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Impact of the Cropping Frequency of Bahiagrass, Cotton, and Corn on the Severity of Diseases of Peanut and on Yield[1]

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SUMMARY

The impact of crop rotation on the severity of leaf spot diseases and southern stem rot on peanut cv. 'Georgia Green' was evaluated in a study established in 1988 at the Wiregrass Research and Education Center in Headland, AL. While 34 different rotations were included in this study, notable cropping patterns tested included one year of peanut cropped after one year of pearl millet (PM), velvetbean (V), or summer fallow (F); one, two or three years of corn (C) or cotton (Ct); one year of each of the former crops; and one, two, three, or four years of bahiagrass (B). Fertility, weed, insect, and leaf spot control recommendations of the Alabama Cooperative Extension System were followed. The highest leaf spot severity ratings were noted in the plots maintained in a peanut monoculture. When compared to the disease ratings for the peanut monoculture, significant reductions in leaf spot severity were recorded where peanut followed two or more years of corn, cotton, or patterns with both crops in succession, and bahiagrass. Leaf spot ratings were also reduced in peanut cropped after one year of winter rye followed by either velvetbean or pearl millet. Often, white mold damage levels were higher in plots where peanut were produced every two years than in those plots cropped to peanut for at least three consecutive years. Among the one-year cropping patterns, peanut grown after a corn crop suffered less white mold damage, compared with those peanuts produced after one year of cotton, velvetbean, or pearl millet. Surprisingly, peanut cropped after two or three years of corn, cotton, patterns with both crops in succession, and bahiagrass often had white mold levels similar to those plots maintained in continuous peanut production. While crop rotation did have a significant impact on peanut yield, productivity did not necessarily increase as the interval between peanut crops was lengthened. When compared to the peanut monoculture, yield was generally higher where peanut were cropped after two or three years of corn, three years of cotton, patterns with both crops in succession, and three or four years of bahiagrass, but not one, two, or five years of the former crop. Generally, peanut produced after one year of corn, or winter rye followed by velvetbean or summer fallow had yields higher than those recorded for the peanut monoculture, did several of the two- and three-year cropping patterns.

INTRODUCTION

Peanut (*Arachis hypogaea* L.) is among the most important crops produced in Alabama, Georgia, and Florida. Provisions of the 2002 Farm Bill, which resulted in the elimination of the quota support price and the establishment of the peanut market loan program, have greatly reduced the gross value of the peanut crop in the tri-state region and may trigger a sharp decline in farm income. While the elimination of the quota price will bring the cost of U.S. peanuts in line with that of imports, a decline in farm income and higher production costs may have a detrimental impact on peanut production in the southeast.

Early leaf spot caused by *Cercospora arachidicola* Hori and late leaf spot caused by *Cercosporidium personatum* Berk. & Curtis are potentially the most destructive diseases on peanut across the southeast. Currently, early leaf spot is the more common and damaging of the two leaf spot diseases on Alabama's peanut crop. However, severe outbreaks of late leaf spot continue to occur, particularly on those commercial peanut lines that are sensitive to this disease. Failure to control these diseases with timely fungicide applications in selected fields may reduce expected yields by 50% or more (Shokes and Culbreath 1997). The impact of crop rotation on the onset and development of early or late leaf spot on peanut is not well defined. In an on-farm demonstration, Kucharek (1975) noted a sizable reduction in the incidence of Cercospora leaf spot on peanut cv. 'Florunner' grown after one year of corn, compared to the same cultivar cropped after peanut. When plots were left unprotected from leaf spot diseases, defoliation levels were also higher in plots in continuous peanuts than in those in their first peanut crop (Nutter & Shokes 1995). In another Georgia study, early and late leaf spot diseases on peanut were more severe in short term rotations (Brenneman et al. 1995). In contrast, cropping frequency in production fields had no impact on the level of leaf spot-induced defoliation on peanut in fields in Alabama (Bowen et al. 1996).

In Alabama, occurrence of white mold, which is caused by *Sclerotium rolfsii* Sacc., increases as the number of years between peanut crops decreases, and fields cropped to peanut every other year typically suffer the heaviest pod losses to this disease (Bowen et al. 1996). In addition, peanut yield was inversely related to incidence of white mold and was directly related to the number of years between peanut crops (Bowen et al. 1996). Bowen et al. (1996) also noted that peanut cropped after three or more years of bahiagrass or cotton had the lowest incidence of this disease. Similar levels of white mold suppression with non-hosts of *S. rolfsii* have been noted in previous studies (Brenneman et al. 1990, Johnson et al. 1999a, Johnson et al. 1999b, Rodriguez-Kabana et al. 1991, Rodriguez-Kabana et al. 1994). While the commercial peanut lines 'Southern Runner', 'Florida C-99R', and 'Georgia Green' are less sensitive than 'Florunner' to white mold, none have demonstrated the level of resistance to this disease required to reduce the need for protective fungicide treatments of tebuconazole (Folicur 3.6F), azoxystrobin (Abound 2SC), or flutolanil (Moncut 70DF) (Brenneman et al. 1990, Hagan et al. 1999).

