Comparison of Yield, Value, and Seed Quality Factors of Florunner and Southern Runner Peanut[1]

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ABSTRACT

Florunner and Southern Runner peanut (*Arachis hypogaea* L.) cultivars were evaluated for yield, market grade and seed infections by *Aspergillus* spp. following treatment with fungicide programs for control of peanut leaf spot (*Cercospora arachidicola* Hori and *Cercosporidium personatum* (Berk. & M. A. Curtis) Deighton) in field trials during 1989 and 1991. The fungicide treatments were: 1) nonsprayed control; 2) chlorothalonil 1.26 kg a.i./ha (seven total applications); 3) the same as treatment no. two except tebuconazole 0.25 kg a.i./ha was substituted for chlorothalonil at applications three and five in 1989; and 4) the same as treatment no. three except cyproconazole 0.23 kg a.i./ha, was used instead of tebuconazole in 1991. Yield, grade ($/m.t.), and total crop value ($/ha) were higher for both cultivars when treated with chlorothalonil and either tebuconazole or cyproconazole than when chlorothalonil was used alone. Southern Runner had significantly lower percent damaged kernels (DK) than Florunner. In addition, Florunner peanuts treated with either tebuconazole or cyproconazole had significantly reduced DK when compared to chlorothalonil alone. Other market grade factors were not significantly different ($P<0.05$) between cultivars when each was harvested at optimum maturity. Major colonizers of damaged kernels were *Aspergillus* spp., *Fusarium* spp., and *Rhizoctonia spp.* Fungicide treatment and cultivar effects on kernel colonization by *Aspergillus flavus* Link:Fr. varied between environments. Southern Runner had higher levels of *A. flavus* contamination in the undamaged kernels than Florunner in 1991, but not in 1989. Possible increased incidence of infection and colonization by *A. flavus* in Southern Runner require further study.

Key Words: *Aspergillus* spp., *Arachis hypogaea*, damaged kernels, seed quality.

Early and late leaf spot (caused by *Cercospora arachidicola* Hori and *Cercosporidium personatum* (Berk. & M. A. Curtis) Deighton, respectively), southern stem rot (caused by *Sclerotium rolfsii* Sacc.), and Rhizoctonia limb rot (caused by *Rhizoctonia solani* Kühn anastomosis group four (AG-4)), all cause considerable peanut (*Arachis hypogaea* L.) yield losses (3, 4, 19). Alabama peanut growers rely on fungicides and cultural practices to control these diseases. Disease

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management decisions including cultivar and fungicide selection affect not only disease control and yield, but also may change seed quality (13, 16, 20). Seed quality is a composite of market grade, *Aspergillus flavus* Link:Fr. infection, aflatoxin contamination and possibly other factors. Grade ($/m.t.) and yield determine the crop's value ($/ha). Aflatoxins are produced by *A. flavus* group fungi (*A. flavus* and *A. parasiticus* Speare).

Peanut disease management will change as new cultivars and fungicides become available. The cultivar Southern Runner was released in 1986 with moderate resistance to *C. personatum* and rust (*Puccinia arachidis* Speg.) (14). More recent data indicate resistance of Southern Runner to *S. rolfsii* (2, 6) offering growers a method to reduce yield losses and disease control costs. However, industry acceptance of Southern Runner has been slow due to shelling and market grade characteristics that differ from other commonly grown runner-type cultivars. The late maturity (145-160 days) of Southern Runner may also be contributing to acceptance of this cultivar.

Experimental ergosterol-biosynthesis-inhibiting (EBI) fungicides, such as tebuconazole (a-[2-(4-chlorophenyl)ethyl]-a-(1,1-dimethylethyl)-1H-1,2,4-triazole-1-ethanol) and cyproconazole [4-chlorophenyl-1-cycloprppylethyl-1-(1H-1,2,4-triazole-1-ethanol)butan-2-ol] have provided excellent control of peanut leaf spot, southern stem rot, and Rhizoctonia limb rot in field trials (8,10), but these materials are not currently registered for peanut in the United States. Tebuconazole has also reduced the incidence of seed colonizing fungi in field tests (5). The best method for utilization of EBI fungicides is still being debated. However, two to four applications of an EBI fungicide, like tebuconazole, at timings specific for control of southern stem rot and Rhizoctonia limb rot are considered likely control strategies.

