Effects of Fungicides, Cultivars, Irrigation, and Environment on Rhizoctonia Limb Rot of Peanut

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ABSTRACT

Barnes, J. S., Csinos, A. S., and Hook, J. E. 1990. Effects of fungicides, cultivars, irrigation, and environment on Rhizoctonia limb rot of peanut. Plant Dis. 74:671-676.

Diniconazole, flutolanil, and PCNB + ethoprop were evaluated in field tests in Plains and Tifton, Georgia, for control of Rhizoctonia limb rot of peanut caused by *Rhizoctonia solani* AG-4. Diniconazole applications at 60 + 90 days after planting (DAP) or 60 + 90 + 120 DAP were generally the best treatments for reducing incidence of limb rot in Plains. Based on a visual rating of incidence of Rhizoctonia limb rot after inverting, applications of diniconazole at 60 + 90 DAP significantly reduced disease incidence over applications at 90 + 120 DAP in Florunner, Pronto, and late-planted Florunner peanuts. Flutolanil reduced Rhizoctonia limb rot but was less effective than the two best diniconazole treatments. PCNB + ethoprop generally did not reduce incidence or severity when compared to the control. In Tifton, application of diniconazole every 14 days at 0.28 kg a.i./ha provided the greatest reduction in disease incidence in Florunner and New Mexico Valencia A (NMVA) cultivars. Pronto had significantly less Rhizoctonia limb rot than Florunner, and Florunner had less than NMVA. Irrigation increased disease incidence by as much as 109% over plots that received no irrigation.

Additional keywords: sterol biosynthesis-inhibiting fungicides

Rhizoctonia limb rot, caused by *Rhizoctonia solani* (Kühn) anastomosis group 4 (AG-4), has become a very important disease of peanut (*Arachis hypogaea* L.) in Georgia. Yield losses in Georgia in 1988 amounted to 8.5% or approximately $44 million (18).

By mid-season (70 days after planting), reddish brown lesions with growth rings are observed on lower lateral branches (limbs) in close contact with the soil. Lesions may elongate throughout the season, depending on environmental conditions. Branches may become girdled and wilted, with the lesions or entire branches appearing shredded. Pegs on infected branches exhibit similar symptoms and may detach from the plant during the digging operation, which leaves pods in the soil (17).

Development, incidence, and severity of Rhizoctonia limb rot is thought to be dependent on environmental conditions. Previous observations (17) indicate that the disease occurs under cooler, moister conditions in late August or early September. Thompson (17) also noted the prevalence of limb rot in fields under sprinkler irrigation. More recently, Brenneman and Sumner (5) have shown that wounding of branches by frequent tractor traffic increases incidence of the disease by digging time.

Accepted for publication 8 March 1990 (submitted for electronic processing).

Control measures for limb rot are ineffective with currently registered fungicides. Although PCNB in combination with an insecticide is recommended for control of *Sclerotium rolfsii* Sacc., the causal agent of southern stem rot, this material may not reduce incidence of limb rot (7). Cultural practices recommended for limb rot control include the reduction of excessive vine growth and the judicious utilization of irrigation late in the season (6).

Systemic, sterol biosynthesis-inhibiting fungicides have given excellent control of Rhizoctonia limb rot in field tests (1,4,5,7,14,16), but these materials have not been registered for peanut. Among those fungicides, diniconazole has been evaluated in Georgia and Alabama (1,4,7,16) and shows good potential for control of foliar and soilborne peanut diseases. Flutolanil, a benzanilide fungicide, has also shown promise in controlling both southern stem rot and limb rot in Georgia (8); however, strategies for controlling Rhizoctonia limb rot in particular have not been thoroughly evaluated.

Although *R. solani* is present in virtually all peanut soils in Georgia, Rhizoctonia limb rot has become a problem during only the last 10 years. Between 1970 and 1980, irrigation in Georgia increased nearly 700% (9). Maintenance of a lush canopy through irrigation and leaf spot control may provide a suitable environment for soilborne pathogens such as *R. solani.*

Objectives of this research were to study the epidemiology of *R. solani* as a pathogen of peanut limbs through the use of specific fungicide applications; to evaluate diniconazole, flutolanil, and PCNB + ethoprop for control of Rhizoctonia limb rot in three peanut cvs., Florunner, Pronto, and New Mexico Valencia A, and in late-planted Florunner; and to determine the effect of irrigation and environment on Rhizoctonia limb rot incidence and severity.

