Evaluation of Runner Peanut Cultivars and Advanced Georgia Breeding Lines for Yield and Resistance to Late Leaf Spot Under Three Disease-Management Programs[1]

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ABSTRACT

Pod yield and resistance to late leaf spot, caused by *Cercosporidium personatum* (Berk. & M.A. Curtis) Deighton, were evaluated on nine advanced Georgia breeding lines and five cultivars of peanut (*Arachis hypogaea* L.): Florunner, Georgia Runner, GK-7, Southern Runner, and Sunrunner. Peanuts were grown at Tifton, GA during 1987-1988 under three leaf spot programs using diniconazole at 0.14 kg/ha with Agri-Dex® (0.5% v/v): 1) unsprayed, 2) 28-day, and 3) 14-day spray schedule. Final disease ratings (Florida 1 to 10 scale) were made approximately 1-wk prior to harvest. In unsprayed plots, Southern Runner and GaT-2566 had significantly lower leaf spot disease ratings than Florunner, GK-7, Sunrunner, and Georgia Runner. Across all fungicide treatments, yields of Georgia Runner averaged significantly higher than the four other cultivars and GaT-2566. Average yields were 5111, 4497, 4433, 4404, 4377, and 4022 kg/ha for Georgia Runner, Southern Runner, GK-7, GaT-2566, Sunrunner, and Florunner, respectively. In addition to low yield potential of GaT-2566, it was susceptible to Rhizoctonia limb rot (*R. solani* Kühn, anastomosis group 4). However, Georgia Runner was found to have moderate tolerance to late leaf spot and excellent yield potential.

Key Words: Fungicides, diniconazole, groundnut (*Arachis hypogaea*), *Cercosporidium personatum*, disease tolerance, and yield evaluation.

Leaf spot diseases, caused by *Cercospora arachidicola* S. Hori (early leaf spot) and *Cercosporidium personatum* (Berk. & M.A. Curtis) Deighton (late leaf spot), are destructive diseases wherever peanuts (*Arachis hypogaea* L.) are grown. Annual losses of yield attributed to leaf spot diseases, primarily late leaf spot in Georgia, have averaged 5% even with use of protectant fungicides. Without extensive use of fungicides, production of a crop would be uneconomical as losses would likely approach 50% (19). Peanut production in the United States has depended mainly on routine applications of chlorothalonil due to its effectiveness (18), either on a calendar or advisory schedule (16).

Of the runner-type peanuts grown in the southeastern United States, Florunner was released in 1969 and has been the predominant peanut cultivar for the past 20 years. Sunrunner was released by the University of Florida in 1982 and is similar to Florunner. GK-7 was privately released by AgraTech Seeds, Inc. around 1984. It is also similar to Florunner but has darker green foliage and more prominent main stems.

Until the release of Southern Runner in 1984 (11), no commercial cultivars were available with meaningful resistance to late leaf spot. The level of resistance in Southern Runner is moderate and fungicide applications are still needed to obtain optimum yields. This cultivar also has been found to have partial resistance to southern stem rot (*Sclerotium rolfsii* Sacc.) (4). Southern Runner differs from Florunner in having a flatter canopy, lighter green foliage, and slightly smaller seeds with tan testae. This cultivar matures about 2 to 3 wk later than Florunner. Poor acceptance of Southern Runner by shellers and processors has confined its planting to a small percentage of the peanut crop. Therefore, Southern Runner has not significantly reduced the amount of fungicide used in the southeast for leaf spot control.

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A common goal of various peanut breeding programs is to produce a commercially acceptable cultivar with a high level of resistance to leaf spot diseases. Unfortunately, many breeding lines with resistance to leaf spot have unacceptably poor yields or other undesirable characteristics. Georgia Runner is a runner-type peanut cultivar recently released by the Georgia Agricultural Experiment Stations (2). It has been found to be highly productive in state yield tests in comparison to other standard cultivars (3).

Chemical control strategies for leaf spot management are expected to change in the next few years as some of the ergosterol biosynthesis inhibiting (EBI) fungicides are registered for control of foliar and soil-borne diseases. Although no longer being developed for use on peanut, diniconazole is a highly active EBI fungicide representative of the triazoles. Other fungicides possessing similar chemistry are propiconazole (Tilt®) and tebuconazole (Folicur®). Both were recently registered for use on peanut in the United States. Widespread use of EBI fungicides would dramatically affect management of diseases of peanut because of their high level of activity against numerous fungal pathogens.