While evaluating disease management strategies it is important to assess the impact they have on general product quality as well as yield and disease control. The objectives of this study were to: 1) compare grade characteristics, yield, and value of Southern Runner and Florunner peanut cultivars under various disease control strategies, and 2) compare seed colonization by *A. flavus* group fungi and *A. niger* of the two cultivars treated with the various fungicide programs.

Materials and Methods

Field Trials

Experiments were conducted at the Wiregrass Substation of the Alabama Agricultural Experiment Station, near Headland, AL during the 1989 and 1991 growing seasons. Registered Florunner and Southern Runner seed were planted in a field site in 1989 that had a rotational history of one year cultivated summer fallow (1988), and two years (1986, 1987) peanut prior to the test. In 1991, the field site had been planted in peanut the previous two years. Each cultivar was planted in single rows 0.9 m apart at a seeding rate of 112 kg/ha. Planting date was 8 May, in both 1989 and 1991. Aldicarb [2-methyl-2-(methylthio)propionaldehye-O-(methylcaramoyl)oxime] was applied in both years as Temik® 15G (3.4 kg a.i./ha, Rhone Poulenc, Research Triangle Park, NC) in a 30-cm band at-planting. No additional insecticides were applied in 1989. In 1991, methomyl (S-methyl-N-[(methylcaramoyl)oxy]-thioacetimidate) was applied as Lannate® 1.8L (0.26 kg a.i./ha, E. I. Du Pont De Nemours and Co., Wilmington, DE) on 19 Jun and 7 Aug. Weed control was according to Alabama Cooperative Extension Service recommendations (1). Supplemental irrigation was applied as needed to maintain plant growth. A randomized complete block-split plot design was utilized in both years with six replications per fungicide treatment representing whole plots and cultivars as subplots. Whole-plots were 16 12-m-long rows in 1989, and eight 10.6-m-long rows in 1991. Subplots were eight rows in 1989, and four rows in 1991. Treatments were: 1) nonsprayed control; 2) chlorothalonil (tetrachloroisophthalonitrile) applied as Bravo 720® (1.26 kg a.i./ha, ISK Biotech Corp. Mentor, OH) on a 14-day schedule beginning at 37 days after planting (DAP) in 1989, and 40 DAP in 1991 (seven total applications); 3) the same as treatment no. two except, tebuconazole (Folicur® 3.6F, 0.25 kg a.i./ha, Miles, Kansas City, MO) was substituted for chlorothalonil at sprays three (67 ± 2 DAP), and five (95 ± 1 DAP). Induce® surfactant (0.5% v/v, Helena Chemical Co., West Helena, AR) was added to all tebuconazole applications; and 4) the same as treatment no. three except in 1991, cyproconazole (Alto® 100SL, 0.23 kg a.i./ha, Sandoz AG, Des Plains, IL) was used instead of tebuconazole. This substitution was made using a similar triazole class EBI fungicide because of lack of availability of tebuconazole. Fungicide treatments were applied using a tractor-mounted boom sprayer with three Teejet® TX8 nozzles (Spraying Systems Co., Wheaton, IL) per row delivering 140.2 L of liquid per ha at 413.4 kPa.

Assessment of Yield, Disease and Grade Components

Both cultivars were harvested at maturity. Florunner was dug at 130 and 131 DAP, and Southern Runner was dug two weeks later in 1989 and 1991, respectively. Florunner maturity was based on the pod maturity profile (23). Plants were mechanically inverted, air-dried 3-4 days, and pods were mechanically harvested and dried to approximately 10% moisture before weighing.

Number of southern stem rot loci were recorded on 12 Sep 1989, and 5 Sep 1991. One stem rot locus consisted of ≤30 cm of stem rot infected plants in a row (19). Rhizoctonia limb rot was assessed immediately after peanuts were dug and inverted using different methods in 1989 and 1991. The first year, a visual rating of limb rot incidence was made of each plot on a 1 to 5 scale, where: 1 = 0% limbs with limb rot lesions, and 5 = 100% limbs with limb rot lesions. The second year, limb rot incidence was assessed by removing five randomly selected limbs (branches) from each plot. Number of limb rot lesions was recorded for the first 30 cm from the base of each limb.

