AN ECONOMIC ANALYSIS OF BEST MANAGEMENT PRACTICES FOR LOUISIANA COTTON PRODUCTION

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Abstract

A number of Best Management Practices (BMPs) have been identified for cotton production in Louisiana. These practices are generally designed to mitigate the potential adverse impacts of cotton production on the environment. While there has been some research on the technical aspects of these practices, there has been little work on the economics of the practices. This paper examines the results of three experiments conducted by the Louisiana Agricultural Experiment Station involving BMPs for cotton. Specifically, the paper uses partial budget analysis to evaluate alternative BMPs to estimate the potential for adoption by producers. Results suggest that there are significant economic incentives for producers to adopt several BMPs relating to soil conserving tillage and cover crop practices. Further, the results indicate that there are economic incentives for producers to incorporate nutrient management strategies as a part of cotton production BMPs.

Introduction

The LSU Agricultural Center, working with a variety of other state and federal agencies, has developed a set of Best Management Practices (BMPs) for the major agricultural enterprises in the state. It is generally recognized that runoff from crops can have a potentially significant impact on the surface water quality in the crop producing areas of the state. Therefore, BMPs are designed to be used by producers to control the generation or delivery of pollutants from agricultural production to the water supply. The BMPs provide growers some guidelines on practices they can implement to reduce the potential negative impact agricultural production might have on the environment.

This paper focuses on BMPs for cotton production in Louisiana. Cotton accounts for the second largest acreage among row crops. It is grown on a variety of soils located primarily along the major river bottoms in the state. One major area of cotton production is located in an area of the state known as the Macon Ridge. loess soils found in this area are generally classified as highly erodible. Because much of the cotton production occurs in close proximity to streams or on highly erodible soils, it is important to implement BMPs that have the potential to mitigate any adverse impacts on water quality.

Best Management Practices for cotton production in Louisiana have been developed in three major areas: (1) soil and water management; (2) pesticide management; and (3) nutrient management. Within each of these categories, a number of specific practices are identified that can reduce or prevent erosion. For example, the soil and water management area includes specific recommendations on irrigation practices, conservation tillage, residue management, field borders and filter strips, and conservation practices. Most practices identified are cross-referenced to the NRCS code that contains the specific practice.

Objectives and Procedures

The general objective of this study was to determine the economic viability of selected BMPs for cotton production in Louisiana. Over the years, a number of production practices for cotton have been identified as conserving soil and/or water resources. As a general rule, practices were defined based on technical merit or their ability to contribute to the conservation of natural resources. There has not been an extensive economic evaluation of various practices to help identify those practices that have a high probability of being adopted by producers.

In this study, a selected number of specific BMPs for cotton production that have a known potential for reducing runoff or other negative impacts of cotton production are identified. Further, the list of BMPs is restricted to those practices for which research data are available to permit an economic analysis. For purposes of this study, the BMPs selected include conservation tillage and nutrient management practices. Partial budget analysis is used to compare alternative practices with conventional practices to determine if there is an economic incentive for producers to adopt the BMPs. Alternatively, some practices that are deemed desirable may require some type of economic incentive to achieve adoption by individual producers. The partial budget analysis will provide some initial approximations on the magnitude of incentives that may be required to induce adoption of certain practices.

The specific practices examined here include reduced tillage, cover crops, and nutrient management for cotton production in northeast Louisiana. Data for the analysis are taken from research stations located on soils representative of cotton production in this area of the state. The Northeast Research Station, located at St. Joseph, Louisiana and the Macon Ridge Research Station located at Winnsboro, Louisiana, have conducted long-term research studies on alternative production systems for cotton.

