PEANUT

Peanut Response to Cultivar Selection, Digging Date, and Tillage Intensity

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ABSTRACT

Peanut (*Arachis hypogaea* L.) in the United States is generally grown in conventionally tilled systems. However, interest in reduced tillage peanut production has increased. Five experiments were conducted in North Carolina to determine if cultivar selection and digging date affected peanut yield and economic value when peanut was seeded into conventionally tilled seedbeds compared with strip tillage into small-grain cover crop or stubble from the crop planted the previous summer. In separate experiments, peanut yield and economic value in these tillage systems were compared with peanut strip-tilled into beds prepared the previous fall (stale seedbeds). Cultivar selection and digging date did not affect pod yield or gross value when comparing tillage systems. Pod yield in conventional and stale seedbed systems was similar in all five experiments where these systems were compared, and yields in these tillage systems exceeded those of strip tillage into crop stubble in three of five experiments. Pod yield was similar among all three tillage systems in the other two experiments. In experiments where only conventional tillage and strip tillage systems were compared, pod yield was similar between the two tillage systems in four experiments, higher in conventional tillage compared with strip tillage in one experiment, and higher for strip tillage compared with conventional tillage in one experiment. In 16 of 17 comparisons, pod yield of peanut planted in conventional tillage systems equaled or exceeded that of peanut planted into stubble from the previous crop.

Peanut in the United States is typically grown in conventionally tilled systems (Sholar et al., 1995). Peanut response to reduced tillage has been inconsistent. Research suggests that yields in reduced tillage systems can be lower than (Brandenburg et al., 1998; Cox and Sholar, 1995; Grichar, 1998; Jordan et al., 2001; Sholar et al., 1993; Wright and Porter, 1995) or similar to (Baldwin and Hook, 1998; Dowler et al., 1999; Hartzog et al., 1998; Williams et al., 1998) yields in conventional tillage systems. Higher yields in reduced tillage systems have been associated with lower incidence of tomato spotted wilt virus (TSWV) (Baldwin and Hook, 1998; Johnson et al., 2001; Wright et al., 2000). In most experiments where this disease is not a factor, yields in reduced tillage systems often do not exceed those of conventional tillage. Determining the cause of inconsistent yield response to reduced tillage would be beneficial in determining when reduced tillage systems could be successfully implemented in peanut production.

Cultivar selection can have a dramatic effect on crop response to production and pest management practices. Culpepper et al. (1997) reported that peanut cultivars responded differently to the plant growth regulator prohexadione calcium (calcium salt of 3,5-dioxo-4-propionylcyclohexanecarboxylic acid). Cultivars also respond differently to digging date (Jordan et al., 1998). Disease management approaches can be affected by cultivar selection (Bailey, 2002). Virginia market-type cultivars vary considerably in pod size, maturity, and several other agronomic factors (Swann, 2002). Although not well established in the literature, pod loss can be severe if peanut is dug under poor soil conditions (Beam et al., 2002). It is suspected that pod loss may be greater in reduced tillage systems than conventional tillage systems because the plants may be more difficult to dig. Peanut cultivars with larger pods may be more susceptible to digging losses compared with smaller-seeded cultivars because they have a greater surface area, which may cause increased exposure to detachment during the digging process. Practitioners indicate that pod loss from smaller-seeded runner market types is less than that for large-seeded virginia market types during the digging component of the harvest process. However, these comparisons have not been documented in the literature. Determining if pod yield differs among tillage systems for cultivars with different pod sizes may help explain inconsistent peanut response to reduced tillage systems.

Stale seedbed crop production has been successful for a variety of row crops, including soybean [*Glycine max* (L.) Merr.] and cotton (*Gossypium hirsutum* L.) (Shaw, 1996). Seedbeds are prepared the previous fall or during the spring several weeks or months before seeding directly into previously established stale seedbed without significant soil disturbance. This approach to peanut production may be a viable alternative to both conventional tillage systems and strip tillage directly into stubble from the previous crop.