MATERIALS AND METHODS

Field trial, Plains, 1988. The research area was located on the Southwest Georgia Branch Experiment Station at Plains on a Greenville sandy clay loam (clayey, kaolinitic, thermic Rhodic Paleudult, pH 6.0). Florunner and Pronto peanuts were evaluated in 1988 for field infection by *R. solani* and *S. rolfsii* under different fungicide treatments. Each plot consisted of two 7.6-m-long rows spaced 0.7 m apart. Plots were separated by 0.9 m. Treatments were arranged in a split-plot design with four replications, with cultivars as whole plots and fungicide treatments as subplots. Florunner and Pronto peanuts were seeded on 5 May. A second planting of Florunner peanuts was seeded on 23 May. Pronto, Florunner, and late-planted Florunner peanuts were dug and inverted on 2 and 30 September and 11 October, respectively, and combined on 14 September and 11 and 17 October, respectively. Except for root disease control, cultural practices, fertilization, and pest control were consistent with Georgia Cooperative Extension Service recommendations (10). Plants were irrigated with 10 overhead sprinklers applied as needed to encourage vigorous plant growth. Rainfall and irrigation for the season totaled 41, 52, and 59 cm for Pronto, Florunner, and late-planted Florunner, respectively.

Diniconazole and flutolanil treatments were applied at 187 L/ha of spray volume with a CO_2-activated backpack sprayer. A 0.5% crop oil concentrate (Agridex, Helena Chemical Company, West Helena, AR) was added to all diniconazole applications. PCNB 10G at 11.2 kg a.i./ha + ethoprop 3G at 3.4 kg a.i./ha was applied in a 30-cm band over the row. Specific timings and rates of each treatment are listed in the tables.

A visual rating of disease incidence was made after peanuts were dug and inverted. Six random, 30-cm-long locations in each plot were rated on a scale from 0 to 100 for percentage of branches infected by *R. solani* (7). Areas of rows infected with *S. rolfsii* were avoided for all ratings. Number of disease loci caused by *S. rolfsii* were recorded after peanuts were dug and inverted. One locus consisted of 30 cm or less of infected row (12). Yields were calculated after peanuts were dug, combined, and weighed.

Disease data for both cultivars were analyzed together. Yields of both Florunner plantings were analyzed separately from the Pronto yields because of the inherent yield differences between the two cultivars. Data were subjected to analysis of variance and Duncan's multiple range test.

Field trial, Tifton, 1988. The cvs. New Mexico Valencia A (NMVA) and Florunner were evaluated for susceptibility to Rhizoctonia limb rot and southern stem rot in 1988 in a randomized complete block design with five replications. The research area was located near Tifton on a Tifton loamy sand (fine, loamy, siliceous, thermic Plinthic Paleudult, pH 6.2). Plots were 6.1 m long with rows 0.9 m apart. Both cultivars were seeded on 5 May, dug and inverted on 28 September, and combined on 6 October. Production practices were consistent with Georgia Cooperative Extension Service recommendations (10). Plots were irrigated 10 times for a total of 78.8 cm of water for the growing season. Diniconazole, flutolanil, and PCNB + ethoprop treatments were applied as described for the Plains field trial. Specific timings and rates of the treatments are listed in the tables.

All disease and yield data were subjected to analysis of variance and Duncan's multiple range test. Disease data for both cultivars were analyzed together on each sample date. Yields for both cultivars were analyzed separately because of the inherit yield differences between the cvs. Florunner and NMVA.

Irrigation study, Tifton, 1988. The soil was a Tifton loamy sand (fine, loamy, siliceous, thermic Plinthic Paleudult, pH 6.5) common to the peanut production region in this area of the state. On 4 May, Florunner peanuts were planted 5.1 cm deep at the rate of 112 kg/ha. Conventional tillage and management practices such as gypsum, fertilization, weed control, foliar fungicide, and insecticides were consistent with Georgia Cooperative Extension Service recommendations (10). Irrigation treatments were arranged in a randomized complete block design with four replications. Individual plots were 12.2 m × 12.2 m (five two-row beds per plot). Irrigation was supplied by two sprinklers positioned on opposite corners of each plot. When conditions called for irrigation, all replicates of the given treatment were irrigated simultaneously.