Cotton production system research at the Macon Ridge location has focused on conservation tillage and cover crop systems. This research has been ongoing for about 14 years and the long term impacts of various production systems on soil properties and yields have been demonstrated. Three tillage systems and four cover crop regimes were included in the study. Tillage systems included conventional, ridge-till, and no-till systems. The conventional tillage system is typical of the tillage systems generally used by most cotton producers in the area at the time the research was initiated. This system does not include any deep tillage operations because such operations are not appropriate for the soil type. The ridge-till system involves tillage of only the top of the row, while the no-till system does not disturb the soil surface except for the planting operation with a no-till planter. For each tillage system, there are four cover crops— no cover; wheat plus vetch, hairy vetch, and wheat.

The Northeast Research Station has also conducted research on nutrient management for cotton production. This research has focused on optimum fertilization rates for cotton production. Application rates are a key component in the best management practices for nutrient management.

Results

Table 1 shows the average lint yields for the various treatments over the life of the experiment. Although not shown in Table 1, the no-tillage system had the highest average yields across all cover crop treatments. The wheat cover crop generally produced the highest average yield for each of the tillage systems. Overall yields for the conventional tillage system were slightly higher than the no- tillage system when no cover crops were used. Given that the yields are fairly similar, there appears to be little incentive for producers to adopt the no-tillage system as part of a best management strategy.

Table 2 shows the average yields, variable costs, and average returns above variable costs for each of the treatments in the long-term experiment. Since there are additional costs associated with the use of cover crops, a decision to adopt a different tillage system cannot be based on yields alone. As shown in Table 2, on average, the no-tillage system with the wheat cover crop offers the highest returns above variable costs. Since these experiments

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:193-195 (2001)
National Cotton Council, Memphis TN

are conducted in a dryland production system, adverse rainfall patterns have a dramatic impact on yields. This was especially true in 1998 and 1999 when rainfall was extremely limited. For most treatments, lint yields ranged between 350 and 475 pounds per acre during the 1998-99 period. However, the no-tillage system continued to have the highest yields with average yields of more than 500 pounds per acre. These results suggest that there is some economic incentive for producers to adopt the no-tillage system as part of a cotton best management practice program.

Since a considerable amount of cotton in this area of the state is irrigated, a similar study was undertaken in 1991 to examine the impact of nitrogen levels on cotton yields for alternative cover crops under irrigation. **Table 3** shows the yield response to the various nitrogen levels for each of the cover crop regimes across tillage systems. Note that the overall yield levels for this experiment are considerably higher than the non-irrigated yields shown in Table 1. This illustrates the importance of having adequate moisture to effectively utilize the available nitrogen fertilizer. These results suggest that the optimal nitrogen rate across cover crops is 70 or 105 pounds per acre. On average there was a 17 pound increase in lint yield, with the wheat cover crop adding an additional 35 pounds of nitrogen for a total of 140 pounds of nitrogen. If lint is 60 cents per pound the additional lint would contribute just over $10 in additional revenue compared to added costs of $8.75 if nitrogen is 25 cents per pound. Not shown in the table are the data indicating that in four of the nine years of the experiment, the additional yield would not have generated sufficient additional revenue to cover the nitrogen costs. In one year, yields actually declined with the higher nitrogen rate. Results of this experiment do not support the need for higher rates of nitrogen beyond the recommended rates under irrigated conditions. Again, these results suggest that there is no economic incentive for producers to apply excessive amounts of nitrogen to achieve optimal yields and maximize profits from cotton production.

A substantial amount of cotton is produced on heavier soils in the state and research has been conducted to determine optimum fertilization rates on these soils. **Table 4** shows the lint yield for each of the nitrogen application treatments for the last three years of the experiment. These results illustrate inconsistent yield responses to additional nitrogen beyond the recommended 90 pounds per acre. Further, there was no significant response to different application techniques. These results also demonstrate that there is no economic incentive for cotton producers to apply excessive amounts of nitrogen for optimum cotton production on sharkey clay soils.