The objectives of this research were to determine if peanut response to tillage was associated with cultivar selection and digging date and if peanut yield in stale seedbeds differs from yield in conventional tillage or strip tillage into crop stubble.

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Published in Agron. J. 95:380–385 (2003).

Abbreviations: CBR, Cylindrocladium black rot; %ELK, percentage of extra large kernels; %TSMK, percentage of total sound mature kernels; TSWV, tomato spotted wilt virus.

MATERIALS AND METHODS

Interactions of Tillage, Cultivar, and Digging Date

Experiments were conducted at one site in 1997, three sites in 1999, and at one site each in 2000 and 2001 (Table 1). The experiment was conducted near Tyner, NC, in 1997 on a Wanda fine sand (Siliceous, thermic, Typic Udipsamments). The experiments in 1999 were conducted on private farms in eastern North Carolina located near Tyner and Williamston on a Conetoe loamy sand (loamy, mixed, thermic, Arenic Hapludults) and near Gatesville on a Wanda fine sand. In 2000 and 2001, the experiment was conducted at the Peanut Belt Research Station located near Lewiston-Woodville on a Norfolk sandy loam (fine-loamy, siliceous, thermic, Typic Paleudults). Conventional tillage consisted of disking once or twice, field cultivating, and ripping and bedding at Gatesville, Lewiston-Woodville, Williamston, and Tyner (1997). At Tyner in 1999, conventionally tilled areas were not bedded. Reduced tillage systems consisted of no tillage into a wheat (*Triticum aestivum* L.) cover crop established on flat ground at Tyner in 1999. Reduced tillage at the other locations consisted of strip-tilling a 40-cm-wide band on 96-cm rows into corn (*Zea mays* L.) residue (Williamston and Lewiston-Woodville) or cotton residue (Gatesville and Tyner) using strip tillage implements consisting of two sets of coulters and basket attachments following an in-row subsoiler. Subsoiler depth was set at 30 to 40 cm with peanut planted within 1 wk following strip tillage. Existing winter vegetation and emerged summer weeds were controlled using sequential applications of glyphosate [*N*-phosphonomethyl)glycine] and paraquat (1,1′-dimethyl-4,4′-bipyridinium ion). Seedbeds were weed free at the time of planting. Disease, insect, in-season weed management, and gypsum source and rate varied by location. However, inputs were held constant over the entire test area at each location. Production and pest management practices were based on North Carolina Cooperative Extension Service recommendations. No major visual differences in plant stand were noted among tillage systems. Early leaf spot (caused by *Cercospora arachidicola* Hori) and southern stem rot (caused by *Sclerotium rolfsii* Sacc.) were the major diseases in these fields and were controlled with routine applications of chlorothalonil (tetrachloroisophthalonitrile) and tebuconazole {α-[2-(4-chlorophenyl)-ethyl]-α-(1,1-dimethylethyl)}. Fields were not fumigated regardless of field history of Cylindrocladium black rot [caused by *Cylindrocladium parasiticum*] (CBR).

Treatments in 1997 consisted of three tillage systems (conventional, strip tillage into stale seedbeds, and strip tillage into a wheat cover crop) and three cultivars (NC 7, NC-V 11, and Gregory). In experiments conducted from 1999 through 2001, treatments consisted of two tillage systems (conventional tillage and strip tillage or no tillage into crop stubble or killed wheat), four cultivars (NC-V 11, NC 12C, Perry, and VA 98R), and two digging dates (late September and mid-October). Peanut cultivars were seeded at 120 kg ha^{-1} (NC-V 11 and VA 98R) and 140 kg ha^{-1} (NC 7, NC 12C, Gregory, and Perry), which produce similar plant populations (Jordan, 2002). These cultivars are the dominant virginia market types planted in North Carolina (Spears, 2002). Days from emergence to optimum maturity of these cultivars can vary by approximately 3 wk (Swann, 2002). Although pod maturation using mesocarp color determination (Sholar at al., 1995) was not used to initiate digging, peanut in North Carolina is generally dug from late September through mid-October.