The peanut root-knot nematode *Meloidogyne arenaria* (Neal) Chitwood is a widespread and often destructive pest of peanut across the southeast and Texas. As a general rule, the more frequently peanut is produced in a particular field, the greater the risk that root-knot populations will exceed the action threshold (Rodriguez-Kabana et al. 1987). Typically, juvenile populations are significantly higher and yields are sharply lower when peanuts are produced more than once in a three-year period (Bowen et al. 1996, Rodriguez-Kabana et al. 1987, Rodriguez-Kabana et al. 1994, Timper et al. 2001). When compared with continuous peanuts, yields are often higher where peanut is cropped after one year of bahiagrass (Paspalum notatum (Flugge) (Johnson et al. 1999b, Rodriguez-Kabana et al. 1988), corn (Johnson et al. 1999b), or cotton (*Gossypium hirsutum* L.) (Johnson et al. 1999b, Rodriguez-Kabana et al. 1991). In Alabama farm fields, the heaviest root-knot-related yield losses are often seen in fields kept in continuous peanut production (Bowen et al 1996). While widely used on peanut across the southeastern peanut production regions to suppress the peanut root-knot nematode, nematicides do not consistently increase peanut yield (Rodriguez-Kabana et al. 1991, Timper et al. 2001).

Pesticides are not a long-term alternative to crop rotation for protecting peanut from *S. rolfsii* and peanut nematodes. Fungicides and nematicides used to control southern stem rot and peanut root-knot, respectively, are very costly and are often only partially effective in preventing sizable losses in crop yield and quality, particularly in fields cropped every year or every second year to peanut. With the lower peanut loan price, costly pesticide inputs must be eliminated to maintain farm profitability. To reduce variable production costs, Alabama peanut growers, particularly in the Wiregrass Region, must adopt cropping practices that reduce the risk of disease damage and nematode outbreaks. The objective of this study is to identify sustainable and profitable cropping patterns that will be acceptable to Alabama peanut producers.

MATERIALS AND METHODS

In 1988, this study was established at the Wiregrass Research and Extension Center in an established bahiagrass pasture with a Dothan fine sandy loam (fine-loamy, siliceous, thermic Plinthic Palendults) soil (< 1% OM). The experimental design was a randomized complete block with four complete replications. Individual plots consisted of twelve 9.2- m rows spaced 0.9 m apart. In 1988, a total of 36 cropping sequences were tested where peanut (P), corn (C), and bahiagrass (B), were included in the design. Among the most notable cropping patterns initially included were P-P-P (long-term peanut monoculture), P-C-P-C, C-P-C-P, B-P-B-P, P-B-B-B-B-P, P-B-B-B-P, P-B-B-P, B-B-B-P-P, B-B-B-B-P-P, and B-B-B-P-P-P. The remaining bahiagrass - peanut rotations are listed in table 1. In 1994, some of the duplicate bahiagrass rotations were replaced with those that included cotton (C), as well as a winter cover crop of rye (R) that was followed by summer fallow (F), pearl millet (PM), or velvetbean (V) and then peanut the following year. Cropping patterns that included cotton were Ct-Ct-Ct (cotton monoculture), Ct-P-Ct-P, P-Ct-P-Ct, Ct-Ct-P, Ct-Ct-Ct-P, Ct-C-P, Ct-C-P, Ct-Ct-Ct-P-P, and Ct-Ct-Ct-P-P-P. Peanut and corn rotations added in 1994 were C-C-P, C-C-C-P, and C-C-C-P-P. The other cropping sequences added in 1994 are listed in Table 1. Data from selected cropping sequences will be presented here in Table 2 to Table 5.

