# REDUCED TILLAGE RESEARCH WITH PEANUT IN NORTH CAROLINA (1997-2005)

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## ABSTRACT

Reduced tillage peanut (*Arachis hypogaea* L.) production continues to gain interest in North Carolina. Forty-one experiments were conduced from 1997 through 2005 to compare peanut yield in conventional tillage systems to yield of peanut strip tilled into stubble from the previous crop or into residue from dessicated small grain. When pooled over all experiments, pod yield in conventional tillage was 130 lb/acre or 3.0% higher when peanut was in strip tillage. Yield varied by less than 5% in 15 of 41 experiments, and in these experiments yield of strip tillage exceeded that of conventional tillage in 60% of experiments. When yield differed by 5 to 10%, yield in strip tillage exceeded that of conventional tillage in 55% of experiments. Yield differences of 10 to 15% were higher in strip tillage in 62% of experiments. However, when yield differences exceeded 15%, yield always favored conventional tillage. These data indicate that strip tillage is increasingly a viable option for peanut growers in North Carolina.

## INTRODUCTION

Research indicates that peanut response to reduced tillage can be inconsistent (Baldwin and Hook, 1998; Brandenburg et al., 1998). However, advantages to reduced tillage peanut production exist, and more recently recommendations on reducing tomato spotted wilt of peanut have included planting peanut in reduced tillage systems (Brown et al., 2005; Hurt et al., 2003). Peanut in North Carolina was planted in reduced tillage systems by approximately 23% of farmers during 2004 (Table 1). Determining the impact of tillage on peanut yield continues across the peanut belt, and defining interactions among tillage systems and other production and pest management practices is important in order to develop recommendations for growers, especially for those planting Virginia market types. In 2003 an Advisory Index was developed based on research from 1997 to 2001 to assist growers in deciding whether or not to transition to reduced tillage systems (Jordan et al., 2004b). Objectives of this article are to provide a summary of experiments conducted from 1997-2005 in North Carolina where conventional tillage systems and strip tillage systems were compared and to scrutinize the current Advisory Index developed for transitioning from conventional tillage peanut to reduced tillage peanut.

## MATERIALS AND METHODS

Experiments were conducted in North Carolina from 1997 through 2005 at a variety of locations, on several soils, and with various Virginia market type cultivars (Table 2). Although these experiments often had multiple variables, in this article peanut response to tillage systems was pooled over treatment factors to compare general trends. Risk of yield being lower in reduced tillage systems compared with conventional tillage systems was compared for each experiment

using the Advisory Index developed in North Carolina for transitioning to reduced tillage peanut production (Jordan et al., 2004b).

## RESULTS AND DISCUSSION

When averaged over the 41 experiments, peanut pod yield was 103 lb/acre higher in conventional tillage compared with strip tillage into stubble or dessicated cover crop (Table 2). However, differences in response to tillage were noted when comparing data from 1997-2001 to data from 2002-2005. In the former experiments, yield was 5.0% higher in conventional tillage systems. However, during 2002-2005, yield was 2.3% higher when peanut was planted in reduced tillage. This difference most likely reflects a transition to peanut on coarser-textured soils in the latter data set. Experiments during 2002-2005 were conducted on Norfolk, Goldsboro, and Wanda soil series while experiments during 1997-2001 included these soil series and finer-textured soils such as those from Craven, Perquimans, and Roanoke series. These soils tend to be less amenable to strip tillage peanut production unless beds are established during the fall prior to planting peanut in the spring (Jordan et al., 2002). Although yield differences were often noted at levels higher than 15% (Table 3), many of these experiments were conducted on finer-textured soils. During the period 2002-2005, experiments were conducted on soils that reflect grower plantings under current marketing options. Fewer growers are now planting Virginia market type peanut on finer textured soils due to lower yield potential often associated with digging losses in either conventional or reduced tillage systems. Growers continuing to produce peanut on coarser textured soils may be able to plant in reduced tillage systems without sacrificing yield. Considerable variation in yield was noted among experiments, soil series, and other treatment factors, and results from these individual experiments have been reported elsewhere (Jordan et al., 2001, 2002, 2003, 2004a, 2004b, 2005).

