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Partial Returns from Cotton Conservation Tillage Practices *in the Mississippi Delta*

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Abstract

Producers and conservationists are concerned about soil erosion and soil loss, but producers also are concerned about profits. Many studies have examined tillage methods as a means of conserving soil. Other studies have evaluated cover crops as a means to conserve soils. This study evaluated a combination of these two methods of soil conservation based on the economic returns associated with each of the defined systems.

Field studies were conducted at Stoneville, Mississippi, for the period 2000–2004. Treatments consisted of conventional till, no-till, low-till subsoiling, no-till with winter wheat cover crop, and low-till subsoiling with winter wheat cover crop. Partial budgets were developed for each treatment over the 5 years of the study. Within the partial budgets, both direct and total specified expenses for the specified tillage and cover crop practices were calculated.

Results indicated that the highest returns and lowest relative risk were obtained from a traditional no-till system compared with the other systems in the study. Yield increases from cover crops did not offset the added expense. Subsoiling also did not increase returns enough to offset the added expense and may have even reduced yields. The conventional tillage system had relatively high returns but was found to be among the riskiest (highest variance) of the treatments analyzed. Producers requiring a cover crop system might choose the no-till cover crop system because it had the highest mean net returns of the two cover crop systems.

Partial Returns from Cotton Conservation Tillage Practices in the Mississippi Delta

Introduction

Producers and conservationists are concerned about soil erosion and soil loss, but producers also are concerned about profits. Many studies (Harrison et al., 2004; Waitrak et al., 2005; Culpepper et al., 2005) have examined tillage methods as a means of conserving soil. Other studies (Cummings, et al., 2003; McGregor, et al., 1996) have evaluated cover crops as a means to conserve soils. While these studies are useful, none has focused on a combination of the two methods (cover crops and tillage) from an economics perspective. This study was conducted to evaluate the combination of these two methods of soil conservation based on the economic returns associated with each of the defined systems.

Cotton production in some areas has switched to no-till and/or conservation tillage due to mandates associated with highly erodible soils. Other cotton growing areas have begun using less tillage as a means to cut production costs. Conventional farming methods (subsoiling, disking, cultivating, etc.) often require 7–10 trips across the field for field preparation and weed control (MSU planning budgets, 2006). As production costs have risen (diesel fuel in 1999 was $0.64 per gallon versus $2.23 in 2006 — MSU planning budgets), producers have sought alternative methods to produce cotton. Most in the cotton industry would assume that herbicide-tolerant cotton varieties have facilitated the reduction in tillage trips (Roberts, 2006).

Some of the "conservation" tillage systems include fall seedbed preparation. The implementation of fall seedbed preparation and a spring herbicide "burn down" has led to these fields being left bare throughout much of the year, possibly increasing soil loss. Bare soils during the winter and spring, which is historically the rainy season in the Midsouth and Southeast, may lead to soil losses that are not that different from the traditional/conventional farming system. Cover crops may be an alternative to reduce soil losses in these types of systems, as well as no-till systems (Martin and Locke, 2006).

As production costs have risen over the last few years, cotton lint prices have remained relatively stable (USDA, 2006). Thus, producers are reluctant to adopt new production systems and practices without information on how these systems and practices will affect farm returns. This study evaluated cover-crop versus no-cover-crop practices across three tillage systems. Tillage systems evaluated included a "common practices" conventional tillage system (i.e., fall subsoiling plus fall and spring seed-bed preparation), no-till, and no-till with fall subsoiling.

Materials and Methods

Field studies were conducted at Stoneville, Mississippi, for the period 2000–2004. Land area was approximately 7.5 acres with cotton grown on 38-inch row spacings. Plots were eight rows wide and 780 feet long. Soils were primarily Dundee very fine sandy loam but changed down the row to a Dundee silty clay loam. Treatments were conventional till (CT), no-till (NT), low-till subsoiling (LTSS), no-till with winter wheat (common Midsouth and Southeast cover crop) cover crop (NTCC), and low-till subsoiling with winter wheat cover crop (LTSSCC).