With the exception of the established bahiagrass, plot areas were prepared for planting with a disk harrow, as well as a subsoil and mold board plow. Optimal soil fertility and pH were maintained according to the results of an annual soil fertility assay, which was done by the Soil Laboratory at Auburn University. Corn and bahiagrass were planted in late March or early April, while cotton was sown in mid-April. From 1988 until 1997, peanut (*Arachis hypogaea*) cv. 'Florunner' was planted at 5 to 6 seed/ft row in the first or second week of May. In 1998, the peanut cultivar 'Georgia Green' replaced 'Florunner'. The planting date for pearl millet and velvetbean coincided with those dates for peanut. Rye cv. 'Wren's Abruzzii' was drilled at recommended seeding rates in early to mid-November. Cotton cv. 'DPL 555 B/RR' was planted in 2000, 2001 and 2002. The corn cv. 'DK 687 RR' was planted in 2000 and 2002, but 'DK626 RR' was produced in 2001. Fertilization practices, along with the insect and weed control practices of the Alabama Cooperative Extension System for all rotation crops were followed. Escape weeds in the peanut, cotton, and corn plots were pulled by hand. The summer fallow (F) plots were periodically disked during the summer to destroy emerging volunteer peanuts and weeds. Plots were watered as needed with a side roll irrigation system.

Table 1. Summary of cropping patterns through 2002 production season.

TMT No.	Cropping pattern[y]	TMT No.	Cropping pattern	TMT No.	Cropping pattern
1	P-P-P (16 yr)[z]	14	B-B-B-P-P-P	27	C-C-C-P-P
2	P-C-P	15	B-B-B-B-P-P-P	28	P-R/V-P
3	C-P-C-P	16	B-P-P-P-P	29	P-R/PM-P
4	B-P-B-P	17	B-B-P-P-P-P	30	CT-CT-P
5	B-B-P	18	B-B-B-P-P-P-P	31	CT-CT-CT-P
6	B-B-B-P	19	B-B-B-B-P-P-P-P	32	P-R/F-P
7	B-B-B-B-P	20	P-P-P	33	CT-C-P
8	B-P-P	21	P-C-P	34	P-CT-P
9	B-B-P-P	22	C-CT-P	35	CT-CT-CT-P-P
10	B-B-B-P-P	23	CT-CT-P	36	C-C-C-P
11	B-B-B-B-P-P	24	P-PM-P	37	C-C-P
12	B-P-P-P	25	P-F-P	38	CT-P-P
13	B-B-P-P-P	26	CT-CT-CT	--	

[y]Key to crop abbreviations: P = peanut, B = bahiagrass, C = corn, PM = pearl millet, R = winter rye, V = velvetbean, F = summer fallow, and Ct = cotton.
[z]Plots first established in 1986.

To control early and late leaf spot, broadcast applications of chlorothalonil (Bravo Ultrex, Syngenta Crop Protection, Greensboro, NC) at 1.4 lb formulated product/A were initiated approximately 35 to 40 days after planting, and applications were repeated at 14-d intervals until approximately 2 weeks before the expected digging date. All applications were made with a tractor-mounted four-row boom sprayer with three TX-8 hollow cone nozzles per row that were calibrated to deliver 15 gal/A spray volume.

Corn was field dried and then harvested in late August. Peanuts were dug on the optimum digging date, as determined using the hull scrape method of estimating pod maturity (Williams and Drexler 1981), and were later harvested with a two-row combine. A sample was taken from the pods harvested from each plot, which was then dried, cleaned, and graded according to current Federal Inspection Service (USDA) guidelines. Cotton was picked in mid- to late-October several weeks after the application of a defoliant. In all cotton, corn, and peanut plots, the center two rows were harvested for yield.

Disease and Nematode Assessment

Beginning in 1988, incidence of white mold on peanut was determined immediately after plot inversion by counting the number of disease loci in the harvest rows where one locus was defined as the number of consecutive symptomatic plant(s) in $\leq$ 1 ft of row (Rodriguez-Kabana et al. 1975). In 2001 and 2002, the severity of early and late leaf spot on peanut was assessed approximately one- to two-weeks prior to the anticipated digging date using the Florida leaf spot scoring system (Chiteka et al. 1988). Approximately 20 cores were taken to a depth of 4 in. with a 1-in. soil tube for a nematode assay in August 2000, 2001, and 2002. In 2000 and 2001, samples were collected only from the plots cropped to peanut. Root-knot nematode juveniles in approximately one pint (500 cc) of soil and data were enumerated as the number of juveniles per 100-cc soil. In each year, analysis of variance was conducted and significance of rotation effects was compared with Fisher's Least Significant Difference (LSD) test at the $P \leq 0.05$ level.

RESULTS AND DISCUSSION

Peanut Leaf Spot Severity

In 2001, heaviest leaf spotting and premature defoliation were noted in plots that had been cultivated in peanut for at least three consecutive years (Table 2). The leaf spot ratings for the P-C-P cropping sequence did not differ significantly from those recorded for the plots in continuous peanuts. In contrast, a significant reduction in leaf spot severity was noted where peanuts were produced after two or three years of bahiagrass, as well as after three years of either cotton or corn.