The experimental design was a randomized complete block with a split-plot arrangement of treatments. Tillage served as whole plots and combinations of cultivars and digging dates served as subplots. The size of each subplot was four rows (96-cm spacing) in 1997 or two rows (same spacing) from 1999–2001 by 12 to 15 m. Subplots were replicated twice.

Peanut was inverted in early October (Tyner in 1997) or in late September and mid-October (digging date treatments in 1999–2001) and allowed to air-dry for 4 to 7 d before harvesting with a small-plot combine. A 0.5-kg sample was removed from each subplot from the 1999–2001 experiments and used to determine percentages of extra large kernels (%ELK), sound mature kernels, sound splits, total sound mature kernels (%TSMK), and other kernels using Cooperative Grading Service criteria for quota peanut (Peanut Loan Schedule, 1997–2001, USDA-FSA-1014-3). These values were used to determine market value ($ kg^{-1}). Gross economic value ($ ha^{-1}) was calculated as the product of pod yield and market value.

At Williamston and at Lewiston-Woodville in 2000, visual estimates of percentage of plants in each subplot expressing CBR symptoms (Bailey, 2002) was determined before vine inversion using a scale of 0 (no CBR symptoms) to 100 (100% of each 30-cm section of row exhibiting CBR symptoms).

Table 1. Year, location, soil series, conventional tillage system, seedbed present during strip till operation, and cultivars from 17 trials comparing tillage systems in North Carolina, 1997–2001.

Year	Location	Soil series†	Conventional tillage	Strip tillage seedbed	Cultivars
			Interactions of tillage, cultivar, and digging date		
1997	Tyner‡	WFS	Disk/Rip/Bed	Wheat	NC 7, NC-V 11, Gregory
1999	Gatesville	WFS	Disk/Rip/Bed	Cotton stubble	NC-V11, NC 12C, VA 98R, Perry
1999	Williamstown	GSL	Disk/Rip/Bed	Corn stubble	NC-V11, NC 12C, VA 98R, Perry
1999	Tyner	CSL	Disk	Cotton stubble	NC-V11, NC 12C, VA 98R, Perry
2000	Lewiston-Woodville	NSL	Disk/Rip/Bed	Corn stubble	NC-V11, NC 12C, VA 98R, Perry
2001	Lewiston-Woodville	NSL	Disk/Rip/Bed	Corn stubble	NC-V11, NC 12C, VA 98R, Perry
			Comparison of conventional, stale seedbed, and strip tillage systems		
1998	Halifax	NSL	Disk/Chisel/Rip/Bed	Wheat	NC-V11
1998	Woodland	CrSL	Disk/Chisel/Rip/Bed	Cotton stubble	NC-V11
1999	Woodland‡	CrSL	Disk/Chisel/Rip/Bed	Cotton stubble	NC-V11
1999	Halifax	NSL	Disk/Chisel/Rip/Bed	Wheat	NC 12C
1999	Rocky Mount‡	GSL	Disk/Rip/Bed	Cotton stubble	VA 98R
1999	Scotland Neck	NSL	Disk/Rip/Bed	Wheat	NC-V11
1999	Edenton	RSL	Disk/Chisel/Rip/Bed	Cotton stubble	NC-V11
2000	Woodland‡	CrSL	Disk/Rip/Bed	Wheat	NC-V11
1998	Lewiston-Woodville	NSL	Disk/Rip/Bed	Cereal rye	NC 7
2000	Lewiston-Woodville‡	NSL	Disk/Rip/Bed	Corn stubble	NC 12C
2001	Lewiston-Woodville‡	NSL	Disk/Rip/Bed	Corn stubble	NC 12C

† CLS, Conetoe loamy sand; CrSL, Craven silt loam; GSL, Goldsboro sandy loam; NSL, Norfolk sandy loam; RSL, Roanoke silt loam; WFS, Wanda fine sand.
‡ Experiments where stale seedbeds were included. Conventional tillage and strip tillage into previous crop stubble or cover crop were included in all experiments.

