TILLAGE AND HERBICIDE MANAGEMENT OF TWO VARIETIES OF PEANUT

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ABSTRACT

Peanut *(Arachis hypogaea)* research is needed that leads to improved competitiveness and helps improve grower's financial condition. Research was conducted to determine pod and seed yield and seed quality of two peanut varieties ('Georgia Green' and 'Andru 93') under five tillage and two herbicide management programs, double-cropped following a winter cover crop of rye *(Secale cereale).* A split-split plot experimental design with six replications was used to evaluate two varieties of peanut grown under five tillage systems with two herbicide programs. Four variations of conservation tillage using strip-till management following winter rye provided peanut pod and seed yield equal to the conventional tillage in-row subsoil system. Overall average pod yield for the five tillage treatments was 5,862 lb/A at 10% moisture. Pod yield was 6,136 lb/A for Georgia Green compared with 5,612 lb/A for Andru 93, a 9.3% advantage for Georgia Green. Herbicide management using Starfire plus Storm gave significantly higher pod yield (5,983 lb/A) compared with management using Cadre (5,785 lb/A). On the other hand, the most troublesome weed, fall panicum *(Panicum dichotomiflorum,* was controlled best using Cadre. Data from this experiment provide further proof that strip-till management in Florida's sandy soils can be equal to conventional tillage in-row subsoil management.

INTRODUCTION

Peanut *(Arachis hypogaea)* farmers are faced with increasing global competition, thereby placing greater emphasis on the need for research that will lead to improved competitiveness (Baldwin, 1998). In 1997, total Florida land area devoted to peanut production was approximately 84,000 acres with a farm gate value of over $54,000,000. The actual economic value to Florida and the US economy would be over $160,000,000 due to the multiplier effect (Anon., 1998).

Positive results were achieved with in-row subsoil no-till (strip-till) peanut in the 1980s (Costello, 1984; Costello and Gallaher, 1985; Gallaher, 1983), however, many growers were reluctant to modify their conventional production practices. No-till/conservation tillage management programs have recently received greater attention. Much of this attention was initiated with the Food Security Act (Anon., 1985) and the Food, Agricultural, and Conservation Trade Act (Anon., 1990). These acts, passed by US Congress, provided token dollar support to participating farmers and required that they implement an approved conservation plan by the end of 1994.

Because of renewed interest in conservation tillage peanut, strip-till (no-till plus subsoil) research on peanut was initiated again in 1997. No-till plus subsoil (Strip-till) planted peanut research on weed control during the 1997 and 1998 growing seasons at Gainesville, FL has shown good results, with pod yields as high as 3,900 lb/A in 1998 (Edenfield et al., 1999). Yield differed between years and was likely due to the use of 'Georgia Green' variety in 1998 versus 'Florunner' in 1997. In both years, pod yield was positively related to the degree of weed control. With proper management for good disease control, 'Florunner' peanut yields over

6,000 lb/A are possible (Overman and Gallaher, 1990). This latter yield should be our goal for peanut farmers and newly developed varieties should make this possible.

The objective of this research was to determine pod and seed yield and seed quality of two peanut varieties under five tillage and two herbicide management programs double-cropped following a winter cover crop of rye *(Secale cereale).*

MATERIALS AND METHODS

The experiment was conducted in 1999 at the Green Acres Agronomy Field Research Laboratory near Gainesville, FL on an Arredondo fine sand (Sandy Siliceous Thermic Paleudult) (Anon. ,1994). The experimental area was harrowed and 60 lb rye/A was seeded November 20, 1998 and fertilized with 200 lb/A of 12-4-8 (N-P_2O_5-K_2O). On February 12, 1999, 200 lb/A of ammonium nitrate were applied and followed by 2,4-D Amine 4 at 1.0 lb ai/A for winter broadleaf weed control. Rye straw treatments were implemented on May 13,1999, followed by 30-inch wide strip-till rows made with the Brown-Harden in-row-subsoil planter.