With the exception of the rye/velvetbean and rye/pearl millet cropping sequences, leaf spot severity in the plots in continuous peanuts was similar to the levels of these diseases observed in 2002 in the plots where peanuts were cropped every second year (Table 2). Surprisingly, leaf spot levels noted for the former rotation patterns were significantly lower, compared to the rotation patterns where peanuts followed one year of corn, cotton, pearl millet, or summer fallow. The disease ratings for the cropping sequences where peanuts were produced for at least two consecutive years had significantly lower leaf spot ratings, compared to the plots maintained in continuous peanut production. Peanuts grown after two years of cotton or corn, but not the rotations that included one year of cotton and corn, generally suffered less leaf spot damage than in those plots where peanuts followed one year of summer fallow or other crops. As expected, leaf spot levels in plots where peanuts were cropped after two years of cotton or corn, or after three years of bahiagrass did not significantly differ.

Limited information has been available to support antidotal observations that cropping sequence has a significant influence on the severity of leaf spot diseases on peanut. As previously reported by Kucharek (1975) and Brenneman et al. (1995), cropping sequence does have a significant impact on the severity of leaf spot on peanut. Kucharek (1975) noted that peanuts grown behind one year of corn or soybean suffered far less early leaf spot at 31 and 46 DAP than continuous peanuts but did not rate disease incidence just before the crop was dug at the end of the growing season. Brenneman et al. (1995) demonstrated that early leaf spot levels were lower throughout the production season for peanut cropped behind three years of bahiagrass. However, the impact of cropping patterns commonly followed on Alabama farms was not evaluated. In the current study, significant reductions in leaf spot severity were observed not only where peanut followed three years of bahiagrass, as reported by Brenneman et al. (1995), but also in a number of other cropping patterns. Compared to the ratings for continuous peanuts, significant reductions in leaf spot levels were seen where peanut was cropped after two years of cotton, corn, both crops in succession, and bahiagrass. In addition, the above cropping patterns appeared to be just as effective in slowing leaf spot development as the rotation pattern where three years of bahiagrass were followed by one peanut crop. While leaf spot severity in the plots where peanut were cropped every second year often did not differ significantly from the disease ratings for continuous peanuts, the rye/velvetbean and rye/pearl millet cropping patterns also suppressed disease development in the following peanut crop.

White Mold Incidence

In 2000, the frequency of cropping peanut had a significant impact on white mold incidence (Table 3). Incidence of white mold was significantly higher where peanuts were grown after one pearl millet crop, compared to the plots in continuous peanuts or to the one year rotation of corn, bahiagrass, winter rye/velvetbean, summer allow, and winter rye/summer fallow with peanut, but not the cotton-peanut rotation. Surprisingly, the peanuts cropped after three years of bahiagrass had white mold damage levels similar to those in plots in continuous peanut production for 14 years.

While peanut production was scheduled for relatively few cropping sequences, significant differences in white mold incidence were noted again in 2001 (Table 3). When compared to the plots in peanut monoculture for 15 years, disease incidence was significantly higher in peanut produced after one year of corn or after three consecutive years of peanut. In contrast, disease incidence in the plots maintained in the peanut monoculture did not significantly differ from the levels found in plots where peanut followed two, three, or four years of bahiagrass, as well as three years of corn.

For 2002, white mold incidence was lower in the plots maintained in continuous peanuts than in the peanuts cropped after one year of pearl millet, velvetbean, cotton, or summer fallow, but not those cropped to peanut after corn or bahiagrass (Table 3). Winter rye appeared to have no impact on the incidence of white mold where peanut followed pearl millet, velvetbean, or summer fallow. Surprisingly, disease loci counts in peanuts produced after two years of cotton or corn, or after one year of each of the latter crops, were similar to the counts recorded in the plots where peanut followed one year of bahiagrass, pearl millet, velvetbean, cotton, or summer fallow. In addition, white mold incidence was lower in peanuts grown after one rather than two years of peanut.

Incidence of white mold was often significantly lower in the plots cropped to peanut in four or more successive years than in those where peanut was produced after two years of cotton or corn, or after one year of both of these crops (Table 3). Plots where peanut were grown after one year of cotton, rye/velvetbean, rye/pearl millet, rye/summer fallow, and pearl millet without the rye cover crop, but not bahiagrass, corn, or summer fallow suffered significantly higher white mold damage than those maintained in peanut monoculture in 2000 and 2001. Peanut that followed one year of corn also had lower damage ratings than peanut produced after one year of cotton, rye/velvetbean, rye/pearl millet, rye/summer fallow, or pearl millet without the rye cover crop; peanut after two years of cotton or corn, peanut after or one year of both of the latter crops, as well as after two and three years of bahiagrass. Similar white mold incidence was noted in the plots in continuous peanuts and in those where peanut were cropped after one, two, and three years of bahiagrass.