Percentage of plants exhibiting symptoms characteristic for TSWV symptoms (Bailey, 2002) was determined for each subplot at Lewiston-Woodville in 2001 using a scale of 0 (no TSWV symptoms) to 100 (100% of each 30-cm section of row exhibiting TSWV symptoms).

Peanut was not irrigated regardless of year or location, and rainfall amounts were recorded at Lewiston-Woodville only. With the exception of Tyner in 1997, rainfall was adequate for normal crop growth and development throughout most of the growing season. At Tyner in 1997, less than 5 cm of rainfall was noted from mid-June through early September.

Data for pod yield from the experiment in 1997 were subjected to analysis of variance for three (tillage system) × three (cultivar) factorial treatment arrangement. Data for pod yield, market grade factors, and gross economic value were subjected to analyses of variance for the two (tillage system) × four (cultivar selection) × two (digging date) factorial treatment arrangement for experiments conducted from 1999 through 2001. Data for CBR and TSWV incidence were subjected to analyses of variance for a two (tillage system) × four (cultivar) factorial treatment arrangement pooled over digging dates. Visual ratings of disease incidence were recorded before digging. Means for significant main effects and interactions were separated using Fisher's Protected LSD Test at $P \leq 0.05$.

Comparison of Conventional, Stale Seedbed, and Strip Tillage Systems

Experiments were conducted in North Carolina from 1998 through 2000 near Woodland on a Craven silt loam (clayey, mixed, thermic, Typic Paleudults), in 1998 and 1999 near Halifax on a Norfolk sandy loam, and in 1999 at the Upper Coastal Plain Research Station located near Rocky Mount on a Goldsboro sandy loam (fine-loamy, siliceous, thermic Aquic Paleudalts) (Table 1). Experiments were also conducted in 1999 near Edenton on a Roanoke silt loam (clayey, mixed, thermic, Typic Ochraquepts) and Scotland Neck on a Norfolk sandy loam (Table 1). In 1998, 2000, and 2001, the experiment was also conducted near Lewiston-Woodville on a Norfolk sandy loam soil (Table 1). Conventional tillage systems included disking, chisel plowing (all experiments except Rocky Mount, Lewiston-Woodville, and Scotland Neck), field cultivating, and ripping and bedding. Strip tillage into the previous crop stubble was included in all experiments except Lewiston-Woodville in 1998 [rye (*Secale cereale* L.) cover crop]. Previous crops were corn (Lewiston-Woodville) or cotton (Edenton, Halifax, Rocky Mount, Scotland Neck, and Woodland). In experiments conducted during 1999 and 2000 at Woodland and 2000 and 2001 at Lewiston-Woodville, peanut was also seeded into beds prepared by disking and bedding the previous fall. At Rocky Mount in 1999, peanut was seeded into beds prepared by bedding old crop rows during the previous fall or winter without prior tillage. With the exception of the experiment at Edenton, strip tillage implements consisted of two coulters and basket arrangements following an in-row subsoiler. At Edenton, a vertical-action tiller with in-row subsoiler was used to establish the tilled zone. Peanut was planted within 1 wk following strip tillage. The cultivar NC 7 was planted at Lewiston-Woodville in 1998. The cultivar NC-V 11 was planted at Edenton, Halifax in 1998, Scotland Neck, and Woodland. The cultivar VA 98R was planted at Rocky Mount, and the cultivar NC 12C was planted at Halifax in 1999 and Lewiston-Woodville in 2000 and 2001. Plot size was eight rows (96-cm spacing) by 20 m at Halifax, Scotland Neck, and Woodland and four rows (96-cm spacing) by 15 m at Edenton, Lewiston-Woodville, and Rocky Mount.

Peanut was not irrigated regardless of year or location. Although specific rainfall amounts were not recorded at on-farm locations, rainfall was generally sufficient for normal growth and development throughout most of the growing season at all locations during all years. Pest management and production practices were administered as described in the experiments evaluating interactions of tillage, cultivar, and digging dates.