Pod samples of 500 grams were processed according to Federal State Inspection Methods (22) for obtaining percentages of total sound mature kernels (TSMK), extra large kernels (ELK), damaged kernels (DK), and other kernels (OK). Total sound mature kernels included both sound mature (SMK) and sound split kernels. Determinations of SMK and ELK percentages were from slotted peanut grading screens as follows: SMK riding a 0.64 x 2.54 cm screen; and ELK riding a 0.85 x 2.54 cm screen. The dollar value per metric ton was calculated based on U.S. loan support schedule for each respective year. Total crop values of harvested peanuts per hectare were based on yield and value per metric ton.

Analysis of Seed infection

In both years, 25 undamaged SMK and 25 DK seed from each plot were tested for fungal infections. Seeds were surface-sterilized by soaking in an aqueous solution of 0.5% sodium hypochlorite for 1 min., rinsed twice in sterile distilled water. Then seed were plated on Griffin's (M3S1B) medium (15). Five surface-sterilized seed were placed on each plate. The plates were incubated at 35 C in the dark and colonies of fungi were recorded in 4-7 days. Additional seed mycoflora determinations of damaged kernels were made using the above protocol except for nonselective potato dextrose agar medium and incubation at 30 C for 4-10 days.

Statistical Analysis

Analysis of variance (ANOVA) was performed separately on data from each year. Arcsine transformed data were used for analysis of variance determinations for both seed colonization and market grade factors (21). Other data were not transformed due to a lack of heterogeneity of variance. Means for fungicide treatments and cultivars were compared using Fisher's protected least significant difference (9, 21). All differences referred to in text were significant at $P \leq 0.05$.

Results and Discussion

Yield, value, and seed quality differed among years due to environmental conditions. In the 1989 growing season rainfall was near normal except for heavy rains from cracking to early pod fill; 1991 had sufficient moisture through early pod fill with little rainfall later in the growing season. Because of these differences in the above years, data are presented separately. The test area was irrigated four times during 1989, while in 1991, no irrigation was required.

Yield, Disease and Value

The mean total pod yields of all treatments and cultivars were 4,271 and 3,852 kg/ha, in 1989 and 1991, respectively.

Across whole plot treatments, pod yields were significantly greater for Southern Runner than Florunner in 1991 (Table 1). No differences in pod yields between the two cultivars was detected in 1989. Among fungicide treatments, application of either tebuconazole or cyproconazole increased yields of each cultivar an average of 25.8% over chlorothalonil alone (Table 1).

Southern stem rot incidence was lower in Florunner plots treated with a combination of chlorothalonil and either tebuconazole or cyproconazole as compared to chlorothalonil alone in both years (Table 2). Southern Runner plots averaged 73% fewer stem rot loci than Florunner plots over the two-year period. The resistance of Southern Runner to stem rot has been previously reported (2, 6). Rhizoctonia limb rot incidence was moderately severe in both years. Rhizoctonia limb rot ratings were

Table 1. Mean pod yield (kg/ha) and crop value ($/metric ton) of Florunner (FR) and Southern Runner (SR) peanut cultivars treated with chlorothalonil alone or in combination with either cyproconazole or tebuconazole during 1989 and 1991.

			Yield (kg/ha)[w]				Unit value ($/metric ton)			
			1989		1991		1989		1991	
Treatment	Rate (kg a.i./ha)	No. Sprays	FR	SR	FR	SR	FR	SR	FR	SR
Nonsprayed	--	0	2,900	3,543	2,704	3,652	665.16	707.69	670.96	732.72
Chlorothalonil	1.26	7	3,994	4,330	3,422	4,174	610.26	678.88	683.36	699.59
Chlorothalonil	1.25	5	5,323	5,536	NT	NT	708.82	696.82	NT	NT
Tebuconazole	0.25	2								
Chlorothalonil	1.26	5	NT	NT	4,492	4,670	NT	NT	728.49	727.20
Cyproconazole	0.23	2								
LSD ($P \leq 0.05$)[x]			NS		643		NS		NS	
LSD ($P \leq 0.05$)[y]			664		684		49.06		NS	
Fungicide treatment			0.0001[z]		0.0001		0.0029		NS	
Cultivar			NS		0.0001		NS		NS	
Fungicide treatment X cultivar			NS		0.0244		NS		NS	