The impact of cropping sequence on the incidence of white mold did not follow the pattern established for leaf spot diseases where severity increased the more frequently peanuts were grown. In all three years, damage in plots maintained in continuous peanuts was similar and sometimes significantly lower than in those plots cropped to peanut once every two, three, or even four years. As previously reported by Bowen et al. (1996), incidence of white mold was significantly lower in one of two years for plots in continuous peanut, compared with those cropped to peanut after every second year. In general, relatively few differences in disease damage levels were noted among the crops evaluated in a one-year rotation with peanut. As noted by Rodriguez-Kabana et al. (1992), one year of velvetbean had no impact on the incidence of white mold. In addition, two consecutive years of cotton, corn, and bahiagrass failed to reduce white mold incidence in the following peanut crop below the levels noted in the plots in continuous peanut production. Timper et al. (2001) also found that damage attributed to this disease in plots in continuous peanuts and in plots cropped to peanut after two years of cotton or corn was similar, while disease levels for the two-year bahiagrass-peanut rotation were lower. In contrast, white mold damage was significantly lower where peanut were grown after two years of cotton (Johnson et al. 1999a, Johnson et al. 1999b, Rodriguez-Kabana et al. 1991,Rodriguez-Kabana et al. 1994), corn (Johnson et al. 1999a), or bahiagrass (Brenneman et al. 1995, Johnson et al. 1999a, Timper et al. 2001), compared to continuous peanuts. Incidence of this disease in peanut cropped after three years of cotton, corn, and bahiagrass appeared to be higher here than in a previous survey of Alabama farm fields (Bowen et al. 1996).

Lower white mold incidence suggests that a disease suppressive microflora and/or microfauna has developed in the plots that have been in peanut monoculture since 1986.

Peanut Root-Knot Nematode

In 2000, soil samples for nematode assays were taken only from those plots cropped in that year to peanut. Cropping pattern appeared to have a limited impact on populations of the peanut root-knot nematode. In the peanut monoculture, numbers of peanut root-knot juveniles were similar to those where peanut were cropped after one year of corn, cotton, bahiagrass, winter rye/pearl millet, winter rye/velvetbean, or winter rye/summer fallow (Table 4). In addition, plots cropped to peanut after three years of bahiagrass and the peanut monoculture had similar populations of peanut root-knot juveniles. Numbers of peanut root-knot larvae were significantly higher where peanut followed a summer fallow the previous summer, compared with those recorded for the peanut monoculture and for peanut grown after three consecutive years of bahiagrass.

For the following year, nematode assays were conduced on soil samples collected from all plots. Not surprisingly, the fewest peanut root knot juveniles were found in the plots cropped in 2001 to at least one year of corn, cotton, bahiagrass, pearl millet, and winter velvetbean, as well as summer fallow (Table 4). Juvenile numbers in the plots cropped to peanut every two years were similar to those where peanuts were produced once every three to four years of corn, cotton, or bahiagrass. Nematode populations recorded for the peanut monoculture, however, did not differ significantly from those found in corn, cotton, pearl millet, velvetbean, summer fallow, or bahiagrass. In addition, juvenile numbers found in the second year of cotton, corn, or fourth year of bahiagrass were also similar to those obtained for the peanut monoculture. Highest number of juveniles was noted on peanut grown after three consecutive years of cotton. However, all of the plots cropped to peanut in 2001 supported similar numbers of peanut root-knot juveniles.

Peanut Yield

In 2000, peanut-cropping frequency appeared to have limited impact on pod yield (Table 5). When compared to plots where peanuts have been grown in at least three successive years, the yield of peanut produced after three years of bahiagrass did not significantly differ. Yield of peanuts grown after one year of velvetbean or summer fallow were significantly higher than those produced after two or more successive peanut crops, as well as those grown after one year of pearl millet. Otherwise, pod yields of peanuts grown after one year of bahiagrass, cotton, or corn were similar to the yield of those plots maintained in a 14-year peanut monoculture.