Diniconazole (mainly the S(+) isomer) has strong plant-growth regulating (PGR) activity on peanut (15). After the cancellation of daminozide (Kylar®) for use on peanut for suppression of vine growth, other chemicals with similar activity have been investigated. Use of such PGR materials have the potential to increase peanut yield by controlling excess vine growth and reducing harvest losses.

The combination of a peanut cultivar with a moderate level of resistance to early and late leaf spot and the judicious use of EBI fungicides could reduce the amount of fungicides needed to produce an economical crop of peanut. This dual approach to leaf spot control could reduce the cost of disease control (7) and the loss of yield due to plant injury during application (6). Other benefits of some EBI fungicides include the control of soil-borne diseases such as southern stem rot (*S. rolfsii*) and Rhizoctonia limb rot (*R. solani* Kühn, anastomosis group 4) (5,9).

Objectives of this study were to evaluate and compare nine advanced Georgia breeding lines, the recently released cultivar Georgia Runner, and four standard peanut cultivars for leaf spot resistance, yield potential, and response to a PGR compound under three spray programs. Diniconazole was selected as a representative of the EBI fungicides due to its strong activity against leaf spot diseases and high level of PGR activity.

Materials and Methods

Field Trials.

Field trials were conducted at the Coastal Plain Experiment Station in Tifton, GA during 1987 and 1988. The soil type was a Tifton loamy sand (fine-loamy, siliceous, thermic Plinthic Kandiudult, pH 6.0). Prior to this trial, the land was planted to peanut for two consecutive years after one year of corn. Each year the land was moldboard plowed and disked. Fertilizer was applied as needed according to soil test analysis. Peanut seed of nine advanced breeding lines and five cultivars were planted in May of each year and managed according to standard practices for peanut production in Georgia (14), except for leaf spot control. Applications of irrigation water (2.5 cm) were made as needed: two in 1987, one in 1988.

Of the four standard cultivars tested, Florunner, GK-7, and Sunrunner served as susceptible checks for leaf spot. Southern Runner was included as a partially resistant cultivar. Georgia Runner and the nine advanced breeding lines chosen for additional evaluation had exhibited high yield in other field trials. These lines were part of the Georgia peanut breeding program and consisted of GaT-2566, -2637, -2640, -2641, -2642, -2643, -2645, -2646, and -2648. Georgia Runner was evaluated as GaT-2636.

Experimental design was a split plot in which main-plot treatments were genotypes and sub-plot treatments were foliar disease programs. Whole plots were randomly arranged in complete blocks with four replications. Individual sub-plots were single beds 4.57 m long with two rows per bed spaced 0.81 m within a bed and 1.02 m between rows in adjacent beds. To increase levels of inoculum, two non-sprayed border rows of Florunner peanut were grown between whole plots.

Applications of Diniconazole for Control of Late Leaf Spot.

Diniconazole [(E)-1-(2,4-dichlorophenyl)-4,4-dimethyl-2-(1,2,4-triazol-1-yl)-1-penten-3-ol)] was applied at 0.14 kg/ha as Spotless® 25W from Valent USA Corp., Walnut Creek, CA. This EBI fungicide was tank-mixed with Agri-Dex® (0.5% v/v), a non-ionic surfactant and spray oil (Helena Chem. Co., Memphis, TN). The three treatments for control of leaf spot were: 1) non-sprayed, 2) 28-day schedule, and 3) 14-day schedule. Fungicides were applied using a CO_2 back-pack sprayer and boom with three D2-13 nozzle tips per row at a level to provide complete coverage of plants. Nozzles were calibrated to deliver 141 L/ha at 345 kPa with a ground speed of 4.35 km/hr. In 1987, both the 14- and 28-day schedule treatments were applied on 16 Jun, 13 Jul, 10 Aug, and 6 Sep. Additional 14-day treatments were applied on 29 Jun, 27 Jul, 24 Aug, and 21 Sep. In 1988, both spray treatments were applied on 22 Jun, 20 Jul, 17 Aug, and 15 Sep, and the additional 14-day treatments were applied on 6 Jul, 3 Aug, and 31 Aug.

Disease and Yield Evaluations.

