + flutolanil, and chlorothalonil fungicide programs were evaluated on selected peanut cultivars for the control of early leaf spot (ELS) and southern stem rot (SSR) in 2000, 2001, and 2002. A peanut-cotton-peanut rotation was followed and the plots were irrigated as needed. Virugard and Georgia Green were planted in all 3 yr. The late-maturing line Southern Runner was planted only in 2000 and was replaced with Florida C-99R in 2001 and 2002. Since the ranking of fungicide programs for ELS and SSR control and yield response was similar over peanut cultivars, data for each variable in 2000, 2001, and 2002 were pooled. The 0.34-kg ai/ha azoxystrobin and pyraclostrobin programs gave better ELS control than the season-long chlorothalonil standard in 1 yr. However, SSR control and yield response to pyraclostrobin was similar to the chlorothalonil standard. Significant reductions in SSR damage and higher yields were obtained with 0.34-kg ai/ha azoxystrobin program in all 3 yr. When compared to the chlorothalonil standard, the 0.47-kg ai/ha azoxystrobin program gave superior SSR control in 2000 and 2001, but significantly better ELS control and higher yield were obtained only in 2001. Tebuconazole-treated peanuts had similar ELS ratings to those recorded for the chlorothalonil standard and azoxystrobin programs in 2000 and 2001, but the ELS ratings for the former program were significantly higher in 2002. While tebuconazole reduced SSR damage compared with chlorothalonil alone, the azoxystrobin and chlorothalonil + flutolanil programs controlled SSR significantly better than tebuconazole in at least 1 yr. Also, the 0.34-kg ai/ha azoxystrobin program significantly increased yield above that of the chlorothalonil standard more consistently than did tebuconazole. Relatively few differences in disease control or yield response were noted between the two chlorothalonil + flutolanil programs, but both increased yield above that of the chlorothalonil standard. By maturing about 2 wk before Georgia Green, Virugard may have escaped some ELS and SSR damage, which may have contributed to its higher yield. There are indications that the late-maturing Florida C-99R has partial resistance to ELS but not SSR. Georgia Green proved more susceptible to both diseases than Virugard or Florida C-99R but no peanut cultivar produced consistently higher yields.

Key Words: Bravo Ultrex, Folicur 3.6F, Moncut 50W, Moncut 70DF, Headline 2.09EC, Abound 2.08SC, *Arachis hypogaea*, *Cercospora arachidicola*, *Sclerotium rolfsii*.

For nearly 30 yr, chlorothalonil (Bravo Ultrex, Bravo WeatherStik 6F, Echo 720 6F, Terranil 6F) has been the most widely used fungicide in Alabama for the control of early leaf spot (ELS) caused by *Cercospora arachidicola* S. Hori, late leaf spot caused by *Cercosporidium personatum* Berk. & M.A. Curtis, and rust caused by *Puccinia arachidis* Speg. on peanut (8, 14, 18, 21, 24). Despite the widespread use of chlorothalonil on peanuts across the Southeastern U.S., this fungicide continues to give effective control of the above diseases (11, 16, 17). Chlorothalonil has no activity against the soil-borne fungus *Sclerotium rolfsii* Sacc., the causal agent of southern stem rot (SSR) on peanut (8, 12, 15, 16, 17).

Within the last decade, tebuconazole (Folicur 3.6F) (1, 2, 4, 5, 6), azoxystrobin (Abound 2.08SC) (14, 22), and pyraclostrobin (Headline 2.09EC) (10, 17) have been registered for the control of SSR, Rhizoctonia limb rot caused by *Rhizoctonia solani* Kuhn, leaf spot diseases, and rust. Depending on the product, two to four applications of these fungicides are made as part of the recommended seven-application calendar regime (18). Typically, a chlorothalonil fungicide fills the remaining three to five treatment slots in a tebuconazole, azoxystrobin, or pyraclostrobin program to minimize the risk of fungal pathogens from developing resistance to triazole or strobilurin (Qol) fungicides (18). Flutolanil (Moncut 70DF) will control SSR and Rhizoctonia limb rot but must be applied with a chlorothalonil or propiconazole (Artisan 3.6F) tank-mix partner to control ELS, late leaf spot, and rust (18, 19).