In the following year, intervals of one or more years between peanut crops often, but not always, resulted in yields higher than in those plots where peanut were cropped for three or more consecutive years. Peanuts produced after three but not two years of bahiagrass or after three years of cotton yielded significantly higher than plots maintained in a 15-year peanut monoculture (Table 5). Yield of peanut grown after three years of bahiagrass, corn, or cotton did not significantly differ. However, peanuts produced after three successive years in cotton did not differ in yield from those produced after three or more consecutive peanut crops.

For the 2002-growing season, plots cropped to peanuts in the two previous years generally yielded significantly less than where the same crop followed at least one year of corn, pearl millet, velvetbean, or cotton, or followed two but not one year of bahiagrass (Table 5). Also, yield for peanut grown winter rye/ summer fallow, but not after summer fallow alone, was significantly higher than that recorded in the plots in peanuts for two or more consecutive years and was similar to those recorded for the majority of other one-year rotation patterns. Among the one-year rotations, the best yield response was seen where peanut followed a single crop of corn or pearl millet. Surprisingly, peanuts produced after two years of cotton or corn had yields similar to those obtained where a one-year rotation pattern included these same crops. Generally, peanuts grown after four years of bahiagrass yielded significantly higher than the majority of the peanut rotation patterns evaluated in 2002.

Peanut cropping frequency and crop selection had a significant impact on peanut yield. However, peanut yield did not always increase as the time interval between peanut crops was lengthened. Of the crops evaluated in a one year rotation with peanut, consistent yield gains were obtained in both years with velvetbean and winter rye/summer fallow and in two of three years with corn, when compared with the yield recorded for a peanut monoculture. In one of two years, significant yield increases were also obtained where peanut followed one year of bahiagrass, pearl millet, cotton, or summer fallow. In previous studies, peanut yield in a bahiagrass-peanut (Brenneman et al. 1995, Johnson et al. 1999b), corn-peanut (Johnson et al. 1999), and cotton-peanut (Johnson et al. 1999b, Rodriguez-Kabana et al. 1991) cropping pattern was consistently higher than that observed in plots maintained in a peanut monoculture.

Yield gains over a peanut monoculture with two or more years of bahiagrass, cotton, and corn were more erratic than anticipated. In previous studies (Brenneman et al. 1995, Johnson et al. 1999a, Johnson et al. 1999b, Rodriguez-Kabana et al. 1994), yield was consistently higher for peanut cropped after two or more years of bahiagrass, corn, or cotton than for a peanut monoculture. Despite an irrigated production system, similar yields were recorded where peanut followed two bahiagrass, as well as three years of cotton, and the long-term peanut monoculture. However, higher yields were seen where peanuts followed two years of corn, cotton, or both crops, three years of corn, and three or four years of bahiagrass. In addition, peanut cropped after three or four years of bahiagrass yielded significantly higher than some, but not all, of the one-year cropping patterns, particularly the corn-peanut rotation in 2001 and 2002.

CONCLUSION

Crop rotation is the single most effective management strategy for avoiding damaging outbreaks of southern stem rot and peanut root-knot nematode in peanut. While crop rotation alone is not a replacement for fungicide use for leaf spot control, the severity of leaf spot diseases was reduced in our study to the point that fewer fungicide applications may be needed to prevent yield losses to these diseases. While the one-year rotation patterns did not consistently suppress diseases, yield were often higher for peanuts cropped after one year of corn or another crop than those recorded for the long-term peanut monoculture. Reducing the frequency of cropping peanut to once every three to four years further reduced disease pressure and usually resulted in higher yields.

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Table 2. Impact of cropping pattern on the severity of leaf spot diseases on 'Georgia Green' peanut.

Cropping pattern, 1997 to 2002	Leaf Spot Rating[w]		Cropping pattern, 1997 to 2002	Leaf Spot Rating	
	2001	2002		2001	2002
P-P-P-P-P-P[x] ……………………....	6.0[y]	6.3	R/F-P-R/F-P-R/F-P …….……..	--	6.0
P-B-P-P-P-P ………………………	6.0	5.8	Ct-P-Ct-P-Ct-P ……………….	--	5.5
P-P-P-B-B-P ………………………	--[z]	4.5	B-P-B-B-P-B …………………	4.0	--
P-B-B-B-P-P ………………………	4.5	5.5	C-C-P-C-C-P …………………	--	4.8
C-P-C-P-C-P ……………………..	--	5.5	Ct-Ct-P-Ct-Ct-P ………………	--	4.5
P-C-P-C-P-C ……………………....	5.5	--	C-Ct-P-C-Ct-P ………….…….	--	5.0
B-P-B-P-B-P ………………………	--	5.0	Ct-C-P-Ct-C-P ………….…….	--	5.3
PM-P-PM-P-PM-P ……………….	--	5.3	B-B-B-P-B-B …………………	--	--
R/PM-P-R/PM-P-R/PM-P ……….	--	4.3	P-Ct-Ct-Ct-P-Ct ………………	4.5	--
R/V-P-R/V-P-R/V-P ……………...	--	4.5	P-C-C-C-P-C …………………	4.3	--
F-P-F-P-F-P ………………………	--	5.5	P-B-B-B-B-P …………………	--	4.5
LSD (P≤0.05) ……………………..	0.4	1.3	LSD (P≤0.05) ………………..	0.4	1.3

