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Effects of Tillage Practices on Peanut Production in Virginia

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ABSTRACT

A 3-year study was conducted in Virginia to evaluate tillage practices on peanut yield and crop value. Treatment factors included time of plowing, four seedbed preparations, and two cultivations. Pesticides were used to control insects and diseases. Commercially available field implements were used to perform all tillage operations. Peanut yields were higher when the moldboard plowing operation was performed in the fall (Dec) than those when the plowing operation was performed in the spring (Mar). Yields were similar for the four seedbed preparation methods: flat, rotary tiller with shaper, disk bedder, and ripper-bedder. Cultivation (two) did not improve peanut yields. The above tillage treatments affected crop value similarly to peanut yield. The cone index (resistance to cone penetration) was considerably less in the ripper-bedder treatment than in other seedbed treatments. The economic advantage of field equipment to decrease the resistance for root penetration should be evaluated further.

Key Words: *Arachis hypogaea* L., Groundnuts, Peanut Yield, Peanut Crop Value, Cultural Practices, Cone Index.

Generally, peanuts (*Arachis hypogaea* L.) in Virginia are grown in a corn-peanut or corn-corn-peanut rotation. Corn stalks are cut and disked immediately after corn harvesting. The soil is moldboard plowed about 25 cm deep in the spring. It is disked two or three times to smooth the soil, incorporate pesticides, and prepare a level seedbed before planting. Some growers incorporate pesticides, prepare a seedbed with a rotary tiller, and plant all in a single-pass operation.

In recent years, bedding and under-row ripping (ripper-bedder) practices have received considerable attention, especially in corn and soybean production (4, 5, 6). These practices require an additional operation before planting peanuts.

Research was conducted during 1976, 1977, and 1978 to determine the effects of tillage practices on peanut yield and crop value. Cone index measurements for the tillage practices also are reported.

Materials and Methods

Florigiant peanuts were planted in a peanut-corn rotation. Production practices recommended for peanuts in Virginia were followed, except that modified tillage practices were used. The soil type was a moderately well-drained Woodstown loamy fine sand, classified as Aquic Hapludults (fine-loamy, silicious, mesic). Field equipment commercially available to growers was used to perform all tillage operations.

Tillage treatments included moldboard plowing in the fall or spring; preparation of seedbeds 1) in a conventionally flat manner, 2) with a rotary tiller and 3-inch bed shaper (tiller), 3) with a disk bedder, and 4) with a ripper-bedder; and two cultivations versus no cultivation. A rolling-type cultivator with adjustable spider gangs was used to cultivate and maintain seedbed shape. Both cultivations were completed within 6 weeks after planting.

Plots that were moldboard plowed and bedded or ripper-bedded in the fall (Dec) were retilled with the rolling cultivator before planting. Spring plowing and bedding were performed within 6 weeks before planting. Preplant herbicides were incorporated into the flat and tiller plots by use of a rotary tiller and into the bedded plots by use of a rolling cultivator.

Tillage treatments were arranged in a randomized split-split plot complete block design with four replications. Sub-subplots were 18.3 m long by 4 rows wide (row width 0.9 m). The center two rows were used as the test plot. The main plot treatments were time of plowing, subplot treatments were bed preparations, and sub-subplot treatments were cultivations.

Penetrometer measurements, used to characterize the soil resistance to root penetration (3), were made on each of the bed types in the spring plowing treatment. Five random readings were taken in the plant row of each plot during 1976 and 1978. The cone penetrometer was constructed (unpublished, F. S. Wright) to meet the ASAE Standard S313.1 (1). The cone index values were calculated from the force and base area of cone (1.3 cm^2). These values were analyzed with a depth up to 30 cm in increments of 6 cm and averaged over the 2 years.

The peanuts were dug with a digger-shaker-inverter and harvested with a commercial combine. The weight and moisture content of peanuts were determined for each plot. Grade samples were taken and artificially dried. Yield per acre was computed based on 8% w.b. moisture content, and crop value was computed by use of the standard marketing schedule for each year, based on grade factors. The data were subjected to analysis of variance, and significant differences were determined by Duncan's multiple range test.

Results and Discussion

Among the three tillage factors investigated, the time of moldboard plowing had the most consistent effect on peanut yields (Table 1). In 1976, peanut yields in the fall-plowed plots were significantly higher than those in the spring-plowed plots. Trends in 1977 and 1978 were similar, although yield differences were not significant. Overall, the yield averaged 6.4% greater (range = 3 to 8%) and the crop value averaged 8.3% greater (range = 5 to 9%) for fall plowing than for spring plowing. Specific causes for these responses were not determined. Hallock (2) obtained a similar yield response to the date of plowing and suggested that fall plowing reduced the quantities of fresh plant material in the fruiting zone near planting time.