[w] Average of six replications. Each cultivar was mechanically inverted at the optimum harvest date, Florunner was dug and inverted at 130 and 131 DAP in 1989 and 1991, respectively; and Southern Runner was dug and inverted at 144 and 145 DAP in 1989 and 1991, respectively. NT = not tested.
[x] For comparison of cultivars within treatments.
[y] For comparison of treatments within cultivars.
[z] *P* values for analysis of variance. NS = not significant.

Table 2. Incidence of southern stem rot and Rhizoctonia limb rot on Florunner (FR) and Southern Runner (SR) peanut cultivars treated with chlorothalonil alone or in combination with either cyproconazole or tebuconazole during 1989 and 1991.

			Stem rot				Limb rot			
			1989[t]		1991[u]		1989[v]		1991[w]	
Treatment	Rate (kg a.i./ha)	No. Sprays	FR	SR	FR	SR	FR	SR	FR	SR
Nonsprayed	--	0	7.0	1.3	4.7	1.0	3.2	3.3	4.7	8.3
Chlorothalonil	1.26	7	14.3	4.0	8.0	2.8	3.5	3.4	4.3	6.8
Chlorothalonil	1.25	5	4.3	0.7	NT	NT	3.0	3.0	NT	NT
Tebuconazole	0.25	2								
Chlorothalonil	1.26	5	NT	NT	1.5	0.5	NT	NT	4.5	3.2
Cyproconazole	0.23	2								
LSD ($P \leq 0.05$)[x]			3.2		2.9		NS		3.5	
LSD ($P \leq 0.05$)[y]			3.1		3.3		0.34		NS	
Fungicide treatment			0.0001[z]		0.0001		0.0001		NS	
Cultivar			0.0001		0.0001		NS		0.0001	
Fungicide treatment X cultivar			0.0107		NS		NS		NS	

[t] Incidence of southern stem rot (loci per 24 m) was assessed on 12 Sep 1989. Average of six replications. NT = not tested.
[u] Incidence of southern stem rot (loci per 21 m) was assessed on 5 Sep 1991. Average of six replications.
[v] Incidence of Rhizoctonia limb rot was assessed on 29 Sep 1989 (Florunner), and 9 Oct 1991 (Southern Runner), using a 1-5 rating scale where 1=0% of limbs with lesions and 5=100% of limbs with lesions. Average of six replications.
[w] Incidence of Rhizoctonia limb rot was assessed on 30 Sep 1991 (Florunner), and 9 Oct 1991 (Southern Runner) by counting the number of limb rot lesions on five randomly selected lateral limbs (branches) per plot. Average of six replications.
[x] For comparison of cultivars within treatments. NS = not significant.
[y] For comparison of treatments within cultivars.
[z] *P* values for analysis of variance.

lower for plots treated with a combination of tebuconazole and chlorothalonil compared to chlorothalonil alone in 1989 (Table 2). No differences in Rhizoctonia limb rot incidence were found among treatments in 1991. The suppression of southern stem rot and Rhizoctonia limb rot by cyproconazole and tebuconazole fungicides are associated with the yield differences among fungicide treatments (Table 1). Numerous field studies (4, 8, 10) document yield increases obtained with EBI fungicide use due to suppression of southern stem rot and Rhizoctonia limb rot.

Unit value ($/m.t.) was increased for Florunner plots treated with the combination of tebuconazole and chlorothalonil as compared to chlorothalonil alone. Florunner plots receiving only chlorothalonil were lower in both unit value ($/m.t.) and total crop value ($/ha) when compared to those treated with a combination of chlorothalonil and tebuconazole (Tables 1 and 3). Grade data show that deductions ($/m.t.) for high levels of damaged kernels were reducing the unit value of the Florunner plots treated with chlorothalonil alone (Table 4).