Disease observations were made throughout the growing season, and two leaf spot ratings were made each year: 21 Aug and 30 Sep 1987, and 26 Aug and 4 Oct 1988. The final leaf spot rating was made approximately 1 wk before harvest. The subjective Florida 1 to 10 leaf spot scoring system (1= no disease, 10 = defoliated and killed by leaf spot) was used (8). Examination of incubated lesions from leaflets indicated that *C. personatum* was the predominant pathogen (>95%) during the 2-yr field evaluation. The PGR effects of diniconazole were evaluated by measuring the length (cm) of 10 main stems per sub-plot collected prior to harvest. Data were recorded as the average of the 10 measurements.

Peanut plots were dug and harvested during the first week of October, except for Southern Runner which was dug 1 wk later in 1987. Digging times were a compromise among early dates to prevent large yield losses in untreated plots and late dates to allow for maximum yield in plots treated with diniconazole on a 14-day schedule. Any additional delays in digging plots of Southern Runner or other late maturing genotypes would have resulted in complete defoliation and substantial yield losses in untreated plots. Yield was based on weight of harvested peanuts, and weights were adjusted to reflect a moisture content of 7% (w/w). Data were analyzed by analyses of variance, and where appropriate, Fisher's least significant difference test was used for mean separation (SAS Institute, Inc., Cary, NC).

Results

Evaluation of Peanut Genotypes Against Leaf Spot.

By the latter half of August 1987 and 1988, the late leaf spot epidemic had not achieved severe levels of defoliation. Approximately one month later, defoliation was evident in most plots, except those treated on a 14-day schedule in 1988. Analyses of variance on early leaf spot ratings indicated highly significant differences for year x fungicide-treatment interaction ($P \leq 0.0001$). Significant differences were also obtained for genotype x fungicide-treatment interaction ($P \leq 0.005$). The effect of fungicide treatments alone was not significant in the early stages of the epidemic.

Early season disease pressure was high in 1987. In untreated plots, the first leaf spot disease ratings were 43% higher in 1987 than the following year (Fig. 1A). Under the lighter disease pressure in 1988, the 14-day and 28-day schedule provided a 60% and 53% decrease in disease ratings, respectively, compared to the untreated plots. In 1987, the same schedules provided a 62% and 22% decrease, indicating less effective early season control that year on the 28-day schedule.

In unsprayed plots at the first leaf spot rating, Sunrunner and Florunner had the greatest severity of leaf spot (Table 1). Five breeding lines (GaT-2648, -2645, -2640, -2566, and