Peanut was harvested using the equipment described previously. Visual estimates of TSWV incidence were recorded as described previously before digging at Lewiston-Woodville in 1998 and 2001. The experimental design was a randomized complete block with three or four replications. Data for pod yield and TSWV incidence were subjected to analysis of variance when treatments were consistent across experiments. Means were separated using Fisher's Protected LSD Test at $p \leq 0.05$.

RESULTS AND DISCUSSION

Interactions of Tillage, Cultivar, and Digging Date

At Tyner in 1997, the main effect of cultivar selection was significant ($p \leq 0.0001$) for pod yield (data not shown). When pooled over tillage systems in this experiment, pod yield of NC-V 11 exceeded that of the cultivars NC 7 and Gregory by 920 and 1040 kg ha^{-1}, respectively (data not shown). The difference in pod yield noted among these cultivars may have been due to an interaction between cultivar pod size and environmental conditions. Soil was extremely dry during pod fill, and the smaller-seeded cultivar NC-V 11 may have needed less soil water to fill pods than the larger-seeded cultivars NC 7 and Gregory (Jordan, 2002). Tillage did not affect pod yield ($p = 0.1546$), which ranged from 4060 to 4490 kg ha^{-1} when data were pooled over cultivars (data not shown). Lack of a tillage × cultivar selection interaction ($p = 0.7861$) for pod yield suggests that cultivar selection does not play a major role in peanut response to tillage.

Main effects of cultivar and the interaction of experiment × cultivar were significant at $p \leq 0.05$ for pod yield and gross value for experiments conducted from 1999 through 2001 (Table 2). All other main effects and interactions were not significant for pod yield. Other than the interaction of tillage × digging date, main effects and interactions for gross value were also not significant at $p \leq 0.05$ (Table 2). One of the primary objectives of this study was to determine if there was an interaction between cultivar selection and tillage system. Consistent with data from Tyner in 1997, lack of a tillage × cultivar interaction for pod yield ($p = 0.6293$) or market value ($p = 0.3434$) suggests that response to

Table 2. Analyses of variance (*p* values) for pod yield, gross value, and the percentages of extra large kernels (%ELK) and total sound mature kernels (%TSMK) from the study evaluating interactions of tillage, cultivar, and digging date, 1999–2001.

Treatment factor	df	Pod yield	Gross value	%ELK	%TSMK
Experiment (EXP)	4	0.0016	0.0005	0.0193	0.0001
Error A	5	–	–	–	–
Tillage	1	0.7019	0.8992	0.6420	0.3473
EXP × Tillage	4	0.9617	0.9245	0.1548	0.2701
Error B	5	–	–	–	–
Cultivar	3	0.0426	0.0267	0.0059	0.4364
EXP × Cultivar	12	0.0001	0.0001	0.0002	0.3824
Tillage × Cultivar	3	0.6293	0.3434	0.8914	0.3731
EXP × Tillage × Cultivar	12	0.8343	0.3681	0.2348	0.6302
Digging Date (DIG)	1	0.8389	0.9640	0.0038	0.7304
EXP × DIG	4	0.5533	0.1592	0.8118	0.5533
Tillage × DIG	1	0.1780	0.0288	0.6311	0.9885
EXP × Tillage × DIG	4	0.1387	0.1667	0.0158	0.1114
Cultivar × DIG	3	0.4395	0.7033	0.3897	0.2595
EXP × Cultivar × DIG	12	0.6208	0.3195	0.4126	0.8750
Tillage × Cultivar × DIG	3	0.6226	0.5090	0.4304	0.5193
EXP × Tillage × Cultivar × DIG	12	0.5914	0.6901	0.3854	0.8219
Error C	70	–	–	–	–
Coefficient of variation, %	–	14.6	14.6	13.3	5.1

a particular tillage system most likely will be the same regardless of cultivar selection. When pooled over cultivars, digging dates, and experiments, tillage did not affect pod yield ($p = 0.7019$) or gross value ($p = 0.8992$). Pod yield was 3550 and 3570 kg ha^{-1} in conventional and strip tillage systems, respectively (data not shown).