Questions often are raised concerning the effectiveness of tebuconazole, azoxystrobin, pyraclostrobin, and flutolanil programs for the control of diseases on peanut and their impact on pod yield. Other concerns pertaining to escalating production costs and lower prices for farmer-stock peanuts have forced producers to reassess the need for costly fungicide inputs. Finally, little is understood about the role of fungicides such as of tebuconazole, azoxystrobin, and pyraclostrobin on the productivity of peanut cultivars with partial resistance to leaf spot diseases

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and SSR. The objective of this study was to compare the yield of several peanut cultivars produced under irrigation and the efficacy of recommended fungicide programs for the control of ELS and SSR.

Materials and Methods

Peanut (*Arachis hypogaea* L.) cultivars were planted on 18 May 2000, 18 May 2001, and 22 May 2002 at a rate of 17 seed/m of row in an irrigated field at the Wiregrass Res. and Ext. Center, Headland, AL. The runner peanut cultivars Virugard [matures 126 to 140 d after planting (DAP) (group 3 or early)] and Georgia Green [matures 130 to 145 DAP (group 4 or mid-season)] were planted for all three trials (25). Southern Runner [matures 140 to 165 DAP (group 5 or late)] was sown only in 2000 and then was replaced the following year with Florida C-99R [matures 140 to 165 DAP (group 5)] (12, 25). The cropping history of the test areas was a minimum of 10 yr in a peanut-cotton-peanut rotation. The soil type was a Dothan fine sandy loam (fine, loamy, siliceous, thermic Plinthis Palendut) with less than 1% organic matter. The test areas were infested with *S. rolfsii* and significant SSR development had been seen on previous peanut crops.

The test site was prepared for planting with a moldboard plow and disk harrow. Optimal soil fertility and pH were maintained according to the results of a soil fertility assay conducted by the Soil Testing Lab. at Auburn Univ. (20). Broadleaf and grass weeds were controlled by lightly incorporating a pre-emergence application of 0.85 kg ai/ha endosulfan (Sonalan HFP, Dow AgroSciences, Indianapolis, IN) and 1.6 kg ai/ha of metolachlor (Dual Magnum, Syngenta Crop Protection, Greensboro, NC). At 5 d after emergence (ground cracking), an application of paraquat (Gramoxone Maxx, Syngenta Crop Protection, Greensboro, NC) at 0.14 kg ai/ha or an equivalent rate of another formulation of this herbicide coupled with 0.27 kg ai/ha of 2,4-DB (Butyrac 200, Agri Star Inc., Ankey, IA) and 0.55 kg ai/ha of bentazon (Basagran 4EC, BASF, Research Triangle Park, NC) was made. At planting, aldicarb (Temik 15G, Bayer Crop Protection, Kansas City, MO) at 0.83 kg ai/ha was applied in-furrow for thrips control (18). Escape weeds were controlled by field cultivation or pulled by hand. Plots were irrigated with a center pivot irrigation system with ca. 2.5 cm of water on 7 June (19 DAP), 15 June (27 DAP), 28 June (40 DAP), 22 July (64 DAP), 12 Aug. (85 DAP), 18 Aug. (91 DAP), and 29 Aug. (102 DAP) 2000; on 16 July (60 DAP) 2001; and on 10 Aug. (79 DAP), 24 Aug. (93 DAP), and 12 Sept. (112 DAP) 2002.

Four replications of a split-plot design with peanut cultivars as whole plots and fungicide programs as subplots were used. Subplots consisted of four 9.2-m rows spaced 0.9 m apart. Fungicide treatments were randomized within each main plot. Broadcast applications of all fungicides were made on a standard 14-d calendar schedule with a tractor-mounted four-row boom sprayer with three TeeJet® TX-8 hollow cone nozzles (Spraying Systems Co., Wheaton, IL) per row that delivered 140 L/ha.