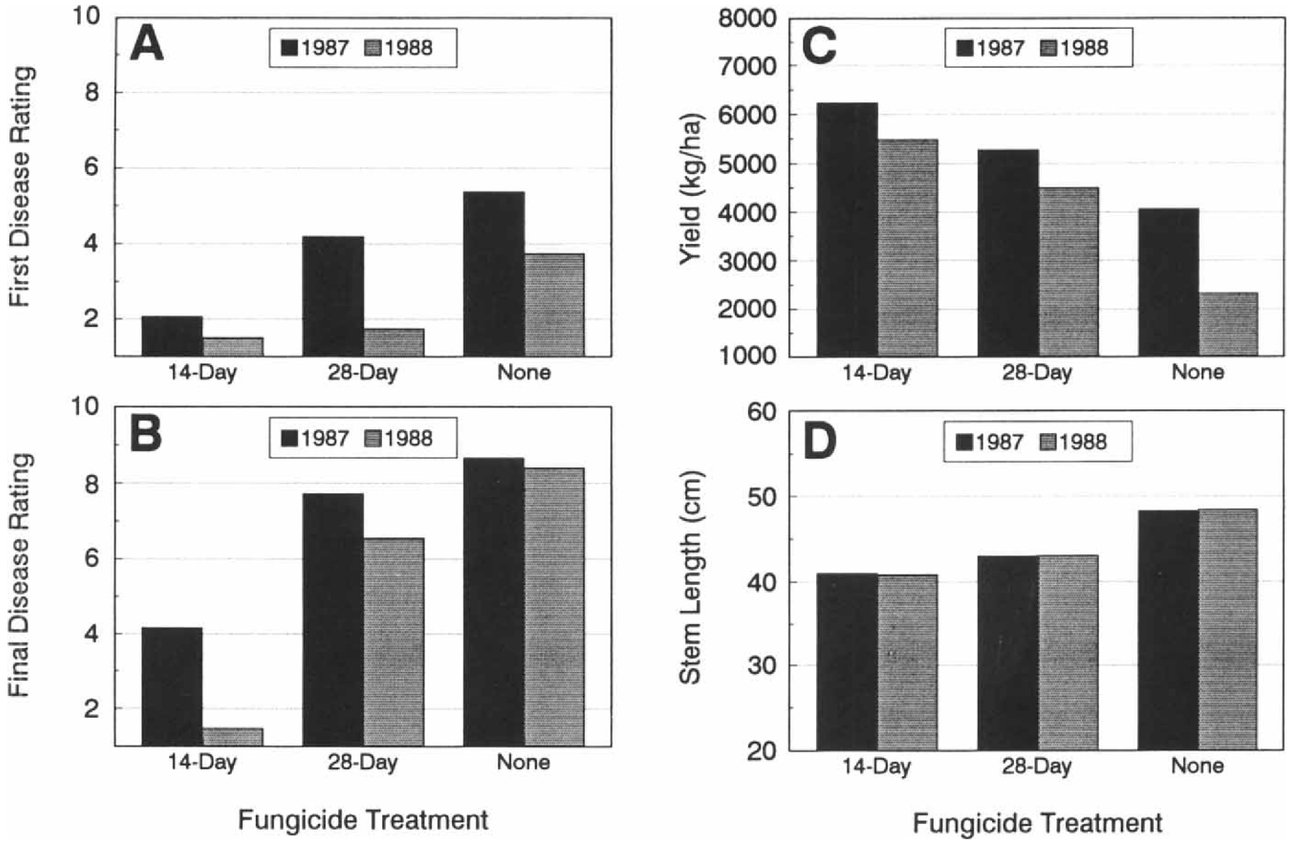

Fig. 1. Disease rating on 21 Aug 1987 and 26 Aug 1988 (A) and 30 Sep 1987 and 4 Oct 1988 (B), yield (C), and stem length (D) averaged over 14 peanut genotypes unsprayed and treated with diniconazole at 0.14 kg/ha plus Agri-Dex® (0.5% v/v) for control of late leaf spot during a 2-yr period. Four applications were made each year on a 28-day schedule, and seven applications were made in 1987 and eight in 1988 on the 14-day schedule. Approximately 1 wk prior to digging, plants were rated for disease severity using the Florida rating scale (1 = healthy, 10 = dead plant), and 10 main stems were measured to evaluate linear growth. Yield was based on weight of peanuts adjusted to 7% moisture (w/w).

Table 1. First rating of leaf spot of peanut genotypes treated with or without diniconazole during a 2-yr period[1].

Peanut genotype	Fungicide treatment[2]			Mean
	Unsprayed	28-day	14-day	
	Disease rating[3]			
GaT-2645	4.19 cd	2.33 d	2.03 ab	2.85
GaT-2640	4.25 cd	2.76 cd	1.75 ab	2.92
Georgia Runner	4.28 cd	2.86 bc	1.83 ab	2.99
GaT-2648	4.01 d	2.96 bc	2.19 a	3.05
GaT-2637	4.53 b-d	2.84 c	1.81 ab	3.05
GaT-2566	4.35 cd	3.18 a-c	1.69 b	3.07
GaT-2646	4.66 a-d	2.91 bc	1.66 b	3.08
GaT-2643	4.65 a-d	2.99 bc	1.63 b	3.09
GK-7	4.60 a-d	3.04 a-c	1.70 b	3.11
GaT-2641	4.58 a-d	3.03 a-c	1.86 ab	3.15
GaT-2642	4.90 a-c	2.90 bc	1.71 b	3.17
Florunner	5.18 ab	3.13 a-c	1.58 b	3.29
Southern Runner	4.61 a-d	3.51 a	1.94 ab	3.35
Sunrunner	5.30 a	3.36 ab	1.70 b	3.45
LSD	*0.766*	*0.501*	*0.459*	--[4]
Treatment Means	4.58 z	2.98 z	1.79 z	*LSD = 2.89*

[1]Disease evaluations were made on 21 Aug 1987 and 26 Aug 1988. *Cercosporidium personatum* was the primary leaf spot pathogen (>95%).
[2]Applications of diniconazole at 0.14 kg/ha with Agri-Dex® (0.5% v/v) began on 16 Jun 1987 and 22 Jun 1988. On the 28-day schedule, four applications were made both years. On the 14-day schedule, seven applications were made in 1987 and eight in 1988.
[3]Disease ratings were based on the Florida 1-10 scale where 1 = no disease and 10 = dead plant. Means in columns followed by the same letter are not different ($P \leq 0.05$) according Fisher's least significant difference test.
[4]Highly significant ($P \leq 0.01$) genotype x fungicide-treatment interaction prohibited combined analyses.

