Comparisons of Conventional and No-Tillage Peanut Production Practices in Central Georgia

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Recent efforts by producers to optimize profits and conserve soil and water have resulted in an increasing interest in the use of conservation tillage practices in peanut production systems. There has been additional interest in doublecropping peanuts behind other crops. Seedbed implements consisting of fluted coulters proceeding in-row subsoilers have been used on a limited basis for planting no-tillage (NT) peanuts (technically, precision tillage) into the residues of small grains. This change in tillage may alter soil characteristics and the incidence of soil arthropod pests and soilborne plant pathogens when compared to conventional tillage (CT) peanut production practices. Pests of major concern in peanut cropping systems of the Southeastern U.S. include the lesser cornstalk borer (LCB), Elasmopalpus lignosellus (Zeller) and Southern stem rot (white mold), Sclerotium rolfsii (Sacc.). Comparisons of NT and CT production practices in terms of yields, quality, LCB damage and S. rolfsii incidence were therefore conducted in peanuts planted at the recommended time and also in peanuts doublecropped behind wheat.

Materials and Methods

NT and CT peanut production systems were compared during 1983 at three sites. Wheat was planted in Taylor Co., GA (site l), Macon Co., GA, (site 2) and Pike Co., GA (site 3) during the Fall of 1982. The soil types were Fuquay sandy loam, Wagram sand and Appling sandy loam at sites 1-3, respectively. During the previous growing season, grain sorghum was produced at site 1 and peanuts were produced at sites 2 and 3. Peanuts were planted in May (monocropped peanuts) and also following wheat harvest in June (doublecropped peanuts). CT and NT plots *of* monocropped or doublecropped peanuts were each arranged in a randomized complete block design with four replicates. Individual plot size was 9.15 x 12.2 m. A two row x 4.6 m section in the center of of each plot was designated for yield and quality measurements, and the remainder of each plot was designated for plant and soil sampling. Paraquat was applied to each cover crop at least one week before planting monocropped peanuts and immediately after planting doublecropped peanuts. CT plots were prepared by moldboard plowing and subsequent smoothing. NT plots were not disturbed. Peanuts (cv. Florunner) were planted (91 cm row spacing) in both NT and CT plots with a two row Brown-Harden Ro-Till (fluted coulter, in-row subsoiler) with conventional planters mounted directly behind each subsoiler shank. Monocropped peanuts were planted on 10 May at sites 1 and 2, and on 6 May at site 3. Doublecropped peanuts were planted on 15 June at site 1, on 14 June at site 2 and on 13 June at site 3.

Weeds were supressed in each NT and CT plot with an at-cracking application of metolachlor + naptalam + dinoseb at 2.2, 3.4, and 1.7 kg/ha, respectively. All plots were treated with 38 kg P/ha and 72 kg K/ha at

cracking; and 850 kg $CaSO_4$/ha, 0.6 kg B/ha and 0.14 kg Mo/ha at flowering. Chlorothalonil (1.3 kg/ha) was applied for foliar disease control 6-7 weeks after each planting and on subsequent 10-14 day intervals. Selections of postemergence herbicides and timing of their applications were based on careful monitoring of weed populations in the two tillage systems at each site. Sethoxydin (0.2 kg/ha) was applied for control of large crabgrass in doublecropped peanuts at site 1. Bentazon (1.1 kg/ha) was applied twice for control of yellow nutsedge in both monocropped and doublecropped peanuts at site 2. Paraquat (0.4 kg/ha) was applied between rows (hooded sprayer) of monocropped and doublecropped peanuts at sites 3 for control of mixed weed populations. Each postemergence herbicide application was required in both NT and CT plots.

LCB populations at each site were assessed 6-7 weeks after each planting, and on subsequent 10-14 day intervals. Sampling was conducted by removing two randomly located 40 x 40 x 10 cm deep soil samples which were randomly located over the row in each plot of each replicate. Subterranean plant parts and soil from eacn sample were examined for LCB larvae and their feeding damage. The percent of LCB damaged hulls at harvest was estimated by counting all hulls obtained in the yield sample from each plot and all hulls with damage characteristic to the LCB damage observed during the sampling program.