For the 2000 trial, the 1.26-kg ai/ha chlorothalonil (Bravo Ultrex, Syngenta Crop Protection, Greensboro, NC) program consisted of seven applications made on a 14-d calendar schedule. A block of four 0.23-kg ai/ha tebuconazole (Folicur 3.6F, Bayer Crop Protection, Kansas City, MO) applications was preceded by two and followed by one application of chlorothalonil at 1.26 kg ai/ha. Applications of 0.34- and 0.47-kg ai/ha azoxystrobin (Abound 2.08SC, Syngenta Crop Protection, Greensboro, NC) programs on 25 July and 22 Aug. were separated by an application of chlorothalonil at a rate of 1.26 kg ai/ha on 8 Aug. A single application of chlorothalonil at 1.26 kg ai/ha + flutolanil (Moncut 50W, Gowan Co., Yuma, AZ) at 1.0 kg ai/ha, was made on 25 July. The remaining applications in the azoxystrobin and the chlorothalonil + flutolanil calendar programs described above were 1.26 kg ai/ha of chlorothalonil. Application dates were 27 June (40 DAP), 11 July (54 DAP), 25 July (68 DAP), 8 Aug. (82 DAP), 22 Aug. (96 DAP), and 5 Sept. (110 DAP) 2000.

In 2001, chlorothalonil, tebuconazole, and azoxystrobin programs were as described above. In addition to the chlorothalonil at 1.26 kg ai/ha + flutolanil at 1.0 kg ai/ha program, a block of four mid-summer applications of chlorothalonil at 1.26 kg ai/ha + flutolanil at 0.23 kg ai/ha was included. Chlorothalonil at 1.26 kg ai/ha filled the remaining treatment slots in both of the above chlorothalonil + flutolanil programs. Fungicides were applied on 25 June (30 DAP), 9 July (52 DAP), 23 July (66 DAP), 6 Aug. (80 DAP), 20 Aug. (94 DAP), and 4 Sept. (109 DAP) 2001.

The 2002 study included the same chlorothalonil, tebuconazole, azoxystrobin, and chlorothalonil + flutolanil programs that were tested in 2001 except for the azoxystrobin at the rate of 0.47 kg ai/ha. In addition, three applications of pyraclostrobin (Headline 2.09EC, BASF, Research Triangle Park, NC) at 0.11 kg ai/ha were bracketed by two applications of 1.26 kg ai/ha chlorothalonil. A program with azoxystrobin at 0.22 kg ai/ha on 23 July and 6 Aug., bracketed by an application of 0.23 kg ai/ha tebuconazole on 9 July and 21 Aug., was also evaluated. The azoxystrobin/tebuconazole treatments were bracketed by applications of chlorothalonil at 1.26 kg ai/ha on 25 June, 3 Sept. and 17 Sept. Application dates were 25 June (34 DAP), 9 July (47 DAP), 23 July (61 DAP), 6 Aug. (75 DAP), 21 Aug. (91 DAP), 3 Sept. (104 DAP), and 17 Sept. (118 DAP) 2002.

Severity of ELS was rated in the center two rows using the Florida leaf spot scoring system (9). Incidence of SSR was determined immediately after the plants were inverted where one locus was the number of consecutive symptomatic plant(s) in ≤ 30.5 cm of row (23). In 2000, ELS and SSR severity ratings were recorded on Virugard, Georgia Green, and Southern Runner on 3 Oct., 12 Oct., and 26 Oct, respectively. In 2001, ELS ratings were taken on 14 Sept. for Virugard, 29 Sept. for Georgia Green, and 17 Oct. for Florida C-99R. In 2002, ELS was rated on 13 Sept. for Virugard, 30 Sept. for Georgia Green, and 17 Oct. for Florida C-99R. The pod maturity hull scrape method was used to estimate the optimal inverting date (26). In 2000, inverting dates were 3 Oct. (138 DAP) for Virugard, 12 Oct. (147 DAP) for Georgia Green, and 26 Oct. (161 DAP) for Southern Runner. Virugard, Georgia Green, and Florida C-99R plots were inverted on 14 Sept. (119 DAP), 1 Oct. (136 DAP), and 17 Oct. (152 DAP) 2001, respectively. Plots were inverted in 2002 on 24 Sept. (124 DAP) for Virugard, 4 Oct. (135 DAP) for Georgia Green, and 17 Oct. (153 DAP) for Florida C-99R. All plots were turned into windrows using a two-row inverter. Yields were taken from the two center rows of each four-row subplot.