Grade Components

Results of peanut market grade determinations are shown in Tables 3 and 4. The percent of ELK and TSMK were not different between cultivars (Tables 3 and 4). Knauft *et al.* (18) showed similar results when comparing TSMK of Florunner and Southern Runner peanuts. In both trials, DK were lower for Southern Runner than Florunner peanuts (Table 4). Treatment with either of the EBI fungicides

Table 3. Mean value ($/ha) and percentages of total sound mature kernels (TSMK) of Florunner (FR) and Southern Runner (SR) peanut cultivars treated with chlorothalonil alone or in combination with either cyproconazole or tebuconazole during 1989 and 1991.

Fungicide Treatment	Rate (kg a.i./ha)	No. Sprays	Crop value ($/ha)[w] 1989 FR	1989 SR	1991 FR	1991 SR	%TSMK[y] 1989 FR	1989 SR	1991 FR	1991 SR
Nonsprayed	–	0	1,995.19	2,376.29	1,452.96	2,175.45	70.7	73.6	69.1	72.6
Chlorothalonil	1.26	7	2,538.47	3,017.79	1,898.23	2,298.94	67.5	71.0	68.8	68.8
Chlorothalonil	1.25	5	3,780.36	3,972.50	NT[x]	NT	73.6	72.1	NT	NT
Tebuconazole	0.25	2								
Chlorothalonil	1.26	5	NT	NT	2680.58	2820.58	NT	NT	72.0	71.4
Cyproconazole	0.23	2								
LSD (P≤0.05)[x]			NS		NS		NS		NS	
LSD (P≤0.05)[y]			719.85		605.74		2.5		3.6	
Fungicide treatment			0.0004[z]		0.0054		0.0194		0.0326	
Cultivar			NS		NS		NS		NS	
Fungicide treatment X cultivar			NS		NS		NS		NS	

[w] Average of six replications. Using arcsine transformed values, analyses of variance were performed separately for each grade variable and year. NT = not tested.
[x] For comparison of cultivars within treatments.
[y] For comparison of treatments within cultivars.
[z] *P* values for analysis of variance.

Table 4. Mean grade percentages for damaged kernels (DK) and extra large kernels (ELK) for Florunner (FR) and Southern Runner (SR) peanut cultivars treated with chlorothalonil alone or in combination with either cyproconazole or tebuconazole during 1989 and 1991.

Fungicide Treatment	Rate (kg a.i./ha)	No. Sprays	% DK[w] 1989 FR	1989 SR	1991 FR	1991 SR	%ELK 1989 FR	1989 SR	1991 FR	1991 SR
Nonsprayed	–	0	4.6	2.5	5.3	2.4	22.3	25.6	10.0	11.9
Chlorothalonil	1.26	7	6.1	3.0	4.4	2.7	23.2	24.6	11.2	10.9
Chlorothalonil	1.25	5	2.1	2.3	NT	NT	28.4	25.1	NT	NT
Tebuconazole	0.25	2								
Chlorothalonil	1.26	5	NT	NT	2.6	1.6	NT	NT	10.2	11.6
Cyproconazole	0.23	2								
LSD (P≤0.05)[x]			1.4		1.3		NS		NS	
LSD (P≤0.05)[y]			1.8		1.5		NS		NS	
Fungicide treatment			0.0381[z]		0.0182		NS		NS	
Cultivar			0.0412		0.0016		NS		NS	
Fungicide treatment X cultivar			NS		NS		NS		NS	

[w] Average of six replications. Using arcsine transformed values, analyses of variance were performed separately for each grade variable. NT = not tested.
[x] For comparison of cultivars within treatments. NS = not significant.
[y] For comparison of treatments within cultivars.
[z] P values for analysis of variance.

tested also improved peanut grade results. Florunner peanuts treated with tebuconazole and chlorothalonil had higher TSMK and lower DK than peanuts treated with chlorothalonil alone. The combination of chlorothalonil and cyproconazole also reduced DK in Florunner in comparison to chlorothalonil alone (Table 4). In both trials damaged kernels typically were caused by fungi causing seed discoloration and/or decay.