Tensiometer cups were placed at depths of 10, 20, 30, 45, 60, 75, 90, and 140 cm and connected by nylon tubing to mercury manometers at the edge of the plots. Soil moisture pressure was observed daily before 0900 hours with tensiometers placed in the peanut row. Number of irrigations, irrigation amount (cm), and total rainfall are listed in the tables.

Irrigation treatments used in this study were: 1) variable—irrigated within 24 hr after more than half of the tensiometers in the control zone (20–90 cm) exceeded 30 kPa matric suction. Plots were irrigated to refill the dry zone; 2) shallow—irrigated within 24 hr after more than half of the tensiometers in the control zone (20–30 cm) exceeded 30 kPa matric suction. Plots were irrigated to refill only the upper 30 cm; 3) deep—irrigated within 24 hr after more than half of the tensiometers in the control zone (60–90 cm) exceeded 30 kPa matric suction. Plots were irrigated to refill only the upper 75 cm; 4) fixed—irrigated three times at 47, 93, and 99 DAP with approximately 5 cm each time; and 5) nonirrigated—plots received no irrigation except for crop establishment and chemigation.

Meteorological observations were made continuously at the test site with a Campbell model 21X datalogger. Variables reported here include air temperature at 1.5 m, rainfall and soil temperature at 10.2 cm deep. Air and soil temperature were recorded with thermistors, and rainfall was recorded with a tipping-bucket rain gauge.

Ratings for Rhizoctonia limb rot were made on 23 July, 7 and 20 August, and 4 September. Five lower lateral branches were collected randomly from each plot. Branches were clipped as close to the main stem as possible. Number of lesions and lesion length were recorded for each branch. After digging and inverting, an additional incidence rating was taken by observing 10 random, 30-cm portions of each plot for the percentage of branches infected by *R. solani* (7). Ratings for southern stem rot were made as described for the Plains field test. Yields were calculated after peanuts were combined (27

Table 1. Influence of diniconazole, flutolanil, and PCNB + ethoprop on incidence of Rhizoctonia limb rot of Florunner, Pronto, and late-planted Florunner peanuts in Plains, GA, in 1988[v]

Treatment[x]	Application rate (kg a.i./ha)	DAP[y]	*Rhizoctonia* rating[w]		
			Florunner	Pronto	Late Florunner
Diniconazole 25WP	.28	60	31.2 abc[z]	2.8 pg	22.5 c–i
Diniconazole 25WP	.28	70	23.8 c–h	3.0 opq	17.5 g–m
Diniconazole 25WP	.28	80	28.0 b–f	6.5 n–q	21.2 d–i
Diniconazole 25WP	.28	90	26.8 c–g	10.8 l–p	24.0 c–h
Diniconazole 25WP	.28	100	28.2 b–e	14.0 i–n	26.2 c–g
Diniconazole 25WP	.28	110	29.2 b–e	11.5 j–p	23.0 c–i
Diniconazole 25WP	.28	120	25.5 c–h	18.8 f–l	28.2 b–e
Diniconazole 25WP	.28 + .28	60 + 90	12.0 j–o	0.5 q	8.8 m–q
Diniconazole 25WP	.28 + .28	90 + 120	26.8 c–g	11.0 k–p	20.5 e–j
Diniconazole 25WP	.56 + .56 + .56	60 + 90 + 120	4.0 opq	0.0 q	4.2 opq
Flutolanil 50WP	1.12 + 1.12	60 + 90	16.2 h–m	2.5 pq	28.2 b–e
PCNB 10G + ethoprop 3G	11.2 + 3.4	60	30.2 a–d	16.5 h–m	26.2 c–g
Untreated Control	···	···	36.5 a	20.0 e–k	38.0 a

[v] Florunner, Pronto, and late-planted Florunner peanuts were planted on 5 May, 5 May, and 23 May, respectively; dug and inverted on 30 September, 2 September, and 11 October, respectively; and combined on 11 October, 14 September, and 17 October, respectively.