Fungicide program and cultivar effects on ELS, SSR, and yield in each trial were tested by analysis of variance. Fungicide program means were compared with Fisher's protected least significant difference (LSD) test at $P = 0.05$. Since the cultivar × fungicide program interactions for ELS, SSR, and yield were not significant in any of the three trials (data not shown), only cultivar (main plots) and fungicide (subplots) means are presented.

Results

The 2000 production season was among the driest recorded at the Wiregrass Res. and Ext. Center. Total rainfall from Apr. through Aug. 2000 was 14.5 cm, significantly less than the historical 62.2 cm mean. Therefore, ELS and SSR were lower than expected. Monthly rainfall totals for most of the 2001 production season were at or above the historical mean. Rainfall totals were at or below the historical average from Apr. to Sept. but above the mean for Oct. 2002.

Early Leaf Spot. In 2000, significant ELS differences were noted among the fungicide programs (Table 1). Due to unusually dry weather patterns throughout much of the 2000 production season, symptoms of ELS were limited to light leaf spotting in the lower and upper canopy, as well as minimal premature defoliation on the chlorothalonil-treated peanuts. Azoxystrobin at 0.34 kg ai/ha controlled ELS significantly better than chlorothalonil alone or the chlorothalonil + flutolanil program. Control of ELS provided by 0.47 kg ai/ha azoxystrobin and the tebuconazole program was similar to that obtained with the season-long chlorothalonil program.

For 2001, ELS intensity was slightly higher than in the 2000 trial. Azoxystrobin at 0.47 kg ai/ha controlled ELS significantly better than chlorothalonil and chlorothalonil at 1.26 kg ai/ha + flutolanil at 1.0 kg ai/ha programs (Table 1). Efficacies of the chlorothalonil, tebuconazole, and 0.34-kg ai/ha azoxystrobin programs for the control of ELS were similar.

In 2002, ELS rating for the tebuconazole program was significantly higher than the other fungicide programs, including season-long chlorothalonil (Table 1). The ELS rating of 4.6 for the tebuconazole-treated peanuts represented light to moderate leaf spotting and a low level of defoliation. Control of ELS obtained with chlorothalonil was similar to that given by 0.34-kg ai/ha azoxystrobin, 1.26-kg ai/ha chlorothalonil + 1.0-kg ai/ha flutolanil, and the azoxystrobin/tebuconazole programs. The low rate of chlorothalonil + flutolanil and pyraclostrobin programs gave better control of ELS than the other fungicide programs.

Southern Stem Rot. In all three trials, SSR incidence was significantly higher for peanuts treated with chlorothalonil compared with other fungicide programs except for the pyraclostrobin program, which was tested only in 2002 (Table 1). Only in 2000 did both azoxystrobin programs control SSR better than the program with one application of flutolanil. In 2001, both tebuconazole and those programs that included flutolanil or azoxystrobin were similarly effective in controlling SSR. In 2002, both flutolanil programs controlled SSR better than tebuconazole, azoxystrobin, or azoxystrobin/tebuconazole programs. In addition, the azoxystrobin/tebuconazole program controlled this disease significantly better than the programs with only one of these fungicides. In all three trials, the four-application chlorothalonil + flutolanil and 0.47-kg ai/ha azoxystrobin programs gave the best control of SSR.

Yield Response. In 2000, 0.34 kg ai/ha (but not the higher rate) of azoxystrobin significantly increased peanut yields compared with the season-long chlorothalonil or chlorothalonil + flutolanil programs (Table 1). Yield response was significantly higher for both azoxystrobin programs than for tebuconazole or chlorothalonil. Pod yields for the chlorothalonil, tebuconazole, or chlorothalonil + flutolanil programs were similar.

Compared to chlorothalonil, significant yield increases were obtained with the tebuconazole, as well as chlorothalonil + flutolanil and azoxystrobin programs in 2001 (Table 1). Yield response to 1.0 kg ai/ha flutolanil was significantly less than four applications of the lower rate of the same fungicide. Yield for tebuconazole was similar to that for the azoxystrobin and chlorothalonil + flutolanil programs.