Collectively, results from these experiments indicate that when at least a 5% difference in yield was noted in the moderate risk category, yield favored strip tillage in 11 of 17 experiments (Table 4). These data also indicate that the Advisory Index is too conservative in that growers might receive a yield advantage from strip tillage when in fact the Advisory Index indicates that there is a moderate risk that yield will be lower in strip tillage than in conventional tillage. However, peanut yielded less in strip tillage than conventional tillage in all nine experiments within the high-risk category. When yield differed by less than 5%, yield in strip tillage exceeded that of conventional tillage in 8 of 15 experiments (Table 5). Consequently, it is apparent that the Advisory Index is incorrect in estimating risk of lower yields in strip tillage in many instances.

## CONCLUSIONS

Adjustments to the current Advisory Index most likely will involve removal of cover crop and tomato spotted wilt components of the Advisory Index and minimizing points associated with the irrigation component (Table 6). Additionally, point values will be adjusted to minimize bias against strip tillage.

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Table 1. Percentages of North Carolina peanut growers implementing specific tillage practices during 1998 and 2004. Data represent approximately 25% of acreage in North Carolina.

| Tillage | 1998 | 2004 |
|---|---|---|
| Disk | 90 | 78 |
| Chisel | 25 | 23 |
| Moldboard plow | 58 | 17 |
| Field cultivate | 75 | 55 |
| Rip and bed | 49 | 39 |
| Bed | 44 | 35 |
| Reduced tillage | 10 | 23 |

Table 2. Year, location, soil series, conventional tillage system, seedbed present during strip-till operation, cultivar, actual yield difference, and percent yield difference from 41 trials comparing peanut in conventional tillage to strip tillage in North Carolina during 1997-2005. A positive value for actual and percent yield indicates that peanut yield was higher in conventional tillage systems compared with strip tillage systems.