The CT treatment consisted of shredding stalks and a fall subsoiling down the row, followed by a fall seedbed preparation with a four-row JD model 886 row-crop cultivator (John Deere Corp., Moline, Illinois) with adjustable ridging/bedding wings. Seedbeds were re-established in the spring with the JD 886 and knocked down with a do-all immediately before planting. The CT treatment might be considered the traditional or usual practice for many producers in the Midsouth. The NT treatment had no soil disturbed other than planting. Nitrogen fertilizer was applied to the NT treatment with an eight-row coulter-type applicator (Bell, Inc., Inverness, Mississippi, Model 3pt-88JB-HF), which was consistent with the nitrogen application on all plots. The LTSS treatment consisted of a fall low-till, down-the-row subsoiling with a four-shank Low-Till subsoiler (Short Line Manufacturing, Shaw, Mississippi). Many would consider the LTSS treatment to be a reduced-till system.

The two cover crop treatments, NTCC and LTSS-CC, had tillage treatments consistent with those described for NT and LTSS. The cover crop consisted of planting 60 pounds of pasture wheat in the fall with a grain drill (TYE 104-4527 Model #1 four-row drill, AGCO Corporation, Duluth, Georgia). The wheat was killed in the spring with herbicides consistent with the herbicide applications made to the other treatments.

Furrow irrigation was used to supply supplemental water to the entire test each year as needed. Irrigation was accomplished by applying water through 12-inch-diameter poly pipe with outlets at every other furrow. The poly pipe was located at the east (right) side of the field, and water flowed from east to west.

Yield data were collected with an AgLeader Model PF3000 Pro yield monitor (Ag Leader Technology, Ames, Iowa) installed on a John Deere Model 9965 four-row cotton picker. Cotton from each plot was weighed in the field using a boll buggy equipped with load cells (Short Line Manufacturing, Shaw, Mississippi) to verify and calibrate the yield monitor data. Geo-referenced soil electrical conductivity (EC) and yield data were processed using the geographical information system software AGIS (Delta Data Systems, Picayune, Mississippi).

All other inputs were supplied consistently to all plots as normal production practices with commercial-sized equipment. Treatments were established with three replications of the five treatments. Treatments remained in the same plots throughout the duration of the study.

All production data were entered into the Mississippi State University Budget Generator (MSBG) in order to calculate net returns (Laughlin et al., 2006). The MSBG is the program used to prepare the Mississippi State University enterprise planning budgets. Partial budgets were developed for each treatment over the 5 years of the study. Within the partial budgets, both direct and total specified expenses per hectare for the specified tillage and cover crop practices

Table 1. Partial budget average specified costs, lint yields, and net returns per hectare for treatments: CT, NT, LTSS, NTCC, LTSSCC, 2000-2004.

	CT	NT	LTSS	NTCC	LTCCSS
Direct Costs	$25.08	$12.22	$16.84	$16.81	$25.08
Fixed Costs	$11.48	$1.72	$5.23	$6.41	$11.48
Total Specified Costs	$36.56	$13.94	$22.07	$23.22	$36.56
Yield	986	955	931	951	986
Net Returns	$479.96	$486.43	$465.79	$475.10	$479.96

were calculated. Total specified expenses included all direct and fixed production expenses (assuming full utilization of equipment) related to subsoiling, seedbed preparation, cover crop planting, and preplant herbicide application. These expenses included interest, labor, and fixed costs of equipment ownership (based on full utilization of equipment), but they did not include any other general farming expenses. The 5-year average total specified costs for each of the treatments are shown in Table 1. Returns for each of the treatments were calculated using the national cotton loan rate of $0.52 per pound of lint, multiplied by the lint yield of each system (Table 1). Net returns were calculated as returns minus total specified costs.

Additionally, a mean-variance analysis was conducted for each of the systems to evaluate the risk-return levels associated with each of the production systems. Mean-variance analysis is often used to rank a set of alternatives based on the trade-off between returns and risk (Robison and Barry).