Regardless of application rate and number, all flutolanil-treated plots yielded significantly higher than the other fungicide programs in 2002 (Table 1). Yield responses to azoxystrobin or azoxystrobin/tebuconazole programs were superior to the pyraclostrobin or chlorothalonil programs. The chlorothalonil and pyraclostrobin programs had similar yields, as did the azoxystrobin and tebuconazole programs.

Table 1. Severity of early leaf spot (ELS), southern stem rot (SSR) incidence, and yield response of irrigated peanut to recommended fungicide programs at the Wiregrass Research and Extension Center, Headland, AL.

Fungicide program	Application rate	Sequence	ELS severity[a] 2000	ELS severity[a] 2001	ELS severity[a] 2002	SSR incidence[b] 2000	SSR incidence[b] 2001	SSR incidence[b] 2002	Yield 2000	Yield 2001	Yield 2002
	kg ai/ha					---- loci/30 m row ----			-------- kg/ha ---------		
Chlorothalonil	1.26	1-7	3.4[c]	4.1	3.6	20.6	33.7	28.3	4392	3544	3426
Chlorothalonil & tebuconazole	1.26 0.23	1,2,7 3,4,5,6	2.9	3.6	4.6	11.2	18.5	22.2	4379	4181	4069
Chlorothalonil & chlorothalonil + flutolanil	1.26 1.26 + 1.0	1,2,4,5,6,7 3	3.5	3.9	3.4	13.8	18.0	7.5	4450	4142	5174
Chlorothalonil & chlorothalonil + flutolanil	1.26 1.26 + 0.23	1,2,7 3,4,5,6	–[d]	3.5	2.7	–	14.3	7.5	–	4467	5140
Chlorothalonil & azoxystrobin	1.26 0.34	1,2,4,6,7 3,5	2.6	3.8	3.6	5.5	19.3	16.7	4985	4181	4365
Chlorothalonil & azoxystrobin	1.26 0.47	1,2,4,6,7 3,5	2.9	3.3	–	7.3	18.8	–	4927	4244	–
Chlorothalonil & azoxystrobin & tebuconazole	1.26 0.22 0.23	1,2,6,7 3,4 5	–	–	3.6	–	–	11.7	–	–	4580
Chlorothalonil & pyraclostrobin	1.26 0.11	1,2,6,7 3,4,5	–	–	2.6	–	–	28.3	–	–	3668
LSD (P = 0.05)			0.5	0.6	0.5	4.2	5.2	4.0	514	325	403

[a]ELS severity was assessed shortly before the date of plot inversion using the Florida leaf spot scoring system on staggered dates based on the maturity group of the four cultivars (main plot) (25).

[b]Incidence of SSR was logged immediately after plot inversion.

[c]Mean comparison in each column was according to Fisher's protected least significant difference (LSD) test (P = 0.05).

[d]– = treatment not tested in that year.

Peanut Cultivars. In all three trials, significant ELS and SSR differences were noted among peanut cultivars (Table 2). In 2000, the late maturing Southern Runner had higher levels of ELS than Georgia Green, but Southern Runner was not significantly different from the early-maturing Virugard. In contrast, Virugard had significantly lower ELS ratings in 2001 and 2002 than Georgia Green. In 2001, late maturing Florida C-99R had an ELS rating that was intermediate between Virugard and Georgia Green. Florida C-99R and Georgia Green had similar ELS ratings in 2002.

In two of three trials, Virugard had significantly less SSR than Georgia Green, Southern Runner, or Florida C-99R (Table 2). For 2002, SSR incidence for Florida C-99R was significantly lower compared to Georgia Green but similar to Virugard.

In all three trials, differences in yield were noted among peanut cultivars (Table 2). In 2000, Virugard yield was significantly higher compared to Georgia Green. Yield response of Southern Runner was similar to the yields for Virugard and Georgia Green. In the 2001 trial, Virugard and Georgia Green yields were similar and significantly higher than those for Florida C-99R. Despite the highest level of ELS and SSR in 2002, yield for Georgia Green, Virugard, and Florida C-99R was similar.