Tillage did not affect CBR incidence ($p = 0.2439$) (data not shown). When pooled over cultivars, CBR incidence was 8 and 7% in conventional tillage and strip tillage, respectively (data not shown). In contrast, TSWV incidence was higher in conventional tillage (14%) compared with strip tillage (7%) at Lewiston-Woodville in 2000 ($p \leq 0.0001$) when pooled over levels of cultivar selection. Previous research (Baldwin and Hook, 1998; Johnson et al., 2001; Wright et al., 2000) suggests that TSWV incidence is lower in reduced tillage systems compared with conventional tillage systems. Response to CBR in strip tillage and conventional tillage systems has been inconsistent (Bailey, 2002).

As expected, variation in pod yield and gross value was noted among cultivars and digging dates depending on the experiment (Table 2). In most cases, differences in gross value among cultivars were similar to differences in pod yield. Pod yield of the cultivar Perry equaled or exceeded that of the other cultivars in all experiments (Table 3). At Gatesville and at Lewiston-Woodville in 2001, pod yield was similar for all cultivars. Pod yield of Perry exceeded that of all cultivars at Williamston, cultivars NC-V 11 and NC 12C at Tyner in 1999, and NC-V 11 and VA 98R at Lewiston-Woodville in 2000. The cultivar NC 12C yielded as much as Perry in three of five experiments. Higher yields for Perry and NC 12C compared with NC-V 11 and VA 98R may have been associated with resistance of Perry and NC 12C to CBR. When pooled over Lewiston-Woodville and Williamston locations, CBR incidence for the cultivars Perry and NC 12C was 2 and 4%, respectively (data not shown). In contrast, CBR incidence was 11 and 12% for the cultivars NC-V 11 and VA 98R, respectively (data not shown). These results are consistent with those reported previously (Bailey, 2002).

In contrast to parallel differences in pod yield and CBR incidence that were associated with cultivar selection, differences in TSWV incidence in conventional tillage systems and reduced tillage systems were not reflected in pod yield differences. At Lewiston-Woodville in 2001, where TSWV incidence in conventional tillage systems was twice as high as that in strip tillage systems when pooled over cultivars (14 vs. 7%), there was no difference in yield (data not shown). Incidence of TSWV ranged from 7 to 15% and did not differ among cultivars (data not shown). Bailey (2002) reported that NC-V 11 expressed greater resistance to TSWV than did NC 12C, Perry, or VA 98R.

Digging date did not affect pod yield ($p = 0.8389$) or gross value ($p = 0.9640$) (Table 2). Peanut response to digging can be variable, and delays in digging can reduce pod yield and gross value (Jordan et al., 1998) and sometimes increases these parameters (Sholar et al., 1995; Wright and Porter, 1995). Although the interaction of tillage system × digging date was significant for gross value ($p = 0.0288$, Table 2), there was no difference in pod yield or gross value among any of the means for

Table 3. Comparison of pod yield, gross value, and percentage of extra large kernels of four peanut cultivars in the interactions of tillage, cultivar, and digging date study.

	1999			Lewiston-Woodville	
Cultivar	Tyner	Williamstown	Gatesville	2000	2001
		Pod yield, kg ha^{-1}			
NC-V 11	3670 b†	2540 b	5530 a	3990 b	2960 a
NC 12C	3860 b	3060 b	5340 a	5150 a	3020 a
Perry	4500 a	3990 a	5640 a	5170 a	3150 a
VA 98R	3960 ab	1920 c	5850 a	3660 b	2730 a
		Gross value, S ha^{-1}			
NC-V 11	2587 b	1728 bc	4127 a	2991 b	2030 a
NC 12C	2749 b	2063 b	4016 a	3751 a	2050 a
Perry	3350 a	2867 a	4235 a	3807 a	2166 a
VA 98R	2838 b	1502 c	4312 a	2637 b	1910 a
		Extra large kernels, %			
NC-V 11	45 b	37 b	46 bc	36 c	35 b
NC 12C	47 b	50 a	59 a	49 a	43 a
Perry	53 a	54 a	51 b	42 b	41 a
VA 98R	52 a	39 b	41 c	38 bc	38 ab

† Means within a year and locations for each parameter followed by the same letter are not significantly different according to Fisher's Protected LSD at $p \leq 0.05$. Data are pooled over levels of tillage and digging date.