[w] Rhizoctonia rating is a visual incidence rating after digging of percent of branches infected by *R. solani* based on a scale from 0 to 100%, where 0 = 0% infection and 100 = 100% infection. Values are the means of six 30-cm locations in each plot, averaged over four replications.

[x] Diniconazole and flutolanil were applied at 187 L/ha as full-canopy sprays with a CO_2-backpack sprayer. Diniconazole was applied with 0.5% Agridex.

[y] DAP = days after planting. 60 DAP = 1 July, 70 DAP = 15 July, 80 DAP = 25 July, 90 DAP = 3 August, 100 DAP = 15 August, 110 DAP = 23 August, 120 DAP = 2 September.

[z] Means in all columns and rows followed by the same letter are not significantly different according to Duncan's multiple range test ($P = 0.05$).

September), dried, cleaned, and weighed. Disease data were subjected to analysis of variance and Duncan's multiple range test or Waller Duncan's *k*-ratio *t* test. Yield data were analyzed using analysis of variance and means were separated by LSD.

RESULTS

Field trial, Plains, 1988. By 3 August (90 DAP), small lesions were observed on lower lateral branches in most plots. By digging time, many lower lateral branches in control plots were completely rotted by the fungus. Diseased areas often extended for several meters in each plot. However, the spatial distribution of the disease was observed to be aggregated within each plot. Based on a visual incidence rating after inverting, untreated control plots of Florunner and late-planted Florunner were not different; however, incidence in Pronto was lower than in either planting of Florunner (Table 1). PCNB + ethoprop reduced incidence of limb rot only in late-planted Florunner. Flutolanil reduced incidence over the untreated control in both cultivars. Diniconazole applications at 60 + 90 DAP or 60 + 90 + 120 DAP resulted in the lowest incidence of limb rot. Plots receiving single applications of diniconazole without regard to time of application in both Florunner plantings generally had a similar disease incidence. Incidence in Pronto was low but increased as applications of diniconazole were delayed. Application of diniconazole at 90 + 120 DAP on either cultivar did not reduce incidence over PCNB + ethoprop.

Southern stem rot was present in this field and caused substantial losses in the untreated control plots (Table 2). Treat-

Table 2. Influence of diniconazole, flutolanil, and PCNB + ethoprop on incidence of southern stem rot of Florunner, Pronto, and late-planted Florunner peanuts in Plains, GA, in 1988[v]

			Disease loci (no./30.5 m)[w]		
Treatment[x]	**rate (kg a.i./ha)**	**DAP[y]**	**Florunner**	**Pronto**	**Late Florunner**
Diniconazole 25WP	.28	60	3.6 b–f[z]	0.0 f	2.0 c–f
Diniconazole 25WP	.28	70	4.0 b–f	0.0 f	5.0 b–f
Diniconazole 25WP	.28	80	3.0 c–f	1.5 def	3.0 c–f
Diniconazole 25WP	.28	90	3.6 b–f	2.5 c–f	2.0 c–f
Diniconazole 25WP	.28	100	6.4 b–f	0.5 f	2.0 c–f
Diniconazole 25WP	.28	110	8.4 bcd	4.5 b–f	1.0 ef
Diniconazole 25WP	.28	120	5.6 b–f	6.0 b–f	2.4 c–f
Diniconazole 25WP	.28 + .28	60 + 90	0.0 f	0.0 f	0.4 f
Diniconazole 25WP	.28 + .28	90 + 120	8.0 b–e	0.5 f	2.0 c–f
Diniconazole 25WP	.56 + .56 + .56	60 + 90 + 120	0.0 f	0.0 f	0.4 f
Flutolanil 50WP	1.12 + 1.12	60 + 90	2.0 c–f	0.0 f	2.6 c–f
PCNB 10G + ethoprop 3G	1.12 + 3.4	60	9.0 bc	6.0 b–f	1.0 ef
Untreated Control	...	...	16.4 a	6.5 b–f	10.4 b

[v] Florunner, Pronto, and late-planted Florunner peanuts were planted on 5 May, 5 May, and 23 May, respectively; dug and inverted on 30 September, 2 September, and 11 October, respectively; and combined on 11 October, 14 September, and 17 October, respectively.

[w] A disease locus is 30.5 cm or less of row infected by *Sclerotium rolfsii* rated after digging and inverting.