The split-splitplot experimental design consisted of six replications with two rows 5 ft wide by 20 ft. There were five main plot tillage treatments, two split-plot peanut variety treatments, and two herbicide treatments as final split-split-plots. Tillage treatments were: 1) strip-till into undisturbed rye straw (no-till plus subsoil); 2) strip-till into rye stubble that had been mowed and straw removed (no-till plus subsoil); 3) strip-till into rye stubble and residue after rye straw was mowed (no-till plus subsoil); 4) strip-till into rye stubble after rye straw was mowed and removed followed by mechanical cultivation (no-till plus subsoil plus conventional tillage cultivation); and 5) strip-till after rye straw was incorporated by conventional tillage (conventional tillage plus subsoiling followed by conventional tillage cultivation). The two varieties were 'Georgia Green' and 'Andru 93'. The two herbicide treatments included: a) Starfire (paraquat) (0.125 lb ai/A) plus Storm (bentazon plus acifluorfen) (0.75 lb ai/A) plus Activate Plus (0.25% v/v) and b) Cadre (imazapic) (0.063 lb ai/A) plus Activate Plus (0.25% v/v).

Peanuts were planted over the strip-till rows at 6 seed/ft of row on May 25,1999. The entire experiment was treated with Roundup Ultra (glyphosate) at 2 lb ai/A plus Prowl (pendimethalin) at 1.0 lb ai/A preemergence on May 27, followed by 0.5-acre inch irrigation on May 28. A sidedress application of 250 lb/A of 17-4-20 (N-P_2O_5-K_2O) was made on June 14. The Starfire plus Storm herbicide treatment was applied on June 17, and the Cadre herbicide treatment was applied on June 24. Insects and diseases were controlled by sprays as follows: Bravo (chlorothalonil) at 0.52 lb ai/A on June 17 and 22 and July 12, and 0.73 lb ai/A on July 22, August 6, 16, and 27 and September 8 and 22; Lannate (methomyl) at 0.30 lb ai/A on June 17, 0.45 lb ai/A on June 22, July 12, and August 16, and 0.60 lb ai/A on September 22; Folicur 3.6 F (tebuconazole) at 0.13 lb ai/A on June 22, July 2, *12* and 22, August 6 and 27, and September 8; Solubor (6.2% Boron) at 3 lb/A on June 22; and applied 900 lb gypsum/A in a 12-inch band over the row on July 8. Weed control ratings were made on October 6, 1999. A rating of 100% weed control represented the presence of no weeds in a plot and 0% control represented complete plot coverage of weeds.

Peanut yield was determined from digging the two row plots on October 11, followed by thrashing with a combine on October 14. Pod subsamples (2.2 Ib) were taken to determine moisture, shelling percent and quality. These subsamples were dried in a forced air seed dryer at outside air temperature (averaged 86°F) for 10 days, removed and weighed to determine moisture loss. A 0.44-lb subsample was taken from these dry samples and used to determine percent shelling, moisture, shrivel seeds, cracked kernels, large kernels, and empty pods. From these measurements, field weights were adjusted to 10% moisture on a pod and seed yield basis.

Data tabulation and transformations were completed by use of Quattro Pro Spreadsheets (Anon., 1993). Analysis of variance and mean separation were conducted for a split-split plot with whole plots in a randomized complete block design using MSTAT (Freed et al., 1987). Means were separated by use of the Least Significant Difference test (LSD) at $p = 0.05$.

RESULTS AND DISCUSSION

No interactions occurred among tillage, varieties, and herbicides for seed yield (Table 1). Shelling percent averaged 79% and sound seed made up 95.5% of total seed yield. These pod yields of over 5,500 Ib/A are well above the 1999 average for the state of Florida (2,800 lb/A) and shows that strip-till peanut was equal to the conventional tillage in-row subsoil treatment. Similar results were documented in the early 1980s (Gallaher, 1983).

In every category of yield, Georgia Green provided greater yield compared with Andru 93 (Table 1). Sound seed yield for Georgia Green was 11.6% greater than Andru 93 but had 35% more cracked kernels and shrivels.