Table 4. Percentage of extra large kernels due to interactions of experiment, tillage, cultivar, and digging date.

		Strip tillage		Conventional tillage	
Location	**Year**	**Early dig**	**Late dig**	**Early dig**	**Late dig**
		Extra large kernels, %			
Tyner	1999	54 a†	50 a	50 a	42 b
Williamstown	1999	43 a	44 a	46 a	48 a
Gatesville	1999	46 a	50 a	47 b	54 a
Lewiston-Woodville	2000	39 b	45 a	40 a	42 a
Lewiston-Woodville	2001	38 a	43 a	38 b	54 a

† Means within a location, year, and tillage system followed by the same letter are not significantly different according to Fisher's Protected LSD Test at $p \leq 0.05$. Data are pooled over cultivars.

this interaction (data not shown). Therefore, the significance of this interaction is unknown.

Main effects and interactions of treatment factors were not significant for %TSMK but were significant for %ELK (Table 2). Main effects of cultivar and digging date as well as interactions of experiment × cultivar and experiment × tillage system × digging date were significant for %ELK at $p \leq 0.05$ (Table 2). When pooled over tillage systems and digging dates, the %ELK for the cultivar NC 12C equaled or exceeded that for Perry, NC-V 11, and VA 98R in two, five, and four experiments, respectively (Table 3). The cultivar NC 12C generally yields a higher %ELK than Perry, NC-V 11, or VA 98R (Jordan, 2002). The interaction of experiment × tillage system × digging date was significant ($p = 0.0158$, Table 2) but could not be easily explained. In 6 of 10 comparisons, there was no difference in %ELK between the two digging dates (Table 4). Delaying digging increased %ELK in only one experiment in strip tillage (Lewiston-Woodville in 2000). In conventionally tilled peanut, %ELK decreased when digging was delayed at Tyner in 1999 while the %ELK increased at Gatesville and at Lewiston-Woodville in 2001 when digging was delayed. Additional research is needed to explain this potential interaction.

Comparison of Conventional, Stale Seedbed, and Strip Tillage Systems

The interaction of experiment × tillage system was significant when conventional tillage, stale seedbed, and strip tillage (into the previous crop stubble) systems were compared (data not shown). However, this interaction was not significant when experiments from Lewiston-Woodville were removed from the analysis, and only those experiments from Woodland during both years and Rocky Mount were combined. When pooled over these experiments, pod yield in stale seedbed and conventional tillage systems was similar and higher than yield of peanut strip-tilled into the previous crop stubble (Table 5). In contrast, pod yield was similar for all tillage systems at Lewiston-Woodville during 2000 and 2001. Soil at Woodland was a Craven silt loam while soil at Rocky Mount was a Goldsboro loamy sand. In contrast, soil at Lewiston-Woodville was a Norfolk sandy loam. Of these soils, the Norfolk sandy loam is considered the better peanut soil. Although not established in the literature, the consensus among practitioners is that peanut responds more favorably to reduced tillage when grown on coarse-textured soils such as Norfolk sandy loam soils that are well drained rather than finer-textured soils that are poorly drained. Establishing beds in the fall and strip tilling into established beds closely resembles a conventional tillage system compared with strip tilling directly into crop stubble. Many practitioners indicate that presence of a raised bed during the digging operation reduces pod loss compared with digging on flat ground or on slightly bedded ground. Often there is very little bed remaining at the time of digging when peanut is strip-tilled into the previous crop stubble. These data suggest that stale seedbed production may be a good compromise between conventional tillage and strip tillage into crop stubble.