[x] Diniconazole and flutolanil were applied at 187 L/ha as full-canopy sprays with a CO_2-backpack sprayer. Diniconazole was applied with 0.5% Agridex.

[y] DAP = days after planting. 60 DAP = 1 July, 70 DAP = 15 July, 80 DAP = 25 July, 90 DAP = 3 August, 100 DAP = 15 August, 110 DAP = 23 August, 120 DAP = 2 September.

[z] Means in all columns and rows followed by the same ietter are not significantly different according to Duncan's multiple range test ($P = 0.05$).

Table 3. Influence of diniconazole, flutolanil, and PCNB + ethoprop on yield of Florunner, Pronto, and late-planted Florunner peanuts in Plains, GA, in 1988[v]

			Yield (kg/ha)[w]		
Treatment[x]	**Application rate (kg a.i./ha)**	**DAP[y]**	**Florunner**	**Pronto**	**Late Florunner**
Diniconazole 25WP	.28	60	6,242 ab[z]	5,327	5,148 bcd
Diniconazole 25WP	.28	70	6,051 abc	5,444	4,992 cd
Diniconazole 25WP	.28	80	5,722 abc	5,086	5,066 bcd
Diniconazole 25WP	.28	90	5,501 abcd	4,740	5,031 bcd
Diniconazole 25WP	.28	100	5,844 abc	5,528	5,872 abc
Diniconazole 25WP	.28	110	5,391 abcd	5,235	5,433 abcd
Diniconazole 25WP	.28	120	5,512 abcd	4,358	5,047 bcd
Diniconazole 25WP	.28 + .28	60 + 90	5,925 abc	4,985	5,205 bcd
Diniconazole 25WP	.28 + .28	90 + 120	5,889 abc	4,934	5,018 bcd
Diniconazole 25WP	.56 + .56 + .56	60 + 90 + 120	5,522 abcd	5,009	5,303 abcd
Flutolanil	1.12 + 1.12	60 + 90	6,509 a	5,432	5,348 abcd
PCNB 10G + ethoprop 3G	1.12 + 3.4	60	5,735 abc	4,914	5,519 abcd
Untreated Control	...	...	4,974 cd	5,329	4,340 d

[v] Florunner, Pronto, and late-planted Florunner peanuts were planted on 5 May, 5 May, and 23 May, respectively; dug and inverted on 30 September, 2 September, and 11 October, respectively; and combined on 11 October, 14 September, and 17 October, respectively.

[w] Yields were calculated after peanuts were dug and inverted, combined, dried, and weighed.

[x] Diniconazole and flutolanil were applied at 187 L/ha as full-canopy sprays with a CO_2-backpack sprayer. Diniconazole was applied with 0.5% Agridex.

[y] DAP = days after planting. 60 DAP = 1 July, 70 DAP = 15 July, 80 DAP = 25 July, 90 DAP = 3 August, 100 DAP = 15 August, 110 DAP = 23 August, 120 DAP = 2 September.

[z] Means are the average of four replications. Yields of both Florunner plantings were analyzed together and separately from the Pronto yields. Means in columns followed by the same letter or no letter are not significantly different according to Duncan's multiple range test ($P = 0.05$).

ments did not differ with regard to reduction of southern stem rot incidence in Pronto peanuts. All fungicide treatments in Florunner reduced incidence of southern stem rot compared to that in the untreated control. All treatments in late-planted Florunner reduced southern stem rot except for the 70 DAP application of diniconazole. Applications of diniconazole at 60 + 90 DAP or 60 + 90 + 120 DAP were generally the most effective treatments for reducing southern stem rot incidence.

Yield of Pronto peanuts did not differ greatly among treatments (Table 3). Flutolanil and diniconazole at 60 DAP were the only treatments that increased yield over the untreated control in Florunner. Diniconazole applied at 100 DAP was the only treatment that increased yield over the untreated control in late-planted Florunner.

Field trial, Tifton, 1988. Lesions were evident in most treatments in both cultivars by 8 August (95 DAP). After a cool, rainy period around 1 September, disease progressed rapidly in unprotected plots. There were no differences between cultivars with the visual incidence rating when plots received a fungicide treatment (Table 4); however, untreated NMVA had greater incidence than untreated Florunner at the time plants were inverted. No differences were observed among diniconazole-treated plots of Florunner. Fourteen-day-interval treatments of diniconazole reduced incidence of limb rot over single diniconazole applications in NMVA. One 70 DAP application of flutolanil was not different from either single application of diniconazole in reducing incidence in Florunner. Flutolanil did not reduce limb rot incidence in Florunner as compared to PCNB + ethoprop or the untreated control.