Seed Infection

The incidence of seed infection with *Aspergillus* spp. were analyzed for both damaged (DK) and undamaged seed (SMK). Similar trends among treatments and cultivars were noted for seed colonization of both damaged and undamaged kernels (Tables 5 and 6). Overall, the incidence of fungal contamination was greater in damaged than undamaged kernels. Damaged kernels have been reported to have higher levels of colonization by *A. flavus* group fungi and higher aflatoxin content (11, 12). Undamaged kernels colonized by *A. flavus* group fungi increased from 2.5% in 1989 to 19.6% in 1991 and increased in damaged kernels from 3.2 to 34.7% for 1989 and 1991, respectively. This difference may be explained partially by environmental conditions late in the 1991 growing season that were closer to optimum for *Aspergillus* activity (12). The total rainfall and irrigation during August and September was 10.4 and 12.9 cm in 1989, and 8.3 and 4.6 cm in 1991. In addition, the rotation history may have affected inoculum levels. In 1989, the field site had been cultivated fallow the previous

Table 5. Mean fungal colonization by *Aspergillus* spp. of sound mature kernels of Florunner (FR) and Southern Runner (SR) peanut cultivars treated with chlorothalonil alone or in combination with either cyproconazole and tebuconazole during 1989 and 1991.

Fungicide Treatment	Rate (kg a.i./ha)	No. Sprays	% *A. flavus*[W]				% *A. niger*			
			1989		1991		1989		1991	
			FR	SR	FR	SR	FR	SR	FR	SR
Nonsprayed	–	0	3.3	2.7	12.8	28.0	26.7	15.3	22.4	22.7
Chlorothalonil	1.26	7	4.4	0.0	17.4	21.2	24.4	20.0	28.5	33.6
Chlorothalonil Tebuconazole	1.25 0.25	5 2	0.0	4.4	NT	NT	4.2	2.7	NT	NT
Chlorothalonil Cyproconazole	1.26 0.23	5 2	NT	NT	11.3	26.8	NT	NT	31.3	17.0
LSD ($P \leq 0.05$)[X]			NS		11.1		NS		NS	
LSD ($P \leq 0.05$)[Y]			NS		NS		NS		NS	
Fungicide treatment			NS[Z]		NS		0.0495		NS	
Cultivar			NS		0.0010		NS		NS	
Fungicide treatment X cultivar			NS		NS		NS		NS	

[W] Results of fungal isolations on M3S1B medium, 25 seed/plot, 5 seed/plate. Average of six replications. Using arcsine transformed values, analyses of variance were performed separately for each *Aspergillus* spp. NT = not tested.
[X] For comparison of cultivars within treatments. NS = not significant.
[Y] For comparison of treatments within cultivars.
[Z] *P* values for analysis of variance.

Table 6. Mean fungal colonization by *Aspergillus* spp. of damaged kernels (DK) of Florunner (FR) and Southern Runner (SR) peanut cultivars treated with chlorothalonil alone or in combination with either cyproconazole and tebuconazole during 1989 and 1991.

Fungicide Treatment	Rate (kg a.i./ha)	No. Sprays	% *A. flavus*[X]				% *A. niger*			
			1989		1991		1989		1991	
			FR	SR	FR	SR	FR	SR	FR	SR
Nonsprayed	–	0	5.0	2.0	22.0	31.3	37.1	16.0	28.0	13.3
Chlorothalonil	1.26	7	3.3	2.0	25.7	30.6	10.0	18.0	40.6	29.1
Chlorothalonil Tebuconazole	1.25 0.25	5 2	2.5	4.0	NT[X]	NT	5.0	8.0	NT	NT
Chlorothalonil Cyproconazole	1.26 0.23	5 2	NT	NT	35.0	52.5	NT	NT	31.7	30.0
LSD ($P \leq 0.05$)[X]			NS		NS		NS		NS	
LSD ($P \leq 0.05$)[Y]			NS		NS		NS		NS	
Fungicide treatment			NS[Z]		NS		NS		NS	
Cultivar			NS		NS		NS		NS	
Fungicide treatment X cultivar			NS		NS		NS		NS	

[W] Results of fungal isolations on M3S1B medium, 25 seed/plot, 5 seed/plate. Average of six replications. Using arcsine transformed values, analyses of variance were performed separately for each *Aspergillus* spp. NT = not tested.
[X] For comparison of cultivars within treatments. NS = not significant.
[Y] For comparison of treatments within cultivars.
[Z] *P* values for analysis of variance.

summer, while the 1991 field site had been planted in peanuts the previous year.