In the remaining experiments where only conventional tillage and strip tillage into the previous crop stubble were compared, pod yield was greater when peanut was strip-tilled into a rye cover crop at Lewiston-Woodville in 1998 (Table 5). However, the opposite response was noted at Scotland Neck in 1999 where pod yield was lower in strip tillage compared with conventional tillage. A higher incidence of TSWV may have contributed to lower pod yield in conventional tillage (29%) compared with strip tillage (17%) at Lewiston-Woodville in 1998 (data not shown). In contrast, less TSWV when peanut was strip-tilled into previous crop stubble (2%) compared with strip tillage into stale seedbeds (9%) or conventional tillage systems (15%) did not affect pod yield at Lewiston-Woodville in 2001 (Table 5). Disease level did not explain differences in yield between tillage systems at Scotland Neck. Pod yield was similar between tillage systems at Edenton, Halifax during both years, and Woodland in 1998 (Table 5).

SUMMARY

Collectively, these data suggest that peanut response to tillage can be inconsistent. Similar results have been

Table 5. Peanut pod yield in conventional tillage systems, stale seedbed systems, and strip tillage into stubble from the previous crop.†

		Lewiston-Woodville			
Tillage system	**Rocky Mount and Woodland†**	**1998**	**2000 and 2001‡**	**Scotland Neck**	**Edenton, Halifax, and Woodland§**
	Pod yield, kg ha^{-1}				
Conventional	3150 a¶	4080 b	3030 a	4380 a	3960 a
Strip tillage into stubble	2350 b	4570 a	3980 a	3730 b	3830 a
Stale seedbeds	3020 a	–	3810 a	–	–

† Data are from Woodland in 1999 and 2000 and Rocky Mount in 1999.
‡ Data are pooled over 2000 and 2001.
§ Data are from Edenton (1999), Halifax (1998 and 1999), and Woodland (1998).
¶ Means within a column followed by the same letter are not significantly different according to Fisher's Protected LSD Test at $p \leq 0.05$.

documented in the literature (Cox and Sholar, 1995; Baldwin and Hook, 1998). One of the primary objectives of this research was to determine if cultivar selection influences peanut response to tillage, and these results suggest it does not. Results also suggest that while tillage systems most likely will not affect CBR incidence, tillage will affect TSWV incidence. Consistent with research (Baldwin and Hook, 1998; Johnson et al., 2001; Wright et al., 2000), a higher level of TSWV was observed in conventional tillage systems compared with strip tillage into stubble from the previous crop. Incidence of TSWV was similar in stale seedbed systems compared with conventional tillage systems.

Although pod yield in conventional tillage systems equaled or exceeded that of strip tillage directly into crop stubble in all but one experiment (16 of 17 experiments), planting peanut in stale seedbeds resulted in yields similar to those in conventional tillage systems in all five experiments where these tillage systems were compared. Planting following strip tillage into crop stubble resulted in pod yields lower than planting into conventionally tilled plots in four experiments. While additional research is needed to more thoroughly evaluate stale seedbed systems, results from these and other studies (Jordan et al., 2001) suggest that stale seedbed peanut production may be a good alternative to conventional tillage systems or strip tillage into the previous crop stubble. These studies were conducted in fields that historically were conventionally tilled and would be considered in a transition from conventional tillage to reduced tillage. Benefits of reduced tillage production such as increased soil tilth often require multiple years to be expressed. Additional research is needed to address the consistency of reduced tillage production after multiple years.

ACKNOWLEDGMENTS

Appreciation is expressed to the staff at the Peanut Belt and Upper Coastal Plain Research Stations for assistance with these experiments. Appreciation is also extended to Ray Garner, Jordan Farms, Arthur Whitehead, Luther Culpepper, Lennie Hinton, David Hare, and Allen Tyre for allowing a portion of these experiments to be conducted on their farms. Al Cochran, Craig Ellison, Paul Smith, Arthur Whitehead, Michael Williams, Carl Murphy, Brenda Penny, Jan Spears, and Josh Beam provided technical assistance. The North Carolina Peanut Growers Association provided financial support for this research.

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