-2637) and Georgia Runner had significantly ($P \leq 0.05$) lower leaf spot ratings than Sunrunner. All six of these genotypes, except GaT-2637, also had a lower disease rating than Florunner. No unsprayed genotypes had significantly lower ratings than GK-7 or Southern Runner. In plots treated on a 28-day schedule, the average disease severity rating was reduced by 35% after application of the first three sprays. Georgia Runner and all of the breeding lines, except for GaT-2566 and -2641, had significantly lower levels of leaf spot than Southern Runner. GaT-2645 had the lowest disease rating, and it was significantly lower than all of the cultivars and breeding lines, except for GaT-2640. Applications of diniconazole on a 14-day spray schedule resulted in excellent disease control, and ratings averaged 61% lower than unsprayed plots. No breeding lines or Georgia Runner had significantly lower disease ratings than any of the four standard cultivars.

Prior to harvest, the final leaf spot severity rating was very high in unsprayed peanut plots both years. The average rating was greater than 8.0 in unsprayed plots for the 2 years of trials, which indicated >90% defoliation. The results of analyses of variance for this final rating of leaf spot indicated highly significant differences for genotype x fungicide-treatment and year x fungicide-treatment interactions ($P \leq 0.0001$). Fungicide treatments alone were also significant ($P \leq 0.05$). Plots treated on the 14-day schedule had significantly lower disease ratings than untreated plots and plots treated on a 28-day schedule.

At the end of the 1987 season, heavy defoliation resulted from disease in untreated plots and plots sprayed on a 28-day schedule. Slight defoliation was observed in plots sprayed on a 14-day schedule. In 1988 virtually no defoliation occurred in plots sprayed on a 14-day schedule. Across all genotypes, applications of diniconazole on a 14- and 28-day schedule suppressed the severity of late leaf spot by 52 and 11% in 1987, respectively (Fig. 1B). Much better control was obtained on the 14-day schedule in 1988 than in 1987 as fungicide applications suppressed the severity of leaf spot by 83%. Fungicide applications on a 28-day schedule in 1988 resulted in a 22% reduction in disease severity.

In unsprayed plots prior to harvest, Southern Runner had the lowest level of disease (Table 2). Three breeding lines, GaT-2566, -2637, and -2640, had significantly lower disease ratings than Sunrunner, GK-7, Florunner, and Georgia Runner. Two additional lines, GaT-2648 and -2642, also had significantly lower disease ratings than GK-7 and Sunrunner. When sprayed with diniconazole on a 28-day schedule, Sunrunner was the least responsive genotype. All of the other genotypes, except GaT-2641 and Florunner, had significant positive responses to the 28-day spray treatment. Southern Runner, GaT-2646, -2642, and -2643 had significantly less disease than Florunner. The 14-day schedule of diniconazole treatments maintained effective leaf spot control on all peanut genotypes. None of the advanced breeding lines or Georgia Runner had disease ratings significantly lower than the four standard cultivars.

Evaluation of Peanut Genotypes for Yield.

The results of analyses of variance for pod yield indicated highly significant differences for genotype and year x fungicide-treatment interaction ($P \leq 0.0001$), and genotype x

Table 2. Final rating of leaf spot of peanut genotypes treated with or without diniconazole during a 2-yr period[1].