The densities of S. rolfsii sclerotia in soil of NT and CT plots at each site were estimated at planting and at harvest of monocropped and doublecropped peanuts. On each date, 20 soil cores (2.5 x 15 cm deep) were obtained from each plot. Bulked cores were air dried and passed through a 2 mm seive, and 500g of soil from each plot was spread evenly on absorbent paper. 90 ml of 1% methanol was applied as an aerosol to the soil and the sample was placed in a plastic bag. Colonies of S. rolfsii on the soil surface were counted after 3 days of incubation at 300°C. Immediately after inverting peanuts at each site, the incidence of S. rolfsii on plants was estimated by examining the subterranean parts of 20 randomly selected plants in each plot.

Peanut plants in all plots were inverted with standard digging equipment. The section in the center of each plot designated for yield and quality measurements was transported from the field and placed in a large drying chamber. Dried hulls were removed from the plants with a stationary peanut thrasher. Peanuts at 8.5% moisture were graded (454 g from each yield sample) in accordance with standard Federal-State inspection service procedures. Data from each planting date at each site (peanut yields, quality aspects, soil insect damage and S. rolfsii incidence) were subjected to analysis of variance (ANOVA) for a randomized complete block design. ANOVA for a series of experiments was also conducted on yield and quality data combined over the three sites.

Results and Discussion

Yields, seed size, and the percent total sound mature kernels (%TSMK) from monocropped and doublecropped peanuts (Table 1) indicated that NT was a viable peanut production practice under the conditions experienced at sites 1-3. Rainfall at each site was sufficient for initial plant growth during May-June, 1983. Drought conditions at sites 1-3 during July and August, resulted in extremely slow plant growth and peanut pod development until adequate rainfall resumed in September (irrigation was not available). Totals for rainfall

measured during July and August were 8.6, 8.7 and 10.1 cm at sites 1, 2 and 3, respectively. The longest period without rain (29 days) occurred during August at site 1. Yields from monocropped peanuts at each of sites 1-3 were higher in NT than in CT, but no significant differences were detected from analysis of individual experiments. A 52% higher yield in NT as compared to CT in monocropped peanuts at site 1 was not significant as a result of considerable variation between replicates which corresponded closely to variation in LCB damage. Quality measurements from NT and CT monocropped peanuts were similar, except for a significantly higher seed size and %TSMK in NT at site 1. Yields from doublecropped peanuts were similar in NT and CT at sites 1 and 3. A 47% higher peanut yield in NT as compared to CT (significant at the 0.09 level) may have been influenced by considerable variation in LCB damage between replicates. This difference also may have been enhanced by competition from a severe yellow nutsedge infestation in CT. Uifferences in quality aspects of doublecropped peanuts included a significantly higher ($P<0.05$) %TSMK in NT at site 2 and significantly higher ($P<0.1$) seed size and %TSMK in NT at site 3.

Table 1. Yield and quality measurements from no-tillage (NT) and conventional tillage (CT) peanuts produced in monocropping and doublecropping production schemes.

Site	Tillage	Monocropped peanuts			Doublecropped peanuts		
		Yield (kg/ha)	Seed size (g/100)	%TSMK	Yield (kg/ha)	Seed Size (g/100)	%TSMK
1	NT	3923	44.2	65.5	2130	40.3	58.8
	CT	2584	40.1**	62.a**	2309	42.2	56.3
2	NT	2808	42.9	70.3	2186	41.4	64.5
	CT	2533	41.4	68.0	1491*	42.0	59.3**
3	NT	4013	43.6	69.8	2897	41.5	64.5
	CT	3346	43.5	65.5	2443	36.0*	58.3*
Means over Sites 1-3:							
	NT	3581	43.5	68.5	2404	41.1	62.6
	CT	2821**	41.7	65.4**	2081*	40.1	58.0*

* indicates significant differences between tillage treatments at the 0.1 level, ** indicates significant differences at the 0.05 level, F-test.

The analysis of data combined over sites (Table 1) indicated that yields and %TSMK were significantly higher in NT than in CT in monocropped peanuts ($P<0.05$) and in doublecropped peanuts ($P<0.l$). The pronounced differences in yields between NT and CT may have resulted from the drought conditions which prevailed during this study. The dead wheat residues in the NT systems may have reduced soil temperatures and increased soil moisture retention compared to CT. Other research has shown that yields and quality from NT and CT

peanuts can be expected to be similar under conditions optimal for plant growth.