| Year | Location | Soil series† | Tillage‡ | | Cultivar | Yield difference | |
|---|---|---|---|---|---|---|---|
| | | | Conventional | Strip | | lb/A | % |
| 1997 | Tyner | CLS | D/R-B | Wheat | Multiple§ | -327 | -8.3 |
| 1997 | Edenton | RSL | D/C-B | Cotton | Multiple¶ | +905 | +21.7 |
| 1997 | Lewiston | NSL | D/R-B | Corn | NC 10C | -458 | -9.7 |
| 1997 | Rock Mount | GLS | D/R-B | Corn | NC 10C | -463 | -10.6 |
| 1997 | Lewiston | NSL | D/R-B | Cereal rye | NC 7 | -438 | -10.7 |
| 1998 | Lewiston | NSL | D/C/R-B | Corn | NC 9 | -116 | -2.9 |
| 1998 | Edenton | RSL | D/C/B | Cotton | NC 7 | +938 | +27.1 |
| 1998 | Edenton | RSL | D/C/B | Corn | NC 7 | +148 | +4.8 |
| 1998 | Halifax | NSL | D/C/R-B | Wheat | NC-V 11 | +277 | +7.2 |
| 1998 | Lewiston | NSL | D/R/B | Wheat | NC 7 | +317 | +11.0 |
| 1998 | Woodland | CrSL | D/C/R-B | Cotton | NC-V 11 | +274 | +9.4 |
| 1999 | Woodland | CrSL | D/C/R-B | Cotton | NC-V 11 | +1069 | +29.9 |
| 1999 | Scotland Neck | NSL | D/R/B | Wheat | NC-V 11 | +729 | +14.9 |
| 1999 | Halifax | NSL | D/C/R-B | Wheat | NC 12C | -192 | -4.2 |
| 1999 | Rocky Mount | GSL | D/R-B | Cotton | VA 98R | +258 | +9.5 |
| 1999 | Edenton | PSL | D/C/R-B | Cotton | NC-V 11 | +115 | +3.4 |
| 1999 | Edenton | PSL | D/C/B | Cotton | NC-V 11 | +981 | +24.3 |
| 1999 | Lewiston | NSL | D/C/R-B | Corn | NC 9 | +614 | +17.2 |
| 1999 | Lewiston | NSL | D/R/B | Cereal rye | NC 7 | -258 | -6.3 |
| 1999 | Gatesville | CLS | D/R/B | Cotton | Multiple# | +146 | +3.1 |
| 1999 | Williamston | GLS | D/R/B | Corn | Multiple# | +4 | +0.2 |
| 1999 | Tyner | CSL | D | Cotton | Multiple# | -162 | -4.5 |
| 1999 | Whitakers | GSL | D/R-B | Cotton | Multiple# | -149 | -4.1 |
| 2000 | Woodland | CrSL | D/R-B | Wheat | NC-V 11 | +546 | +23.2 |
| 2000 | Lewiston | NSL | D/R-B | Corn | NC 12C | +202 | +4.5 |
| 2000 | Lewiston | NSL | D/R-B | Corn | Multiple†† | -258 | -6.3 |
| 2000 | Lewiston | NSL | D/C/R-B | Wheat | NC 12C | +17 | +0.5 |
| 2000 | Rocky Mount | GSL | D/R-B | Cotton | NC-V 11 | +273 | +7.2 |
| 2001 | Lewiston | NSL | D/R-B | Corn | Multiple†† | +53 | +2.0 |
| 2001 | Lewiston | NSL | D/R-B | Corn | NC 12C | -120 | -4.3 |
| 2002 | Lewiston | NSL | D/R-B | Corn | Multiple‡‡ | -715 | -14.6 |
| 2002 | Lewiston | NSL | D/R-B | Crop[g] | NC 12C | -210 | -9.2 |
| 2002 | Rocky Mount | GSL | D/R-B | Cotton | VA 98R | +330 | +8.6 |
| 2003 | Lewiston | NSL | D/R-B | Corn | Multiple‡‡ | +517 | +11.4 |
| 2003 | Tyner | WFS | D/R-B | Wheat | Multiple‡‡ | -54 | -1.0 |
| 2003 | Rocky Mount | GSL | D/R-B | Wheat | Multiple‡‡ | -455 | -12.2 |
| 2004 | Rocky Mount | GSL | D/R-B | Cotton | Multiple‡‡ | -90 | -2.4 |

Table 2. (Cont.)

| Year | Location | Soil series† | Tillage‡ | | Cultivar | Yield difference | |
|---|---|---|---|---|---|---|---|
| | | | Conventional | Strip | | lb/A | % |
| 2004 | Lewiston | NSL | D/R-B | Crop§§ | NC 12C | -551 | -12.4 |
| 2004 | Rocky Mount | GSL | D/R-B | Cotton | VA 98R | -141 | -4.1 |
| 2005 | Lewiston | NSL | R-B | Crop¶¶ | NC-V 11 | +468 | +16.8 |
| Average (1997-2001) | | | | | | +164 | +5.0 |
| Average (2002-2005) | | | | | | -68 | -2.3 |
| Average (1997-2005) | | | | | | +103 | +3.0 |

†Abbreviation: CLS, Conetoe loamy sand; CrSL, Craven silt loam; GSL Goldsboro sandy loam; NSL, Norfolk sandy loam; PSL, Perquimans silt loam; RSL, Roanoke silt loam; WFS, Wanda fine sand.
‡Abbreviations: D, disk; C, chisel; R-B, in-row rip and bed; B, bed. In-row sub-soiling was included at all locations except Edenton when strip tilling.
§Averaged over the cultivars NC 7, Gregory, and NC-V 11.
¶Averaged over the cultivars NC 7, VA 93B, and VA-C 92R.
#Averaged over the cultivars Georgia Green, NC 10C, NC-V 11, NC 12C, Perry, and VA 98R.
††Averaged over the cultivars NC-V 11, NC 12C, Perry, and VA98R.
‡‡Averaged over cultivars Gregory and Perry.
§§Averaged over the rotation crops cotton and corn.
¶¶Averaged over the rotation crops corn, cotton, and grain sorghum.