Peanut genotype	Fungicide treatment[2]			Mean
	Unsprayed	28-day	14-day	
	Disease rating[3]			
Southern Runner	7.04 g	6.69 d	3.11 ab	5.61
GaT-2566	7.81 f	6.99 b-d	3.01 ab	5.94
GaT-2642	8.56 c-e	6.83 cd	2.75 b	6.05
GaT-2646	8.79 a-d	6.78 cd	2.66 b	6.05
GaT-2648	8.46 de	7.13 b-d	2.74 b	6.11
GaT-2643	8.71 b-e	6.90 cd	2.73 b	6.11
GaT-2640	8.36 e	7.33 b-d	2.75 b	6.15
GaT-2637	8.30 e	6.93 b-d	3.35 a	6.19
GaT-2641	8.56 c-e	7.36 a-c	2.66 b	6.20
GaT-2645	8.98 a-c	6.99 b-d	2.73 b	6.23
Georgia Runner	8.95 a-c	7.16 b-d	2.78 b	6.30
Florunner	8.88 a-d	7.59 ab	2.74 b	6.40
GK-7	9.10 ab	7.35 b-d	2.76 b	6.40
Sunrunner	9.15 a	8.03 a	2.66 b	6.61
LSD	*0.418*	*0.668*	*0.511*	--[4]
Treatment Means	8.55 y	7.14 y	2.82 z	*LSD = 3.75*

[1]Disease evaluations were made on 30 Sep 1987 and 4 Oct 1988. *Cercosporidium personatum* was the primary leaf spot pathogen (>95%).
[2]Applications of diniconazole at 0.14 kg/ha with Agri-Dex® (0.5% v/v) began on 16 Jun 1987 and 22 Jun 1988. On the 28-day schedule, four applications were made both years. On the 14-day schedule, seven applications were made in 1987 and eight in 1988.
[3]Disease ratings were based on the Florida 1-10 scale where 1 = no disease and 10 = dead plant. Means in columns followed by the same letter are not different ($P \leq 0.05$) according Fisher's least significant difference test.
[4]Highly significant ($P \leq 0.01$) genotype x fungicide-treatment interaction prohibited combined analyses.

year interaction ($P \leq 0.01$). Fungicide treatments alone were also significant ($P \leq 0.05$). Peanut plots treated on the 14- and 28-day schedule yielded significantly better than the untreated plots. No significant genotype x fungicide-treatment interaction was noted as genotypes responded in a similar manner to the fungicide treatments.

Regardless of treatment, peanut yields were higher in 1987 than 1988 because weather conditions were conducive for good growth of peanuts in spite of the higher severity of leaf spot (Fig. 1C). However, fungicide applications resulted in larger yield increases compared to unsprayed plots in 1988. Applications of diniconazole on a 28-day schedule increased yields by 1216 and 2165 kg/ha in 1987 and 1988, respectively. Greater increases were obtained with applications on a 14-day schedule as yields were increased by 2189 and 3159 kg/ha for the same two years, respectively.

Georgia Runner had the highest average yield of 5111 kg/ha across all fungicide treatments, whereas Florunner was the lowest at 4022 kg/ha (Table 3). Sunrunner and GaT-2566 were the only genotypes that did not yield significantly better than Florunner. Georgia Runner, GaT-2645, and -2640 had significantly higher yields than the four standard cultivars across all treatments. When fungicides were applied for leaf spot control on either the 14- or 28-day schedule, Georgia Runner was also the highest yielding genotype. In unsprayed plots, Georgia Runner had good yield, exceeded only by GaT-2640.

Evaluation of Peanut Genotypes for Sensitivity to Plant Growth Regulating Effects of Diniconazole.

The results of analyses of variance for main stem length indicated highly significant differences for fungicide treatments and genotype ($P \leq 0.0001$). No interactions among variables were detected. Main stem lengths were reduced by fungicide treatments in all genotypes. Average lengths of main stems for the two years of trials were 48.4, 43.1, and 41.0 cm for the unsprayed, 28-day, and 14-day spray schedules, respectively (Fig. 1D). Treatment comparisons showed virtually no differences in average stem lengths from 1987 to 1988. Across all genotypes, four applications of diniconazole on a 28-day schedule suppressed the mean length of the main branch by 11%. Applications of diniconazole on a 14-day schedule had little additional effect as mean stem length was suppressed by a total of 15%.

Southern Runner had the longest average main stem length and was significantly longer than three other standard cultivars, Georgia Runner, and seven of the nine breeding lines, except GaT-2646 and -2642 (Table 4). Both Sunrunner and Florunner had stems of intermediate length. Only Southern Runner was significantly longer and GK-7 shorter than Sunrunner and Florunner.

Evaluation of Peanut Genotypes for Susceptibility to Rhizoctonia Limb Rot.