Discussion

Overall, no fungicide program consistently controlled ELS significantly better than the standard season-long chlorothalonil program in all three trials. The 0.34- and 0.47-kg ai/ha azoxystrobin programs controlled ELS significantly better than chlorothalonil in 2000 only. The program with a single application of chlorothalonil at 1.26 kg ai/ha + flutolanil at 1.0 kg ai/ha was as effective in controlling ELS as the standard chlorothalonil program in 2002. However, ELS ratings in plots receiving four applications of 1.26-kg ai/ha chlorothalonil + 0.23-kg ai/ha flutolanil were lower than the ratings for the season-long chlorothalonil program in 2001 and 2002. In 2002, ELS levels were higher for tebuconazole than for the chlorothalonil, azoxystrobin, and chlorothalonil + flutolanil programs. In 2000 and 2001, the tebuconazole program effectively controlled ELS as other fungicide programs had in previous Alabama field trials (15, 16, 17). In earlier studies, this fungicide was as effective in

Table 2. Ratings for early leaf spot (ELS) and southern stem rot (SSR), and yield of peanut cultivars evaluated at the Wiregrass Research and Extension Center, Headland, AL.

		ELS severity[a]			SSR incidence[b]			Yield		
Peanut cultivar	Maturity	2000	2001	2002	2000	2001	2002	2000	2001	2002
					----- loci/30 m row -----			--------- kg/ha ---------		
Virugard	Early[c]	3.0[d]	2.9	2.3	7.5	15.7	17.3	4929	4218	4432
Georgia Green	Mid	2.8	4.5	4.0	10.8	21.7	19.7	4215	4296	4209
Southern Runner	Late	3.2	–	–	14.3	–	–	4736	–	–
Florida C-99R	Late	–[e]	3.8	3.6	–	24.3	14.8	–	3898	4394
LSD (P = 0.05)		0.4	0.4	0.3	3.0	5.2	2.7	359	230	264

[a]ELS severity was assessed shortly before the date of plot inversion using the Florida leaf spot scoring system on staggered dates based on the maturity group of the four cultivars.

[b]Incidence of SSR was logged immediately after plot inversion.

[c]Maturity for early, mid-season, and late maturing lines occurs approximately 126-140, 130-145, and 140-165 DAP, respectively (25).

[d]Mean comparison in each column was according to Fisher's protected least significant difference (LSD) test (P = 0.05).

[e] – = cultivar not tested in that year.

controlling both leaf spot diseases as azoxystrobin (14) and often provided better leaf spot control than chlorothalonil alone (4). The decline in the efficacy of tebuconazole for the control of ELS appears related to its inability to adhere to the leaf surface rather than increasing resistance or tolerance in target fungi. However, additional studies to assess the sensitivity of *C. arachidicola* and *C. personatum* to tebuconazole and other triazole (ergosterol biosynthesis inhibitor) fungicides should be conducted. As was noted in previous Alabama (17) and Georgia (11) studies, pyraclostrobin often has given better control of ELS than tebuconazole and azoxystrobin programs.

As expected, tebuconazole, azoxystrobin, and flutolanil programs significantly reduced SSR incidence compared to the chlorothalonil program. Azoxystrobin and flutolanil programs may have a slight edge in controlling SSR over tebuconazole. In two of three trials, the 0.34-g ai/ha rate of azoxystrobin controlled SSR better than tebuconazole, compared with improved control in one of two trials with the 0.47-g ai/ha azoxystrobin program. In a series of field trials in Texas (14), azoxystrobin was at least as effective in controlling SSR as tebuconazole. Hagan *et al.* (17) previously noted that flutolanil proved at least as effective in controlling SSR as azoxystrobin or tebuconazole. Surprisingly, pyraclostrobin demonstrated little if any activity against SSR. In previous Alabama studies (17), this fungicide was nearly as effective in controlling SSR as azoxystrobin and tebuconazole programs. Additional studies are needed to clarify the efficacy of pyraclostrobin for the control of SSR.

In all three trials, only the 0.34-g ai/ha azoxystrobin program consistently increased yield above that obtained with the season-long chlorothalonil program. When compared with the chlorothalonil program, yield was significantly higher for the 1.26-kg ai/ha chlorothalonil + 1.0-kg ai/ha flutolanil single-application program and the tebuconazole program in two of the three trials. Of the programs tested in only two trials, the 1.26-kg ai/ha chlorothalonil + 0.23-kg ai/ha flutolanil program and the 0.47-kg ai/ha azoxystrobin program increased yield in both trials compared to chlorothalonil.

