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ECONOMIC CONSIDERATION OF CROP ROTATIONS WITH COTTON

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Abstract

Changes in government farm programs and tighten profit margins have forced producers to explore ways to increase profits and import production efficiency in farming operations. Incentives are now in place to develop and utilize farming systems that reduce costs while maintaining or increasing yields. Utilizing an economically and environmentally sound sustainable crop rotation system is one way that is being used to reduce costs, reduce pest pressures, and increase yields. The main production limitations in the Southeast are poor soils, drought conditions, and pest problems. Rotation systems are a means to reduce the impact on these limitations. A good rotation system will add organic matter to infertile soils for better nutrient and water holding capacity, will lower compaction, and reduce pest levels. Studies throughout the Southeast have shown that both cotton and peanut yields may be increased by utilizing recommended crop rotation systems. In some cases the economic benefits was not evident but overall in the Southeast both yields and economic returns improved with crop rotation. In Florida and Georgia yields for cotton and peanuts have improved by as much as 25 percent due to rotations. Economic returns increased over 15 percent in the two states in some experiments and on-farm studies. Alabama results have also shown positive returns of 10 percent due to rotations. However, a six-year rotation in North Carolina has shown that continuous cotton has a higher per acre return than the rotation systems. This is partly due to higher production costs and low prices for other commodities. Production costs vary throughout the Southeast for cotton. In some areas crop rotations may actually decrease per acre production costs. Some of the studies indicate costs are increased but are more than offset by increased yields. Labor constraints are also a factor that should be considered in the decision. Individual operations may be limited in what type of production system to use by labor availability. Producers need to carefully consider rotation systems as a way to maintain on increase profits and improve soil and cropping conditions. Choices among rotational systems are often more dependent on local agronomic and management considerations than on yield increases and rotational profitability.

Introduction

Cotton acreage has increased in the Southeast since the early 1990's. This is due in part to changes in farm programs and relatively low prices of other commodities that have been grown in the area. Traditional southern crops of peanuts and cotton have been more profitable than the other crops. As production has shifted to increased acreage of cotton and peanuts, yields have suffered due to poor rotations that cause pest and other cultural problems. The lack of profitable rotation crops has forced many producers to planting cotton crops in short rotations or to plant continuous cotton. For producers that grow both cotton and peanuts, profits are more likely than for those producers who must use other crops in their rotation with cotton. Much research has been done to look at the benefits of rotations for cotton. Most rotation studies address only agronomic benefits by comparing yield responses to various treatments. Previous studies concluded that crop rotations produced substantially higher cotton yields than continuous cotton systems in the first year of the study. A Texas A&M University study compared rotations, tillage systems, and fertility levels on cotton yields. The study evaluated cotton-corn, corn-cotton, soybean-cotton, and continuous cotton. The tillage treatment had no effect on yield response. The yield advantage of the different rotations fluctuated widely each year. Rotation is critical for successful cotton production since the crop is susceptible to numerous pest problems that reduce yields. Finding ways to reduce costs is also important as input costs continue to increase without significant price increases for cotton. One of the foundations of a reduced input program is a good crop rotation that lowers pest problems. Of course, the ultimate decision for crop rotations is the profitability of the cropping decision. Producers must analyze the research results and experiment on their farms to answer the does it pay question. Knowing the long-term financial implications of adapting different crop rotations is critical.

Objectives

Cotton acreage has increased in the Southeast since the early 1970's. Much of the acreage has been grown on a continuous cotton basis. Many factors must be considered before adapting a new crop rotation. Along with the agronomic benefits, the potential crop prices and yields, costs of machinery and changes in government programs must be weighed. The objective of this paper is to examine the economic benefits and consideration of cotton rotations in the Southeast. Research results from four states in the Southeast will be discussed.

Results

Georgia

Research was conducted on farms in Georgia over four years to look at economic consideration and nematode management. Including both corn and soybeans in the rotation improved yields but not necessarily returns (Table 1). This is due to higher per acre costs and poor prices for soybeans. This data indicates that a cotton-corn rotation appears to be a profitable alternative to continuous cotton.

North Carolina

Model farms were developed in three counties in eastern North Carolina. Actual yield and price data were utilized in budgets to simulate price risks for adapting different crop rotations. In this study, the model farms showed very different results for the crop rotations (Table 2). The net farm income with the rotations was not as high as the income for continuous cotton. This study illustrates that improved yields alone do not translate into higher net farm income. Agronomic benefits must also be weighed.

Alabama

Seven corn-peanut-cotton rotations were evaluated during a six-year period beginning in 1997 at the Wiregrass Research and Extension Center in Headland, Alabama. The treatments ranged from continuous peanuts to continuous cotton. Plot yields were converted to an acreage basis, and costs from Alabama Cooperative Extension System budgets were applied. Returns per acre were calculated, with the assumption that seed sales covered ginning costs in the case of cotton, and that handling charges were included in the price used for peanuts.

Results in agronomic terms, as shown in Tables 3 and 4, demonstrated the advantages of crop rotation. The average lint yield for plots containing cotton was over nine percent higher than the average for plots with continuous cotton. The average lint yield for the best cotton rotation was over 24% higher than the average for plots in continuous cotton. The results for peanuts were even more striking. The average yield for peanuts in plots containing a cotton rotation was 19% higher than the average for plots with continuous peanuts. The highest yielding rotation for peanuts was over 35% higher than the continuous peanuts. However, over the six years of the study, the continuous plots for both cotton and peanuts produced the most, ranking first by a considerable margin. This is natural considering they produced the appropriate crop each year. This demonstrates the economic basis for the reluctance of farmers to rotate land where an alternative, comparably profitable, enterprise is not apparent. In this analysis, the break-even production level of cotton and peanuts over variable cost was 513 and 2338 pounds, respectively. Break-even production over total cost was 669 pounds of cotton lint and 3117 pounds of peanuts.