The effect of cultivar on colonization by *A. flavus* group fungi was not consistent between environments. The 1991 results showed higher levels of *A. flavus* colonization of undamaged kernels for Southern Runner than were observed for Florunner, while there were no observed differences in 1989 (Table 5). However, no differences were detected for comparison of cultivars treated with chlorothalonil. The reason for this difference is unknown and will need to be studied further to decide if Southern Runner is more susceptible than Florunner to *A. flavus* infection and, if so, how this might relate to aflatoxin production. Wilson *et al.* (24) reported that, based on preliminary results, Southern Runner may have a higher level of aflatoxin accumulation than Florunner under the same environmental conditions. The longer time to maturity for Southern Runner may allow for both greater *A. flavus* infection and aflatoxin contamination if conditions are favorable during the preharvest period. Application of EBI fungicides had little or no effect on *A. flavus* colonization (Table 5) confirming the report of Bowen *et al.* (5) who observed no reduction in *A. flavus* group fungi following application of tebuconazole.

Results of colonization studies, for undamaged seed (SMK), revealed a lack of differences between cultivars for %*A. niger* colonization (Table 5). However, significant fungicide treatment effects for % *A. niger* colonization of were detected in 1989. Analysis of main treatment effects (across cultivars) showed that %*A. niger* colonization was reduced from 21.7% to 3.4% (LSD (P=0.05)= 16.0), for chlorothalonil alone and chlorothalonil and tebuconazole fungicide treatments, respectively. Effects of cultivar and fungicide treatment were not significant for *A. niger* colonization of damaged seed (DK) (Table 6). Diniconazole, also an EBI fungicide, has been reported to reduce peanut seed colonization by *A. niger* in Georgia (7). A second report (5) found no differences in *A. niger* colonization of kernels from plots treated with EBI fungicides.

The fungi most frequently isolated from damaged kernels using a nonselective medium were *Aspergillus* spp., *Fusarium* spp. and *Rhizoctonia spp.*; followed by *Penicillium* spp., and *Rhizopus* spp. in only small amounts. Fungicide treatments did not change the relative importance of the different fungi on damaged kernels. Hanlin (17) reported similar results of fungal isolations from peanut seed in Georgia.

Summary and Conclusions

Our results show that Southern Runner was not significantly different in the market grade characteristics, though it may have better total seed quality due to fewer damaged kernels than Florunner. In the two years evaluated, grade ($/m.t.) reductions due to damaged kernels significantly lowered the crop value of Florunner. Higher levels of *A. flavus* colonization of Southern Runner kernels during 1991 suggest that further investigation is needed to determine if differences exist in the rate of *A. flavus* infection and colonization of Florunner and Southern Runner peanut cultivars.

The incorporation of EBI fungicides, such as tebuconazole and cyproconazole, in a chlorothalonil leaf spot management program reduced the amount of DK, and increased yield, unit value ($/m.t.), and total crop value ($/ha) in comparison to programs without EBI fungicides. This provides evidence that these experimental fungicides have the important nontarget effect of reducing damaged kernels caused by fungi, besides controlling important foliar and soilborne fungal pathogens of peanut (4, 8, 10). However, these EBI fungicides have currently not obtained registration in the United States for use on peanut.