Summary and Conclusions

This paper has examined the results of three experiments conducted by the Louisiana Agricultural Experiment Station relating to BMPs for cotton production in the major cotton producing areas of the state. A partial budgeting analysis of these results suggests that there are significant economic incentives for cotton producers to adopt BMPs for cotton production. Specifically, this study found that under dryland conditions, the use of a no-till tillage system with a wheat cover crop increased expected returns over conventional production systems. Other results also indicted that under irrigation, the no-tillage system was superior to conventional tillage. The inclusion of cover crops in the irrigated system did not significantly improve yields over the native vegetation cover. With only small yield differences, the added costs of cover crops was not justified. Finally, results from the fertilization experiment on sharkey clay soil indicated that producers should not apply nitrogen beyond the recommended rates because there was insufficient yield increases to justify the cost of the additional nitrogen.

In summary, cotton producers in Louisiana have economic incentives to adopt BMPs relating to soil conservation and nutrient management. While the number of BMPs examined in this paper were limited, these BMPs represent significant areas for minimizing the adverse impacts of cotton production on the environment through reduced runoff and proper fertilization application.

References

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Table 1. Average lint yields per acre, by tillage system and cover crop, Northeast Research Station, Winnsboro, Louisiana, 1987-99.

	Lint Yield		
Tillage System/ Cover Crop	**1987-92**	**1993-99**	**Overall**
Surface Tillage			
No cover crop	717	761	741
Wheat + vetch	709	705	706
Hairy vetch	738	727	732
Wheat	737	774	757
Ridge Tillage			
No cover crop	620	683	654
Wheat + vetch	592	633	614
Hairy vetch	701	676	687
Wheat	738	763	751
No-Tillage			
No cover crop	675	767	724
Wheat + vetch	661	721	693
Hairy vetch	738	790	766
Wheat	754	859	810

Source: *1999 Annual Report*, Northeast Research Station, LSU Agricultural Center, Baton Rouge, page 83.

Table 2. Returns above variable cost, by selected tillage system and cover crop, Northeast Research Station, Winnsboro, Louisiana, 1987-99.

Tillage System/ Cover Crop	Yield #lint/ac	Variable Cost $/ac	Returns Above Variable Cost $/ac
Conventional Tillage			
No cover	741	415.05	75.93
Wheat + Vetch	706	489.95	-15.24
Hairy Vetch	732	480.10	12.11
Wheat	757	455.51	53.48
Ridge Tillage			
No Cover	654	435.09	4.67
Wheat + Vetch	614	501.12	-88.25
Hairy Vetch	687	484.28	-22.32
Wheat	751	465.51	39.47
No-Tillage			
No Cover	724	416.49	70.32
Wheat + Vetch	693	472.92	-6.93
Hairy Vetch	766	469.84	45.20
Wheat	810	445.20	99.46

Table 3. Average irrigated cotton yield response to alternative nitrogen levels, for selected cover crops, Northeast Research Station, Winnsboro, Louisiana, 1991-99.

Pounds N Per Acre	Cover Crop		
	Native (#lint/ac)	**Vetch (#lint/ac)**	**Wheat (#lint/ac)**
0	634	1099	677
35	927	1106	875
70	1090	1119	1013
105	1118	1132	1108
140	1043	1089	1137

Source: Annual Reports, Northeast Research Station, LSU Agricultural Center, Baton Rouge, 1991-1999.

Table 4. Average response to selected nitrogen treatments, cotton on clay soil, Louisiana, 1998-2000.

Treatment	Pounds Lint/ acre
1. 90 lb/ac prior to first true leaf	894
2. 120 lb/ac prior to first true leaf	908
3. 90 lb/ac pre-square side-dress	841
4. 120 lb/ac pre-square side-dress	879
5. Treatment #1 plus 30 lb/ac pre-bloom	919
6. Treatment #1 plus 60 lb/ac pre-bloom	914
7. Treatment #1 plus 90 lb/ac pre-bloom	925
8. Treatment #1 plus 120 lb/ac pre-bloom	929