[w]Leaf spot severity was assessed using the Florida leaf spot scoring system where 1 = no disease, 2 = very few lesions on leaves in lower canopy, 3 = few lesions on leaves in lower and upper canopy, 4 = some lesions on leaves in lower and upper canopy with some defoliation (< 10%), 5 = lesions noticeable in upper canopy with some defoliation (<25%), 6 = lesions numerous with significant defoliation (<50%), 7 = lesions numerous with heavy defoliation (<75%), 8 = numerous lesions on few remaining leaves with severe defoliation (<90%), 9 = very few remaining leaves covered with lesions and severe defoliation (<95%), and 10 = plants defoliated or dead.

[x]Key to crop abbreviations: P = peanut, B = bahiagrass, C = corn, PM = pearl millet, R = winter rye, V = velvetbean, F = summer fallow, and Ct = cotton.

[y]Mean comparison in each column was according to Fisher's Least Significant Difference (LSD) test (P≤0.05).

[z]-- = Peanut was not produced in that year of a particular cropping pattern.

Table 3. Incidence of white mold in peanut as affected by cropping pattern.

Cropping pattern, 1997 to 2002	White Mold Incidence[w]			Cropping pattern, 1997 to 2002	White Mold Incidence		
	2000	2001	2002		2000	2001	2002
P-P-P-P-P-P[x] ……………..	24[y]	17	13	R/F-P-R/F-P-R/F-P ………	16	--	27
P-B-P-P-P-P …………….....	34	26	16	Ct-P-Ct-P-Ct-P …………..	30	--	25
P-P-P-B-B-P …………….....	--[z]	--	21	B-P-B-B-P-B …………..….	--	10	--
P-B-B-B-P-P ……………..	--	8	20	C-C-P-C-C-P ……………..	--	--	29
C-P-C-P-C-P ……………..	15	--	14	Ct-Ct-P-Ct-Ct-P …………..	--	--	25
P-C-P-C-P-C ……………..	--	25	--	C-Ct-P-C-Ct-P ……….……	--	--	25
B-P-B-P-B-P ……………...	18	--	22	Ct-C-P-Ct-C-P ……….……	--	--	29
PM-P-PM-P-PM-P ………	42	--	27	B-B-B-P-B-B ……………..	18	--	--
R/PM-P-R/PM-P-R/PM-P .	41	--	27	P-Ct-Ct-Ct-P-Ct …………..	--	11	--
R/V-P-R/V-P-R/V-P ……..	22	--	25	P-C-C-C-P-C ……………...	--	16	--
F-P-F-P-F-P ……………...	21	--	22	P-B-B-B-B-P ……………..…	--	--	9
LSD ($P \leq 0.05$) …………….	12	9	9	LSD ($P \leq 0.05$) ……………..	12	9	9

[w]White mold incidence was rated immediately after plot inversion where 1 locus is defined as <1 ft of consecutive white mold diseased or dead plants per row.
[x]Key to crop abbreviations: P = peanut, B = bahiagrass, C = corn, PM = pearl millet, R = winter rye, V = velvetbean, F = summer fallow, and Ct = cotton.
[y]Mean comparison in each column was according to Fisher's Least Significant Difference (LSD) test ($P \leq 0.05$).
[z]-- = Peanut was not produced in that year of a particular cropping pattern.

Table 4. Populations of peanut root-knot nematode as affected by cropping pattern.