Although not a targeted disease, the severity of Rhizoctonia limb rot appeared to differ between genotypes sprayed with diniconazole on a 28-day schedule in 1988. Severe defoliation due to leaf spot did not provide conditions favorable for development of limb rot in unsprayed plots, and plots sprayed on a 14-day schedule had no detectable levels of limb rot due to activity of diniconazole on *R. solani*. Therefore, only plots sprayed on a 28-day schedule were rated for limb

Table 3. Yield of peanut genotypes treated with or without diniconazole during a 2-yr period[1].

Peanut genotype	Fungicide treatment[2]			Mean	
	Unsprayed	28-day	14-day		
	Yield (kg/ha)[3]				
Georgia Runner	3567	5453	6314	5111	a
GaT-2645	3350	5337	6131	4940	ab
GaT-2640	3730	5059	5989	4926	ab
GaT-2643	3160	5188	6063	4804	a-c
GaT-2646	3486	4910	5989	4795	a-c
GaT-2641	3371	4944	5934	4750	a-d
GaT-2648	3493	4714	6016	4741	a-d
GaT-2637	3432	5093	5622	4716	a-d
GaT-2642	2930	4754	6043	4576	b-d
Southern Runner	3276	4673	5541	4497	cd
GK-7	2801	4842	5656	4433	cd
GaT-2566	3086	4747	5378	4404	c-e
Sunrunner	2279	4619	6233	4377	de
Florunner	2760	4056	5249	4022	e
LSD	--[4]	--	--	*408*	
Treatment Means	3194 z	4885 y	5868 y	*LSD = 1688*	

[1]Peanuts were inverted on 1 Oct 1987, except for Southern Runner a week later, and all genotypes on 6 Oct 1988.
[2]Applications of diniconazole at 0.14 kg/ha with Agri-Dex® (0.5% v/v) began on 16 Jun 1987 and 22 Jun 1988 for control of *Cercosporidium personatum*. On the 28-day schedule, four applications were made both years. On the 14-day schedule, seven applications were made in 1987 and eight in 1988.
[3]Yield based on weight of peanuts adjusted to 7% moisture (w/w). Means in final column followed by the same letter are not different ($P \leq 0.05$) according Fisher's least significant difference test.
[4]No significant peanut genotype x fungicide treatment interaction was detected.

rot immediately after digging by visually estimating the percentage of vines and leaves infected at each of six randomly selected areas in each plot.

Analyses of variance for Rhizoctonia limb rot severity indicated significant ($P \leq 0.05$) differences for genotypes. GaT-2566 was significantly more susceptible to limb rot than all cultivars and breeding lines (data not shown). Approximately 56% of rated branches of GaT-2566 showed symptoms of infection by *R. solani*. GaT-2645 had the lowest disease rating of 16%, and it was significantly more resistant than susceptible genotypes, Southern Runner and GaT-2566. Florunner, GK-7, Sunrunner, Georgia Runner, and Southern Runner had limb rot ratings of 24, 27, 29, 30, and 35%, respectively, and these differences were not significant.

Discussion

The high yield under varying levels of disease pressure and possession of characteristics desirable to the peanut industry resulted in the release of Georgia Runner in 1990 by the University of Georgia. Georgia Runner should be readily accepted by growers, shellers, and processors. This new cultivar has a broader genetic background than other runner cultivars, but it still has the typical spreading runner growth habit and plant appearance. This study showed that the main stem length and response of Georgia Runner to PGR properties of diniconazole were also similar to those of Florunner.

Under conditions of severe leaf spot disease pressure where no fungicide was applied, Georgia Runner had a disease rating that was not significantly different than susceptible cultivars such as Sunrunner, GK-7, and Florunner. Georgia Runner produced yields 11.7% greater when untreated and 11.6% greater when treated on a 28-day schedule than the average yield of the 14 total genotypes. In the absence of disease pressure as provided by a 14-day schedule of diniconazole, the yield of Georgia Runner was only 7.6% greater than the average yield for all genotypes. The ability of Georgia Runner to endure leaf spot without heavy losses in yield or quality appears to qualify this new cultivar as being moderately tolerant to leaf spot as defined by Sharp *et al.* (17).

Over 6 yr and 28 trials of five runner peanut cultivars conducted under standard disease management practices and using appropriate digging dates for the specific cultivars, Georgia Runner averaged 4266 kg/ha (3). These yields exceeded Florunner, Southern Runner, Sunrunner, and GK-7 by 10, 8, 7, and 4%, respectively. In our study, yields of Georgia Runner averaged across all treatments were 9.9% more than the average of the 14 tested genotypes. In addition to possessing moderate tolerance to late leaf spot, Georgia Runner has a very high yield potential and stable performance across several different test environments.