The highest yielding cotton rotation was treatment 6, with cotton rotated with peanuts each year. This rotation produced 160 pounds more of lint per acre on average than continuous cotton. However, other rotations produced nearly as much on average and had much higher total production over the six-year test. The top 3 rotations on the basis of average yield ranked near the bottom in terms of total production due to the fact that these rotations tended to have cotton 50% of the time or less. While the average yield of rotation 4 was over 140 pounds less than that of rotation 6, over the life of the trial it produced over 300 pounds more cotton lint. These rotations would be more attractive in years of low peanut price or higher cotton price.

Florida

Rotation studies have been done in Florida that results in a increased yield for rotations and higher average returns for rotations. Sod based rotation studies have also been researched that indicates that the addition of some type of sod has yield benefits. The addition of sod reduced soil borne disease and helped in improving agronomic cultural practices. Nematode problems are also improved by utilizing a good rotation scheme. Crop yields were improved by over 20 percent and net incomes also improved with rotation (Table 5).

Summary

Economic returns to the grower is the ultimate test of sustainability and changes in Farm Programs often effect the planting and marketing decisions. Producers should utilize research results in deciding on a rotation scheme. Rotations are also a way to reduce input costs which is of vital concern to producers. Reduced input systems are more likely to succeed with a good rotation. The tests discussed in this paper demonstrated the advantages of crop rotation production when profitable alterna-

tives exist. The results also demonstrated that the choice among rotational system is probably more dependent on local agronomic and management considerations than on yield increases and rotational profitability. Major differences in returns between the continuous treatments and some of the rotations exist but not between all of the rotational treatments.

Table 1. Yield and per acre net returns above variable cost (RAVC) for cotton rotations, 1998-2001.

	Aldicarb[1]						
Treatment	**IF**	**SD**	**Rotation[2]**	**Avg Yield[3]**	**Avg Price[4]**	**Variable Cost**	**RAVC**
1	3.5		Ct-Ct-Ct-Ct	866	48.13	$370.53	$46.28
2	5.0		Ct-Ct-Ct-Ct	940	48.01	$379.53	$71.76
3	5.0	5.0	Ct-Ct-Ct-Ct	973	48.25	$399.43	$70.04
4	7.0		Ct-Ct-Ct-Ct	898	48.09	$382.86	$48.99
5	5.0		Cr-Ct-Cr-Ct	171.5/1,131	2.21/39.69	$300.46/$406.22	$60.62
6	5.0		Sb-Ct-Sb-Ct	27.5/1,114	4.95/39.99	$154.91/$404.90	$10.91

[1] On cotton. Pounds per acre applied in-furrow at planting (IF) and side-dress (SD).
[2] Ct = cotton, Cr = corn, and Sb = soybeans. Years 1998-1999-2000-2001.
[3] For treatments 5 and 6, yield is 2 year average yield for corn/cotton and soybean/cotton, respectively.
[4] Weighted average price. Cotton price is cents per lb. Corn and soybean price is dollars per bushel.

Table 2. Jones County, North Carolina Per Acre Income of Various Crop Rotations.

Year	**Con. Cotton**	**C-C-Corn**	**C-C-Wheat**	**C-C-W/S**	**C-C-Soybean**
96	123	126	120	138	103
97	68	61	50	76	63
98	226	142	159	168	161
99	-66	-36	-33	-39	-37
00	136	131	109	124	120
01	140	148	96	103	115
6 yr, Avg.	**104**	**95**	**84**	**95**	**87**

Table 3. Cotton Lint Yield, Auburn Test, 1999-2002.

Treatment Description		**rank**	**Average Yield**	**rank**	**Six-year Total Production**
1	p-ct-ct-p-p-ct	4	705	6	2114
2	c-c-c-c-c-c	6	661	1	3966
3	ct-ct-p-ct-ct-p	5	696	2	2786
4	p-ct-ct-ct-p-ct	7	623	3	2492
5	ct-p-ct-p-ct-p	1	821	4	2464
6	p-p-ct-ct-ct-p	2	774	5	2321
7	ct-p-p-ct-p-p	3	711	7	1422

Table 4. Rotation Costs and Returns, Auburn Test, 1999-2002

Treatment Description		**rank**	**Returns over Variable Cost npv**	**rank**	**Returns over Total Cost npv**
1	p-ct-ct-p-p-ct	6	$635.42	7	-$114.58
2	c-c-c-c-c-c	7	$568.22	5	-$31.78
3	ct-ct-p-ct-ct-p	2	$929.84	2	$229.84
4	p-ct-ct-ct-p-ct	4	$792.34	4	$92.34
5	ct-p-ct-p-ct-p	1	$1,170.50	1	$420.50
6	p-p-ct-ct-ct-p	3	$923.67	3	$173.67
7	ct-p-p-ct-p-p	5	$696.04	6	-$103.96

Table 5. Average Yields and Returns for Cotton Rotations, 1999-2001, Quincy, Florida

Treatment	Yield	Plot Return
1 con, ct	630	$72
2 cn, ct	650	$164
3 c, p	820	$272
4 c,c,p	750	$102
5 c,p,b	910	$318