Cropping pattern, 1997 to 2002	Numbers of root-knot juveniles			Cropping pattern, 1997 to 2002	Numbers of root-knot juveniles		
	2000	2001	2002		2000	2001	2002
P-P-P-P-P-P[x] ……………..	54[y]	201	108	R/F-P-R/F-P-R/F-P ……….	56	0	524
P-B-P-P-P-P ……………...	87	266	173	Ct-P-Ct-P-Ct-P ……………	61	1	69
P-P-P-B-B-P ……………...	--[z]	4	130	B-P-B-B-P-B ……………..	--	36	--
P-B-B-B-P-P ……………..	--	315	260	C-C-P-C-C-P ……………...	--	2	50
C-P-C-P-C-P …………….	68	26	239	Ct-Ct-P-Ct-Ct-P …………..	--	11	270
P-C-P-C-P-C …………….	--	343	--	C-Ct-P-C-Ct-P ……………	--	6	207
B-P-B-P-B-P ……………..	10	0	199	Ct-C-P-Ct-C-P ……………	--	23	338
PM-P-PM-P-PM-P ………	91	5	269	B-B-B-P-B-B …………….	40	36	--
R/PM-P-R/PM-P-R/PM-P	118	3	236	P-Ct-Ct-Ct-P-Ct ………. …	--	401	--
R/V-P-R/V-P-R/V-P ……..	78	0	195	P-C-C-C-P-C ……………...	--	130	--
F-P-F-P-F-P ……………...	176	1	203	P-B-B-B-B-P ……………..	--	17	270
LSD ($P \leq 0.05$) …………….	116	324		LSD ($P \leq 0.05$) ……………..	116	324	

[x]Key to crop abbreviations: P = peanut, B = bahiagrass, C = corn, PM = pearl millet, R = winter rye, V = velvetbean, F = summer fallow, and Ct = cotton.
[y]Mean comparison in each column was according to Fisher's Least Significant Difference (LSD) test ($P \leq 0.05$).
[z]-- = Plots were not sampled for peanut root-knot nematode.

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Table 5. Impact of cropping pattern on the yield of peanut cv. 'Georgia Green'.

Cropping pattern, 1997-2002	Yield lb/A			Cropping pattern, 1997 to 2002	Yield lb/A		
	2000	2001	2002		2000	2001	2002
P-P-P-P-P-P[x] ……………	3137[y]	3206	2612	R/F-P-R/F-P-R/F-P ………...	3880	--	3639
P-B-P-P-P-P …………….	2752	3006	2779	Ct-P-Ct-P-Ct-P ……………..	3144	--	3670
P-P-P-B-B-P ……………	--[z]	--	3499	B-P-B-B-P-B ……………….	--	3674	--
P-B-B-B-P-P ……………	--	4756	2782	C-C-P-C-C-P ……………….	--	--	4159
C-P-C-P-C-P ……………	3740	--	3939	Ct-Ct-P-Ct-Ct-P ……………	--	--	3632
P-C-P-C-P-C ……………	--	4204	--	C-Ct-P-C-Ct-P ……………..	--	--	3635
B-P-B-P-B-P …………...	3319	--	3261	Ct-C-P-Ct-C-P ……………..	--	--	4243
PM-P-PM-P-PM-P …….	3061	--	3865	B-B-B-P-B-B ………………	3095	--	--
R/PM-P-R/PM-P-R/PM-P	2682	--	3911	P-Ct-Ct-Ct-P-Ct ….………...	--	3614	--
R/V-P-R/V-P-R/V-P ……	3887	--	3590	P-C-C-C-P-C ……………….	--	4239	--
F-P-F-P-F-P …………….	3473	--	3146	P-B-B-B-B-P ……………….	--	--	4616
LSD (P≤0.05) …………..	661	643	812	LSD (P≤0.05) ………………	661	643	812

[x]Key to crop abbreviations: P = peanut, B = bahiagrass, C = corn, PM = pearl millet, R = winter rye, V = velvetbean, F = summer fallow, and Ct = cotton.
[y]Mean comparison in each column was according to Fisher's Least Significant Difference (LSD) test (P≤0.05).
[z]-- = Peanut was not produced in that year of a particular cropping pattern.

Crop Produced						Leaf Spot rating		Crop Produced						Leaf Spot rating	
1997	1998	1999	2000	2001	2002	2001	2002	1997	1998	1999	2000	2001	2002	2001	2002
P	P	P	P	P	P			R/F	P	R/F	P	R/F	P		
P	B	P	P	P	P			Ct	P	Ct	P	Ct	P		
P	P	P	B	B	P			B	P	B	B	P	B		
P	B	B	B	P	P			C	C	P	C	C	P		
C	P	C	P	C	P			Ct	Ct	P	Ct	Ct	P		
P	C	P	C	P	C			C	Ct	P	C	Ct	P		
B	P	B	P	B	P			Ct	C	P	Ct	C	P		
PM	P	PM	P	PM	P			B	B	B	P	B	B		
R/PM	P	R/PM	P	R/PM	P			P	Ct	Ct	Ct	P	Ct		
R/V	P	R/V	P	R/P	P			P	C	C	C	P	C		
F	P	F	P	F	P			P	B	B	B	B	P		