Southern stem rot incidence was high in untreated control plots of Florunner and NMVA, with 50.0 and 57.6 loci, respectively, per 30.5 m of row (Table 4). All fungicide treatments in Florunner reduced stem rot incidence compared to the untreated control. Lowest disease incidence was observed with diniconazole applications at 70 DAP at 0.56 kg a.i./ha and with 14-day-interval applications. All fungicide treatments except flutolanil reduced southern stem rot incidence compared to the untreated control in NMVA.

All fungicide treatments in both cultivars increased pod yield over the respective untreated controls (Table 4). Applications of flutolanil at 70 DAP did not increase yield compared to the standard, PCNB + ethoprop, with either cultivar. Fourteen-day-interval applications of diniconazole resulted in the highest pod yields in both cultivars.

Very few lesions developed on lower branches throughout the season. Inoculation of branches in untreated control plots resulted in the development of a few lesions by inverting time, but no data were taken on lesion lengths.

Irrigation study, Tifton, 1988. Rainfall for the growing season was high and, as a result, the nonirrigated treatment received a total of 56.2 cm of water for the season.

The variable treatment, which received the most water (82.8 cm) and the greatest number of irrigations (eight), increased incidence of Rhizoctonia limb rot compared to the fixed and nonirrigated treatments (Table 5).

Southern stem rot incidence was low in this field, and as a result, no differences were observed among treatments (Table 5). Pod yields ranged from 3,559 kg/ha for nonirrigated plots to 4,303 kg/ha for plots receiving the variable irrigation treatment (Table 5); however, no significant differences were observed among treatments.

Cumulative rainfall increased 16.1 cm from 1 September (day 245) to 9 September (day 253), during the time when the 4 September (day 248) sample was taken (Fig. 1). From 30 August (day 243) to 8 September (day 252), daily maximum temperature dropped by 15.4 C. During this same time period, daily maximum soil temperature at 10.2 cm dropped from 41.7 to 22.7 C. Although numbers of lesions per branch and size of lesions were seldom significantly different among irrigation treatments, there was a general trend for lesion number and size of lesion to increase as frequency of irrigation increased.

DISCUSSION

Single applications of diniconazole applied from 60 DAP to 120 DAP were generally ineffective for reducing incidence of Rhizoctonia limb rot in Florunner peanuts. Based on the Rhizoctonia limb rot rating for Pronto, delaying diniconazole applications to 100–120 DAP may result in greater incidence of Rhizoctonia limb rot than earlier applications (60 DAP). Although symptoms of limb rot generally are not severe until after 100 DAP, controlling early season infection with 60–80 DAP applications may reduce disease incidence later in the season. Previous workers have not specifically addressed timing applications for Rhizoctonia limb rot control but have noted control with both season-long applications (7) and at-pegging applica-

Table 4. Influence of diniconazole, flutolanil, and PCNB + ethoprop on incidence of Rhizoctonia limb rot and southern stem rot and yields of Florunner and Valencia peanuts in Tifton, GA, in 1988[t]

Treatment[u]	Application (DAP)	Rate (kg a.i./ha)[v]	Cultivar[w]	*Rhizoctonia* rating[x]	Disease loci (no./30.5 m)[y]	Yield (kg/ha)
Diniconazole 25WP	70	0.28	F	20.4 de[z]	14.4 ef	4,973 a
			V	31.8 bcd	36.8 bcd	2,363 b
Diniconazole 25WP	70	0.56	F	20.2 de	8.0 g	5,084 a
			V	29.2 bcd	25.6 def	2,175 b
Diniconazole 25WP	14 Day	0.28	F	8.4 e	7.2 g	5,188 a
			V	9.8 e	10.4 fg	3,288 a
Flutolanil 50WP	70	1.12	F	26.2 cd	29.6 de	4,040 b
			V	41.0 bc	46.0 abc	1,991 b
PCNB 10G + ethoprop 3G	70	11.2 + 3.4	F	32.8 bcd	21.2 d–g	4,829 ab
			V	43.8 b	32.0 cd	2,363 b
Untreated Control	···	···	F	39.4 bc	50.0 ab	3,148 c
			V	57.2 a	57.6 a	1,362[c]