Yields with the 0.34- and 0.47-kg ai/ha azoxystrobin programs were significantly higher than for the tebuconazole and chlorothalonil + flutolanil programs in 2000. In 2001 and 2002, yields for the 0.34-kg ai/ha azoxystrobin and tebuconazole programs were similar. Grichar *et al.* (14) also noted that the peanut yield with the 0.47-kg ai/ha rate of azoxystrobin program was similar to and sometimes better than the yield response obtained with tebuconazole. While the yields for either rate of chlorothalonil + flutolanil were similar to those for azoxystrobin and tebuconazole programs in 2001, yields for both of the chlorothalonil + flutolanil programs were superior in 2002 to those for all other fungicide programs. Previously, the yield response obtained with chlorothalonil + flutolanil were usually similar to tebuconazole, both rates of azoxystrobin, and pyraclostrobin (17). Application rate did not have a significant impact on the yield response to the azoxystrobin and chlorothalonil + flutolanil programs.

Georgia Green was the most disease-prone of the peanut cultivars tested. Virugard, which probably escaped ELS and SSR by maturing 1 to 2 wk before Georgia Green, suffered less damage from both diseases. In two of three trials, ELS ratings for Georgia Green were higher than those of Virugard and the two late maturing cultivars. Virugard also suffered significantly less ELS damage than Southern Runner or Florida C-99R. Compared with Georgia Green, Florida C-99R had significantly lower ELS ratings and may be partially resistant to both ELS and late leaf spot (8, 13). In one of three trials, SSR damage on Georgia Green was higher compared with the other peanut cultivars. Southern Runner reportedly is partially resistant to SSR (2, 3) but levels of this disease were higher in 2000 on this cultivar than on Virugard or Georgia Green. Showers that occurred just prior to plot inversion may have triggered this late outbreak of SSR on the late-maturing Southern Runner in 2000. Georgia Green proved to be more susceptible to SSR in this study than was noted in a previous Georgia study (2).

Differences in yield among the peanut cultivars were relatively minor. In two of three trials, respectively, yield for Georgia Green and Florida C-99R were significantly lower than those of Virugard. Lower ELS and SSR ratings may largely account for the superior Virugard yields.

The 0.34-g ai/ha and, to a lesser extent, the 0.47-kg ai/ha azoxystrobin programs gave the most consistent disease control and yield gains of the fungicide programs tested. SSR control and yields obtained with both chlorothalonil + flutolanil programs usually were significantly better than chlorothalonil season-long. Tebuconazole continued to be an effective fungicide for the control of ELS and SSR on peanut; however, the occasional decline in ELS activity that has recently been seen in production fields needs to be explored. Pyraclostrobin has excellent activity against ELS and late leaf spot but fewer than three applications at rates higher than 0.11 kg ai/ha will be needed to meet Fungicide Resistance Action Committee (FRAC) recommendations concerning the use of strobilurin (QoI) fungicides (7) and insure effective control of SSR in peanut (11, 17). The azoxystrobin and tebuconazole programs evaluated here followed FRAC resistance management guidelines concerning the use of triazole and strobilurin fungicides, respectively, on peanut (7). Georgia Green was more susceptible to ELS and SSR than Virugard and Florida C-99R. While some variation in yield differences was noted among cultivars, none had a consistent yield advantage over the others.