Fall moldboard plowing in the Virginia peanut production area is not a common practice because inclement weather usually follows the corn, peanut, and soybean harvesting season. Likewise, fall plow-

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Table 1. Effect of time of plowing on peanut yield and crop value, Suffolk, VA.

Year	Yield (kg/ha)		Value ($/ha)	
	Fall	Spring	Fall	Spring
1976	5434a	5029b	2428a	2218b
1977	3707	3453	1640	1497
1978	3455	3360	1546	1477
Av	4199	3947	1871	1730

Treatment means within a year followed by unlike letters are significantly different at the 5% level as determined by Duncan's multiple range test.

ing prevents winter use of the land and increases the susceptibility of the land to erosion.

The type of seedbed preparation before planting significantly affected yeilds only in 1977 (Table 2). Yields from beds prepared flat or with a ripper-bedder were significantly higher than those from beds prepared with a rotary tiller-shaper or disk bedder. No explanation can be suggested for the lack of similar response to bed types in 1976 and 1978. Yields from disk-bedder and ripper-bedder plots averaged 1.9% to 3.6% higher over the 3-year study than those from the plots prepared flat. The benefit of this trend must be viewed in terms of the variability among years and of the additional equipment and costs to perform an added field operation.

Table 2. Effect of seedbed preparation methods on peanut yield, Suffolk, VA.

Year	Yield (kg/ha)			
	Flat	Tiller	Disk-bed	Rip-bed
1976	5100	5200	5370	5255
1977	3773a	3392b	3408b	3746a
1978	3191	3418	3518	3503
Av	4022	4004	4099	4168

Treatment means within a year followed by unlike letters are significantly different at the 5% level as determined by Duncan's multiple range test.

Cone index measurements for all bed types were similar to a depth of 12 cm (Figure 1). Between 12 and 30 cm, the cone index for the ripper-bedder treatment remained at about 800 kPa. The cone index for the other bed types increased with depths between 12 and 30 cm, to a maximum of about 4500 kpa, or about 5.5 times that for the ripper-bedder bed type. Observations of the soil profile made by trenching indicated that the peanut plant roots penetrated the subsoil region in all

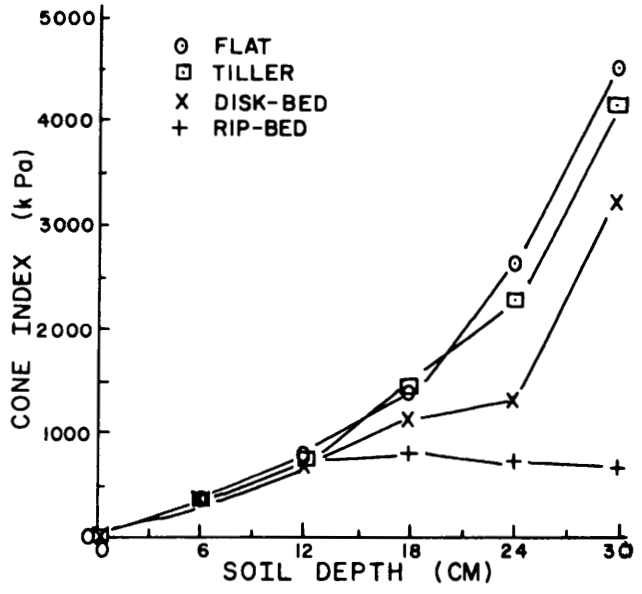

Fig. 1. Average cone index values with soil depth for four seedbed preparations (soil moisture content, 10-12% d.b., Suffolk, VA.

seedbed preparations. The soil moisture content ranged between 10% and 12% d.b.

Cultivation did not influence yield significantly any year (Table 3). However, the average yield for the plots not cultivated was about 1.7% higher than for the cultivated plots. Cultivation may have caused plant injury and root pruning. These results indicate that cultivation is not beneficial if weeds are controlled by herbicides. The cultivation treatments affected the crop value and peanut yield similarly.

Table 3. Effect of cultivation on peanut yield and crop value, Suffolk, VA.

Year	Yield (kg/ha)		Value ($/ha)	
	No cult.	2X cult.	No cult.	2X cult.
1976	5243	5219	2346	2300
1977	3604	3556	1588	1551
1978	3470	3445	1539	1484
Av	4106	4040	1825	1778

Yield responses to the tillage practices included in this study were not outstanding. The time of moldboard plowing and seedbed preparation had the only significant effects, but these were not consistent over the 3 years of the test. Plowing in the fall would not require additional machinery cost over plowing in the spring. Disk bedding and ripper-bedding provide no cost advantage over conventional flat or rotary tiller-shaper tillage for peanut production in Virginia. Although this study was conducted on one soil type, observations at other locations have indicated that peanut plant roots penetrate "hard" soil layers more readily

than do corn plant roots. Thus, additional costs of production equipment to lower soil resistance to root penetration must be considered on an individual basis among farming operations.

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