Yields from doublecropped NT and CT peanuts at sites 1-3 were lower than corresponding yields from monocropped peanuts (Table 1). ANOVA on data combined over sites indicated that yields in NT and %TSMK in CT were significantly lower ($P<0.05$), and seed size and %TSMK in NT, and yields in CT were significantly lower ($P<0.1$) in doublecropped peanuts as compared to monocropped peanuts (differences are not denoted in Table 1). Although the yields obtained from these plantings were low, further research is needed in central Georgia to determine whether doublecropping will be a viable peanut production practice in situations of adequate rainfall or on farms with irrigation.

Soil sampling at each site indicated a general increase in LCB populations throughout July and August, but populations diminished during September. Population densities were extremely variable in both NT and CT plots throughout each site. The only significant difference ($P<0.1$) in measurements of LCB damage between NT and CT was a lower number of damaged hulls in monocropped NT peanuts at site 1. The percentage of damaged hulls in monocropped peanuts at each of sites 1-3 was lower in NT than in CT, but extreme variations between replicates prevented the detection of significant differences. Drought conditions caused a delay in pod development in doublecropped peanuts until rains resumed and LCB populations decreased in September. Numbers of damaged hulls were therefore lower in doublecropped peanuts as compared to monocropped peanuts. Wireworms detected in September in samples from doublecropped peanuts at sites 2 and 3 resulted in hull damage estimates which included both LCB and wireworm damage. The similarities in LCB damage in NT and CT at sites 1-3 suggest that LCB management needs will be similar in NT and CT peanut systems.

Table 2. Hull damage caused primarily by lesser cornstalk borer larvae in no-tillage (NT) and conventional tillage (CT) peanuts produced in monocropping and doublecropping production schemes.

Site	Tillage	Monocropped peanuts		Doublecropped peanuts	
		No. damaged hulls/m row	% damaged hulls	No. damaged hulls/m row	% damaged hulls
1	NT	23.4	6.4	19.8	8.8
	CT	35.1*	14.7	19.0	8.1
2	NT	37.7	14.2	21.6	11.1
	CT	42.0	17.1	12.8	10.1
3	NT	44.6	12.5	36.3	14.3
	CT	45.0	14.8	21.3	9.3

* indicates significant differences between tillage treatments at the 0.1 level, F-test.

Low populations of S. rolfsii were detected at sites 2 and 3 at planting. Sclerotia were detected in soil at harvest in doublecropped NT peanuts at site 1, and in NT and CT of both planting dates at sites 2 and 3 (Table 3). Higher S. rolfsii populations were detected at sites 2 and 3 (peanuts following peanuts)than at site 1 (peanuts following grain sorghum). No significant differences in densities of sclerotia or percentages of infected plants were detected between NT and CT of either monocropped or doublecropped peanuts at sites 1,2 or 3. The presence of surface residues in the NT systems at sites 1-3 did not increase either S. rolfsii populations or the incidence of the disease on plants.

Table 3. Densities of S. rolfsii sclerotia in soil and incidence of the disease at harvest of no-tillage (NT) and conventional tillage (CT) peanuts produced in monocropping and doublecropping production schemes[1].

Site	Tillage	Monocropped peanuts		Doublecropped peanuts	
		No. sclerotia/ 500g soil	% infected plants	No. sclerotia/ 500g soil	% infected plants
1	NT	0	2.5	0.5	0
	CT	0	1.2	0	0
2	NT	3.8	22.0	0.2	6.0
	CT	3.0	17.0	1.8	10.0
3	NT	0.8	7.5	2.2	13.8
	CT	0.5	3.8	2.0	8.8

[1] No significant differences were detected between tillage treatments.

The findings of this study indicate that no-till peanut production is feasible. Under the drought conditions at sites 1-3, NT resulted in higher average yields than CT in both monocropped and doublecropped peanuts. Comparisons of LCB and S.rolfsii populations in the NT and CT systems suggest that current management needs for these pests will be similar in NT. Research is however needed to allow development of optimal management techniques for NT peanut cropping systems.

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