The resistance mechanisms possessed by Southern Runner, including reduced or delayed sporulation (1), were evident in this test as it had the lowest disease rating prior to harvest in both the unsprayed and 28-day spray regime. Such differences may have been more pronounced in field trials using larger blocks without unsprayed border rows of a highly susceptible peanut genotype. The rate-reducing

Table 4. Length of main stem of peanut genotypes treated with or without diniconazole during a 2-yr period[1].

Peanut genotype	Fungicide treatment[2]			Mean
	Unsprayed	28-day	14-day	
	Stem length[3] (cm)			
Southern Runner	51.3	45.4	43.2	46.6 a
GaT-2646	48.4	46.1	42.6	45.7 ab
Georgia Runner	50.2	44.4	42.0	45.5 ab
GaT-2642	50.1	43.2	40.7	44.6 a-c
GaT-2640	48.0	44.1	41.4	44.5 bc
GaT-2648	48.4	43.1	41.4	44.3 bc
GaT-2643	48.7	41.7	42.3	44.2 b-d
GaT-2637	47.2	43.7	41.7	44.2 b-d
Sunrunner	48.9	42.8	40.4	44.0 b-d
GaT-2641	49.2	42.9	39.8	44.0 b-d
Florunner	48.4	42.4	40.5	43.8 b-d
GaT-2645	46.9	42.4	40.6	43.3 cd
GaT-2566	47.3	40.5	39.1	42.3 de
GK-7	45.1	40.1	38.2	41.1 e
LSD	--[4]	--	--	*1.99*
Treatment Means	48.4 x	43.1 y	41.0 z	*LSD = 0.8*

[1]Peanut main stems, 10 per subplot, were measured one week prior to harvest during the last week of September 1987 and 1988.
[2]Applications of diniconazole at 0.14 kg/ha with Agri-Dex® (0.5% v/v) began on 16 Jun 1987 and 22 Jun 1988. On the 28-day schedule, four applications were made both years. On the 14-day schedule, seven applications were made in 1987 and eight in 1988.
[3]Means in final column followed by the same letter are not different ($P \leq 0.05$) according Fisher's least significant difference test.
[4]No significant peanut genotype x fungicide treatment interaction was detected.

properties of Southern Runner exceeded those of Georgia Runner, suggesting that Georgia Runner is only tolerant to late leaf spot and not resistant.

Other breeding lines had some promising traits. Genotypes GaT-2566, -2642, and -2637 may have had some resistance to late leaf spot as their reaction was similar to Southern Runner. As often the case in trials to identify superior breeding lines, these lines were no better in yield than currently available cultivars. Another problem was that GaT-2566 was highly susceptible to Rhizoctonia limb rot. This unexpected problem was detected by rating the genotypes for non-target diseases. Based on average yield, GaT-2645 and -2640 were similar to Georgia Runner under varying levels of leaf spot pressure, but they lacked other outstanding characteristics.

The visual rating system used in this study did not allow for identification of specific components of resistance (8), but it proved effective in identifying Georgia Runner as a high-yielding, leaf spot-tolerant genotype. The emphasis in previous evaluations of these advanced breeding lines was primarily yield. Iroume *et al.* indicated that it would be possible to select leaf spot resistant lines from yield evaluations alone (13). Effective applications of fungicides are still needed to obtain economical pod yields of Georgia Runner and all other tested genotypes. There were no significant differences in average yield across genotypes between a 14-day and 28-day schedule of diniconazole. This agrees with earlier studies using chlorothalonil where there was no difference in pod yield between a 14- and 20-day fungicide schedule (12) or a 10- and 20-day schedule on leaf spot resistant genotypes (10).

The apparent advantage of Georgia Runner is its ability to produce a larger yield than other available cultivars grown under similar conditions, regardless of the success or failure of a leaf spot control program. Weather conditions vary greatly from year to year as demonstrated by the high yields and high severity of leaf spot in 1987 as compared to 1988. In the event of a missed application of fungicide, it appears that Georgia Runner would not suffer severe yield losses as may occur with other cultivars. Georgia Runner offers the overall good qualities of Florunner, but in a genetically diverse cultivar with moderate tolerance to late leaf spot and high yield potential.

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