[t] Florunner and New Mexico Valencia A peanuts were planted on 5 May, dug and inverted on 28 September, and combined on 6 October.
[u] Diniconazole and flutolanil were applied at 187 L/ha as full-canopy sprays with a CO_2-backpack sprayer. All diniconazole sprays were applied with 0.5% Agridex. PCNB + ethoprop was applied in a 30-cm band over the row.
[v] DAP = days after planting, 70 DAP = 16 July, 14-Day = 14-day-interval treatments on 16 July, 30 July, 13 August, 27 August, and 10 September.
[w] F = Florunner, V = New Mexico Valencia A peanuts.
[x] *Rhizoctonia* rating is a visual rating of percent of branches infected at six 30-cm locations in each two-row plot rated after digging and based on a scale of 0–100%, where 0 = 0% infection and 100 = 100% infection by *R. solani*. Values are the means of four replications.
[y] A disease locus is 30 cm or less of row infected by *Sclerotium rolfsii*.
[z] Means in columns followed by the same letter are not significantly different according to Duncan's multiple range test ($P = 0.05$).

Table 5. Effect of irrigation of Florunner peanuts on Rhizoctonia limb rot and southern stem rot incidence and peanut yield in Tifton, GA, in 1988[t]

Control zone[u]	Number of irrigations	Irrigation (cm of H_2O)	Total water (cm)[v]	Rhizoctonia limb rot rating[w]	Disease loci (no./30.5 m)[x]	Yield (kg/ha)[y]
Variable (20-90 cm) tensiometer	8	26.6	82.8	34.5 a[z]	7.8	4,303
Shallow (20-30 cm) tensiometer	6	17.5	73.7	30.0 ab	6.5	4,160
Deep (60-90 cm) tensiometer	4	18.9	75.1	25.5 abc	7.2	4,011
Fixed irrigation (3X)	3	14.7	70.9	21.5 bc	5.0	4,188
No irrigation	0	0.0	56.2	16.5 c	7.5	3,559

[t] Florunner peanuts were planted on 4 May, dug and inverted on 20 September, and combined on 27 September.
[u] Plots were irrigated when tensiometers in control zones of one-half of the plots exceeded 30 kPa. Fixed irrigation received approximately 5 cm each on 20 June, 5 August, and 11 August.
[v] Total water is the sum of irrigation, rainfall (53.02 cm), and irrigation across all plots to aid in seedling emergence (3.15 cm).
[w] Rhizoctonia limb rot rating is a visual incidence rating of percent of branches infected with *R. solani* evaluated after digging. Values are the means of 10 30-cm locations in each plot, averaged over four replications based on a scale of 0–100%, where 0 = 0% infection and 100 = 100% infection.
[x] A disease locus is 30 cm or less of row infected with *S. rolfsii* evaluated after digging and inverting.
[y] Means are the average of four replications. Yields were calculated after peanuts were dug and inverted, combined, dried, and weighed.
[z] Means in columns followed by the same letter or no letters are not significantly different according to Duncan's multiple range test ($P = 0.05$).

tions (8,18). Although lowest incidence ratings were generally observed with three applications of diniconazole at 0.56 kg a.i./ha, incidence of limb rot was never significantly less than that observed with the 60 + 90 DAP treatment at 0.28 kg a.i./ha. Furthermore, no increase in yield was observed with the 60 + 90 + 120 DAP treatment as compared with the 60 + 90 DAP treatment. Thus, a late application of diniconazole at 120 DAP does not appear to offer an advantage in controlling the disease. Flutolanil at 1.12 kg/ha applied at 60 + 90 DAP (Plains) or at 70 DAP (Tifton) significantly decreased incidence of Rhizoctonia limb rot over the untreated control in both Florunner and Pronto. These data support an earlier report (8) of the activity of flutolanil against *R. solani* in peanuts.