Results and Discussion

Results from the 5-year average enterprise budgets suggest the highest returns above treatment costs were obtained from the no-till no cover crop (NT) system (Table 1). The NT system had the lowest production costs (Table 1) because it required fewer trips across the field (i.e., no tillage) and entailed no cover crop expense. The CT treatment had the highest average yield (Table 1), but net returns were reduced by the cost of the fall and spring tillage. The lowest returns for any of the no-cover-crop treatments were obtained from the LTSS treatment. The LTSS also had the lowest average yield of any of the no-cover-crop systems.

The LTSSCC had the lowest net returns of any of the treatments. Net returns for the LTSSCC treatment were lower because it yielded less and required extra expenses for the cover crop and additional tillage. In general, the cover crop systems had relatively lower

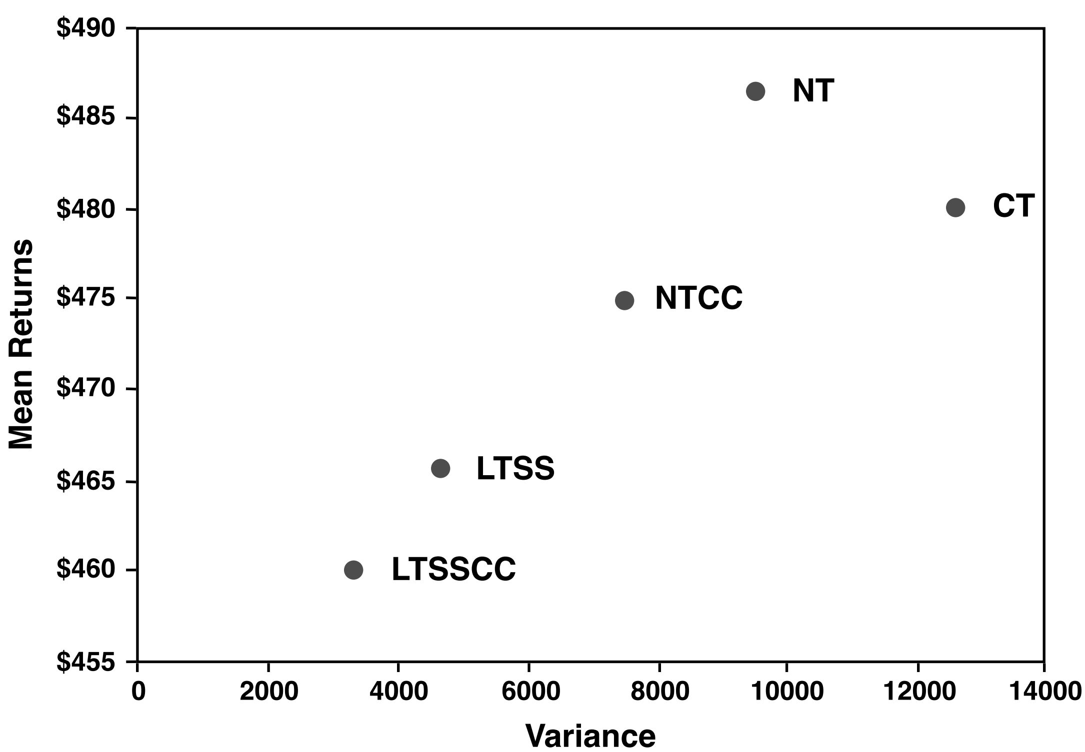

Figure1. Mean Returns versus Variance Analysis for Treatments: CT, NT, LTSS, NTCC, LTSSCC, 2000-2004.

net returns primarily due to the increased expense of the cover crop establishment.

The two subsoil treatments, LTSS and LTSSCC, had the lowest yields and net returns of the five treatments. The lower net returns resulted from low yields and the increased expense of subsoiling. This is a similar finding to Pringle and Martin, who suggested that subsoiling with irrigation would have lower net returns than either irrigation or subsoiling alone.

The mean-variance analysis of the five treatments revealed that the no-till treatment was likely to be the preferred system. The NT treatment had the highest mean returns above treatment costs with less variance than the CT treatment, which had the second highest mean returns of any of the treatments (Figure 1). The other treatments — LTSSCC, LTSS, and NTCC — had lower variance (risk) but also had lower mean net returns. Thus, most individuals would prefer the NT system based on the mean-variance analysis.