Table 3. Comparison of percent differences in peanut yield between conventional tillage and strip tillage from 41 experiments conducted from 1997-2005 in North Carolina.

| Percent difference between conventional and reduced tillage | Number of comparisons falling within a range of percentages | Experiments were yield of conventional tillage exceeded strip tillage | |
|---|---|---|---|
| | | Number | % |
| 0-5.0 | 15 | 6 | 40 |
| 5.1-10.0 | 11 | 5 | 45 |
| 10.1-15.0 | 8 | 3 | 38 |
| 15.1-20.0 | 2 | 2 | 100 |
| 20.1-25.0 | 3 | 3 | 100 |
| 25.1-30.0 | 2 | 2 | 100 |
| >30.1 | 0 | 0 | 0 |
| Total | 41 | 21 | 51 |

Table 4. Number of experiments where greater than 5% difference in pod yield was noted when a moderate risk of yield in strip tillage being lower than yield in conventional tillage was projected by the Advisory Index.†

| Risk of yield in strip tillage being lower than yield in conventional tillage | Actual yield response (1997-2005) | |
|---|---|---|
| | Conventional tillage > Strip tillage | Strip tillage > Conventional tillage |
| Low risk | 0 | 0 |
| Moderate risk | 6 | 11 |
| High risk | 9 | 0 |

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Table 5. Number of experiments where less than 5% difference in pod yield was noted when a moderate risk of yield in strip tillage being lower than yield in conventional tillage was projected by the Advisory Index.†

| Risk of yield in strip tillage being lower than yield in conventional tillage | Actual yield response (1997-2005) | |
|---|---|---|
| | Conventional tillage > Strip tillage | Strip tillage > Conventional tillage |
| Moderate risk | 7 | 8 |

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Table 6. Preliminary adjustment of current Advisory Index to better reflect results from experiments conducted during 1997-2005.

| Current point category (2004-2006)† | | Preliminary adjustment of point category | |
|---|---|---|---|
| *Peanut variety* | | *Soil series* | |
| Virginia market type | 5 | Craven, Lynchburg, Roanoke | 40 |
| Runner market type | 0 | Goldsboro | 20 |
| *Irrigation* | | Norfolk | 10 |
| No irrigation | 10 | Conetoe and Wanda | 0 |
| Irrigation | 0 | *Tillage intensity* | |
| *Soil series* | | No till into flat ground | 40 |
| Craven and Roanoke | 40 | Strip tillage into crop stubble | 10 |
| Goldsboro and Lynchburg | 20 | Strip tillage into stale seedbeds | 0 |
| Norfolk | 10 | | |
| Conetoe and Wanda | 0 | | |
| *Tillage intensity* | | | |
| No till into flat ground | 40 | | |
| Strip tillage into flat ground | 20 | | |
| Strip tillage into stale seedbeds | 0 | | |
| *Small grain cover* | | | |
| Not present | 5 | | |
| Present | 0 | | |
| *History of tomato spotted wilt* | | | |
| No tomato spotted wilt in the past | 10 | | |
| Tomato spotted wilt in the past | 0 | | |
| *Risk of yield being lower in reduced tillage compared with conventional tillage* | | *Risk of yield being lower in reduced tillage compared with conventional tillage* | |
| Low | 30 or less | Low | 40 or less |
| Moderate | 35 to 65 | Moderate | 40 to 50 |
| High | 70 or more | High | 60 or more |

†Jordan, D., R. Brandenburg, B. Shew, G. Naderman, S. Barnes, and C. Bogle. 2004. Advisory index for transitioning from conventional to reduced tillage peanut production in North Carolina. North Carolina Coop. Ext. Ser. AG-644.