No significant difference was observed between either planting of Florunner in incidence of Rhizoctonia limb rot. By 60–70 DAP, vines in both plantings had covered the soil surface, possibly allowing for similar environmental conditions for infection on lower lateral branches. Although maturity of late-planted Florunner was delayed about 10 days as compared to Florunner, this may not have been enough time to allow for an increase in incidence of Rhizoctonia limb rot.

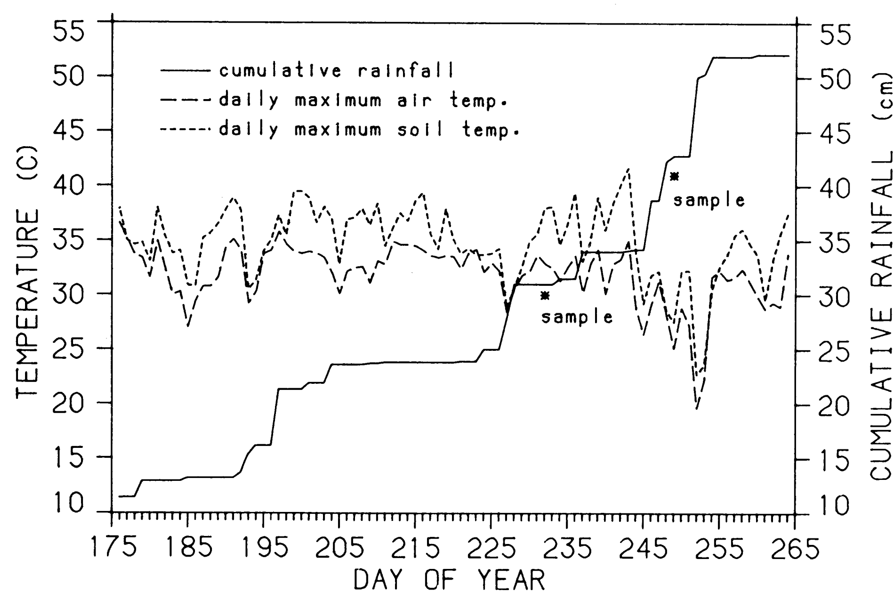

Fig. 1. Cumulative rainfall (cm), daily maximum air temperature (C) at 1.5 m, and daily maximum soil temperature (C) at 10.2 cm below soil surface for the irrigation study in Tifton, 1988. Asterisks on day 233 (20 August), and day 248 (4 September) indicate sample dates.

Pronto had significantly less Rhizoctonia limb rot than Florunner. Pronto is an early maturing, spanish-type peanut with fewer branches than Florunner. Because Pronto was dug and inverted 4 wk before Florunner, incidence may be lower because of removal of the host before environmental conditions were suitable for disease development. Fewer branches in Pronto may allow for a further decrease in incidence by producing a drier canopy microclimate. NMVA was more susceptible to Rhizoctonia limb rot than Florunner. Valencia market-type peanuts have been shown to be highly susceptible to southern stem rot (3).

Irrigation triggered by any tensiometer in the 20-90 cm range (variable) increased incidence of limb rot over the untreated control by 109%. These data support earlier observations that the disease is frequently associated with fields under sprinkler irrigation (17). Although 53 cm of rainfall was recorded over all plots, the additional eight irrigations (26.6 cm) applied to the variable treatment were apparently enough to encourage greater disease development. Timing of these applications may also have been important. Incidence of Rhizoctonia limb rot increased as the frequency of irrigations increased.

Irrigation has been reported to increase many foliar and root diseases (13). In Virginia, incidence of Sclerotinia blight of peanut caused by *Sclerotinia minor* Jagger was increased in plots under sprinkler irrigation (11). Sanders et al (15) reported a decrease in peanut canopy, soil, and stem temperatures in irrigated plots over plots that were water stressed. Because disease development by *R. solani* is generally favored by moderate temperatures (around 25 C; 2), irrigation may provide the moisture and temperature conditions necessary for limb rot disease development.

Severe Rhizoctonia limb rot epidemics occur late in the season, mainly during periods of low temperature and frequent rain (17). Results from this study show an increase in disease severity and incidence during a period of cool, cloudy, and rainy weather around 1 September when the soil temperature dropped quickly. Although this increase in disease could be attributed to other factors, such as plant senescence, Rhizoctonia limb rot has not become severe in years without this change in environmental conditions.

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