Literature Cited

1. Bowen, K.L., A.K. Hagan, and J.R. Weeks. 1997. Number of tebuconazole applications for maximizing disease control and yield of peanut in Grower's Fields in Alabama. Plant Dis. 81:927-931.
2. 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.
3. Brenneman, T.B., W.D. Branch, and A.S. Csinos. 1990. Partial resistance of Southern Runner, *Arachis hypogaea*, to stem rot caused by *Sclerotium rolfsii*. Peanut Sci. 17:65-67.
4. Brenneman, T.B., and A.K. Culbreath. 1994. Utilizing a sterol demethylation inhibiting fungicide in an advisory program to manage foliar and soilborne diseases of peanut. Plant Dis. 78:866-872.
5. Brenneman, T.B., and A.P. Murphy. 1991. Activity of tebuconazole on *Cercosporidium personatum*, a foliar pathogen on peanut. Plant Dis. 75:699-703.
6. Brenneman, T.B., A.P. Murphy, and A.S. Csinos. 1991. Activity of tebuconazole on *Sclerotium rolfsii* and *Rhizoctonia solani*, two soilborne pathogens of peanut. Plant Dis. 75:744-747.
7. Brent, K.J., and D.W. Holloman. 1998. Fungicide resistance: The assessment of risk. Fungicide Resistance Action Committee Monograph No. 2. Global Crop Protection Federation, Brussels.
8. Cantonwine, 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.).
9. 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.
10. Culbreath, A.K., and T.B. Brenneman. 2001. Peanut leaf spot response to rates and application timing of BAS 500 fungicide. Phytopathol. 91:S201-202 (abstr.).
11. Culbreath, A.K., and T.B. Brenneman. 2002. Management of early leaf spot of peanut with pyraclostrobin as affected by rate and spray interval. Online. Plant Health Progress doi:10.1094/PHP-2002-1018-01-RS.
12. Culbreath, A.K., T.B. Brenneman, K. Bondari, K.L. Reynolds, and H.S. McLean. 1995. Late leaf spot, southern stem rot, and peanut yield responses to rates of cyproconazole and chlorothalonil applied alone and in combination. Plant Dis. 79:1121-1124.
13. Gorbet, D.W., and F.M. Shokes. 2002. Registration of 'C-99R' peanut. Crop Sci. 42:2207.
14. Grichar, W.J., B.A. Besler, and A.J. Jaks. 2000. Use of azoxystrobin for disease control on Texas peanut. Peanut Sci. 27:83-87.
15. Hagan, A.K., K.L. Bowen, H.L. Campbell, and M.E. Rivas-Davila. 2002. Peanut disease control field trials, 2001. Alabama Agric. Exp. Sta. Entomol. and Plant Pathol. Departmental Series No. 5. Auburn, AL. 40 p.
16. Hagan, A.K., K.L. Bowen, H.L. Campbell, and M.E. Rivas-Davila. 2003. Peanut disease control field trials, 2002. Alabama Agric. Exp. Sta. Entomol. and Plant Pathol. Departmental Series No. 6. Auburn, AL. 43 p.
17. Hagan, A.K., H.L. Campbell, K.L. Bowen, and L. Wells. 2003. Comparison of Headline 2.09EC and recommended fungicides for disease control and yield response in peanut. Alabama Agric. Exp. Sta. Bull. 650. Auburn, AL. 20 p.
18. Hagan, A.K., J.E. Everest, J.R. Weeks, and D. Hartzog. 2003. Peanut IPM. Alabama Coop. Ext. Sys. 2003IPM360. Auburn, AL. 24 p.
19. 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.
20. Hartzog, D.L., and J.F. Adams. 1988. Soil fertility experiments with peanuts in Alabama 1973-1986. Alabama Agric. Exp. Sta. Bull. 594. Auburn, AL. 39 pp.
21. LaPrade, J., D. Hartzog, J.R. Weeks, W.S. Gazaway, J.W. Everest, and A.K. Hagan. 1999. 1996 Alabama Statewide Peanut Producer Survey for the Alabama Pesticide Impact Assessment Program. Alabama Coop. Ext. Sys. Timely Information (TI-96). Auburn, AL. 7 p.
22. Rideout, S.L., T.B. Brenneman, and A.K. Culbreath. 2002. Peanut disease management utilizing an in-furrow treatment of azoxystrobin. Online. Plant Health Progress doi:10.1094/PHP-2002-0916-01-RS.
23. 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.
24. Smith, D.H., and R.H. Littrell. 1980. Management of peanut foliar diseases with fungicides. Plant Dis. 64:356-360.
25. Smith, O.D., and C.E. Simpson. 1995. Selection of peanut cultivars, pp. 19-22. *In* H.A. Melouk and F.M Shokes (eds.) Peanut Health Management. APS Press, St. Paul, MN.
26. Williams, E.J., and J.S. Drexler. 1981. A non-destructive method for determining peanut pod maturity. Peanut Sci. 8:134-141.