Starfire plus Storm provided greater pod and seed yield in every category except cracked kernels and shrivels compared with Cadre (Table 1). Sound seed yield was 3.8% greater with Starfire plus Storm than Cadre.

The only weed escape was fall panicum *(Panicum dichotomiflorum).* No interactions occurred between tillage treatments and peanut varieties or herbicide management treatments for fall panicum control. However, an interaction for fall panicum control was observed between peanut variety and herbicide treatment (Table 2). Overall, Starfire plus Storm provided less control of fall panicum than Cadre. However, herbicide Starfire plus Storm gave higher fall panicum control for Andru 93 compared with Georgia Green while Cadre gave equal control of fall panicum for both peanut varieties. Even though Cadre gave better weed control for both varieties compared with Starfire plus Storm, use of Cadre resulted in a reduction in yield for both varieties in this study.

These data show that conservation tillage using strip-till management into winter rye cover crop can be as successful as conventional tillage, which was similar to data from Florida in the early 1980s (Costello, 1984; Costello and Gallaher, 1985; Gallaher, 1983). Some Florida farmers are practicing growing winter rye as a cover crop, grazing the rye until near planting time, then ship-till planting directly into the rye stubble, followed by subsequent cultivation for supplemental weed control. They have also demonstrated that this practice provides yield comparable with strip-till and conventional tillage in-row subsoil practices for peanut. These data show that yield of strip-till peanut where rye straw from the winter cover crop is left undisturbed or is mowed and left is equal to conventional tillage. If rye is not needed for cattle grazing, the ground cover by straw would provide significant reduction in wind and water erosion and provide numerous conservation and environmental benefits, characteristic of the benefits of a mulch, without sacrificing yield (Gallaher, 1977; Gallaher and Laurent, 1983).

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Table 1. Peanut yield for five treatments averaged over variety and herbicide treatments; two varieties averaged over tillage and herbicide treatments; and two herbicides averaged over tillage and variety treatments, Gainesville, FL, 1999.

Tillage	Pod Yield	Total Seed	Sound Seed	Seed – C&S	C Seed
	---------- lb/A at 10% moisture ----------				
ST-RSU	5,866	4,637	4,452	4,203	248
ST-RSMR	5,816	4,612	4,401	4,128	274
ST-RSML	6,216	4,932	4,739	4,490	249
ST-RSMRC	5,817	4,662	4,448	4,175	273
ST-RSICT	5,595	4,410	4,194	3,923	271
Level of p	NS	NS	NS	NS	NS
Variety					
Georgia Green	6,136	4,886	4,690	4,389	302
Andru 93	5,612	4,414	4,203	3,979	224
LSD = 0.05 p	264	225	220	215	35
Herbicides					
A	5,983	4,745	4,530	4,258	272
B	5,765	4,557	4,363	4,109	254
LSD = 0.05 p	197	156	153	148	NS
CV	9.14	9.15	9.37	9.66	29.58

ST = strip-till; RSU = rye straw undisturbed; RSMR = rye straw mowed and removed; RSML = rye straw mowed and left; RSMRC = rye straw mowed and removed followed by mechanical cultivation. RSICT = rye straw incorporated by conventional tillage. Sound Seed = All seed minus shrivels; C&S = Cracked kernels and shrivels; C = Cracked kernels. Herbicide A = Starfire + Storm + Surfactant; Herbicide B = Cadre + Surfactant. CV = Coefficient of Variation.

Table 2. Percent control of fall panicum averaged over five tillage treatments for two peanut varieties and two herbicide treatments, Gainesville, FL 1999.

Variety	Herbicide A	Herbicide B	Average
	%		
Georgia Green	71	96	84
Andru 93	85	96	91
Average	78	96	

Level of p for varieties = 0.006; for herbicide = 0.000; for interaction = 0.011. LSD at 0.05 p for interaction = 7.

Interaction comparisons between varieties within a herbicide and comparisons between herbicides within a variety can be made. Herbicide A = Starfire + Storm + Surfactant; Herbicide B = Cadre + Surfactant