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Literature Cited

1. Alabama Cooperative Extension Service. 1990. Peanut Insect, Disease, Nematode, and Weed Control Recommendations. Cir. ANR-360. 11 pp.
2. Arnold, J. E., R. K. Sprenkel, D. W. Gorbet, and J. King. 1988. Resistance of the peanut variety Southern Runner to white mold, *Sclerotium rolfsii*. Proc. Amer. Peanut Res. Educ. Soc. 20:34. (Abstr.).
3. Backman, P. A., and M. A. Crawford. 1984. Relationship between yield loss and severity of early and late leafspot diseases of peanut. Phytopathology 74:1101-1103.
4. Barnes, J. S., A. S. Csinos, and J. E. Hook. 1990. Effects of fungicides, cultivars, and environment on Rhizoctonia limb rot of peanut. Plant Dis. 74:671-676.
5. Bowen, K. L., and P. A. Backman. 1990. Fungicide effectiveness for control of fungal invasion and aflatoxin contamination of peanut kernels. Proc. Amer. Peanut Res. Educ. Soc. 22:32. (Abstr.).
6. 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. 18:62-65.
7. Brenneman, T. B., D. M. Wilson, R. W. Beaver, and A. P. Murphy. 1990. Effects of diniconizole on soilborne pathogens, aflatoxin formation, plant growth, and pod yields of irrigated and nonirrigated peanuts. Proc. Amer. Peanut Res. Educ. Soc. 22:44. (Abstr.).
8. Brenneman, T. B., and D. R. Sumner. 1989. Effects of chemigation and conventionally sprayed tebuconazole and tractor traffic on peanut diseases and pod yields. Plant Dis. 73:843-846.
9. Carmer, S. G., and Walker, W. M. 1982. Formulae for least significant differences for split-plot, split-block, and split-split-plot experiments. Tech. Report No. 10 University of Illinois, Champaign, IL. 8 pp.
10. Culbreath, A. K., T. B. Brenneman, F. M. Shokes, A. S. Csinos, and H. S. McLean. 1992. Tank-mix application of cyproconazole and chlorothalonil for control of foliar and soilborne diseases of peanut. Plant Dis. 76:1241-1245.
11. Davidson, J. I., Jr., C. E. Holaday, and C. T. Bennett. 1981. Separation and removal of aflatoxin contaminated kernels in peanut shelling plants: Part I. A case study. Proc. Amer. Peanut Res. Educ. Soc. 13:29-45.
12. Deiner, U. L., R. E. Pettit, and R. J. Cole. 1982. Aflatoxins and other mycotoxins in peanuts. pp. 486-519 *In* Peanut Science and Technology. H. E. Pattee, and C. T. Young (eds.), Amer. Peanut Res. Educ. Soc., Yoakum, TX.
13. Gorbet, D. W., D. A. Knauft, and F. M. Shokes. 1990. Response of peanut genotypes with differential levels of leafspot resistance to fungicide treatments. Crop Sci. 30:529-533.
14. Gorbet, D. W., A. J. Norden, F. M. Shokes,and D. A. Knauft. 1986. Southern Runner: a new leafspot resistant peanut variety. Univ. Florida Agr. Exp. Stn., Circular S-324. 13 pp.
15. Griffin, G. J., and K. H. Garren. 1974. Population levels of *Aspergillus flavus* and the *A. niger* group in Virginia peanut field soils. Phytopathology 64:322-325.
16. Hammond, J. M., P. A. Backman, and J. A. Lyle. 1976. Peanut foliar fungicides: Relationships between leafspot control and kernel quality. Peanut Sci. 3:70-72.
17. Hanlin, R. T. 1970. Invasion of peanut fruits by *Aspergillus flavus* and other fungi. Mycopathol. Myco. Appl. 40:341-348.
18. Knauft, D. A., D. W. Gorbet., and A. J. Norden. 1988. Yield and market quality of seven peanut genotypes as affected by leafspot disease and harvest date. Peanut Sci. 15:9-13.
19. Rodríguez-Kábana, 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.
20. Sanders, T. H., D. W. Gorbet, F. M. Shokes, E. J. Williams, and J. L. McMeans. 1989. Effect of chlorothalonil application frequency on quality factors of peanuts (*Arachis hypogaea*). J. Sci. Food Agric. 49:281-290.
21. Steel, R. G. D., and J. H. Torrie. 1980. Principles and Procedures of Statistics. McGraw-Hill, New York. 633 pp.
22. U. S. Department of Agriculture. 1986. Farmers Stock Peanuts Inspection Instructions. Agricultural Marketing Service, Washington, DC. 93 pp.
23. Williams, E. J., and J. S. Drexler. 1981. A non-destructive method of determining peanut pod maturity. Peanut Sci. 8:134-141.
24. Wilson, D. M., T. B. Brenneman, R. W. Beaver, A. K. Culbreath, J. A. Baldwin, and J. P. Beasley. 1991. Observations on aflatoxin contamination in Southern Runner in 1990. Proc. Amer. Peanut Res. Educ. Soc. 23:35. (Abstr.).

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