Conclusions

Five tillage cover crop systems were evaluated based on net returns over a 5-year period in the Mississippi Delta. Results indicated that the highest returns and lowest relative risk were obtained from a traditional no-till system among the systems studied. Cover crops did not increase yield enough to offset the expenses associated with cover crop establishment. Subsoiling also did not increase returns enough to overcome the added expense and may have even reduced yields (Table 1). The conventional tillage system had relatively high returns but was found to be among the riskiest (highest variance) of the treatments analyzed. Producers requiring a cover crop system to reduce soil erosion might choose the no-till cover crop system because it had the highest mean net returns of the two cover crop systems evaluated. Environmental benefits, economic or noneconomic, associated with cover crops might lead to different conclusions other than those derived from this analysis.

References

_________ Delta 2006 Planning Budgets. Mississippi State University. Department of Agricultural Economics. Budget Report 2005-05. December 2005.

_________ Delta 1999 Planning Budgets. Mississippi State University. Department of Agricultural Economics. Budget Report 100. December 1998.

Culpepper, S.J., D.S. Carlson, and A.C. York. 2005. Pre-Plant Control of Cutleaf Evening Primrose and Wild Radish in Conservation Tillage Cotton. [Online]. J. Cotton Sci. 9:223-228. Available at http://www.cotton.org/journal/2005-09/4/upload/jcs09-223.pdf.

Cummings, Steve, David Parvin, Steven W. Martin, and Fred Cooke. 2003. The Effect of a Wheat Cover Crop. *In* Proc. Beltwide Cotton Conferences. Nashville, Tennessee. 6-10 Jan. 2003. Natl Cotton Counc. Am, Memphis, Tennessee.

Harrison, M., N. Buehring, and R. Dobbs. 2004. Cotton Yield Response to Reduced Tillage Systems and Rotation. *In* Proc. Beltwide Cotton Conferences. San Antonio, Texas, 5-9 Jan. 2004. Natl Cotton Counc. Am. Memphis, Tennessee.

Pringle III, H.C., and S. W. Martin. 2003. Cotton Yield Response and Economic Implications to In-row Subsoil tillage and Sprinkler Irrigation. [Online] J. Cotton Sci. 7:185-193. Available at http://www.cotton.org/journal/2003-07/4/upload/jcs07-185.pdf.

Laughlin, D, and S.R. Spurlock. 2006. Mississippi State Budget Generator Users Guide (version 6.0) [Online]. Available at http://www.agecon.msstate.edu/ laughlin/msbg.php.

McGregor, K.C., C.K. Mutchler, J.R. Johnson, and D.E. Pogue. 1996. Cooperative Soil Conservation Studies at Holly Springs 1956-1996. Mississippi Agricultural and Forestry Experiment Station Bulletin 1044. Mississippi State University, Mississippi State, Mississippi. Available at http://msucares.com/pubs/bulletins/b1044.htm.

Roberts, R.K., B.C. English, Q. Gao, and J.A. Larson. 2006. Adoption of Conservation Tillage Methods and Genetically Modified Cotton. Selected Paper. SAEA Annual Meetings. Orlando, FL. 4-8 Feb. Available at http://agecon.lib.umn.edu/cgi-bin/pdf_view.pl?paperid=21715&ftype=.pdf. Accessed 21 June 2007.

Robison, L.J., and P.J. Barry. 1987. The Competitive Firm's Response to Risk. MacMillian Publishing Company. New York, NY. ISBN 0-02-948640-8.

USDA. 2006. National Agricultural Statistics Service. Available at http://usda.mannlib.cornell.edu/reports/nassr/price/pap-bb/.

Wiatrak, P.J., D.L. Wright, and J.J. Marois. 2005. Evaluation of Strip Tillage on Weed Control, Plant Morphology, and Yield of Glyphosate-Resistant Cotton. [Online] J. Cotton Sci. 9:10-14. Available at http://www.cotton.org/journal/2005-09/1/upload/jcs09-010.pdf.

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