

WHOLE FARM ANALYSIS OF ULTRA NARROW ROW COTTON CROP ROTATIONS IN THE SOUTHERN PIEDMONT

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Abstract

UNR cotton acreage has increased significantly in the last five years in the North Carolina Southern Piedmont Region. Ultra Narrow Row cotton (UNR) has been adopted in 80 percent of these new cotton acres, with most growing continuous cotton. A model UNR cotton farm was developed to compare a continuous UNR cotton system with four different crop rotations. Five years of actual county yields and prices were used in the model farm. The model farm was developed based on visits and survey of UNR farms in the Southern Piedmont. The wheat-soybean double crop rotation was found similarly profitable as continuous UNR cotton. With a five-percent yield increase, the wheat-soybean and soybean rotations had net farm incomes comparable to continuous UNR cotton.

Introduction

The Southern Piedmont Region of North Carolina has traditionally relied upon livestock, which historically has accounted for approximately eighty-five percent of the area's farm income. Partially due to recently developing environmental and land constraints, the region has seen cotton acreage increase significantly over the past five years. This study focuses on Union County, which is typical of the region. Union County has relatively marginal soils with average crop yields of 83 bushels for corn, 44 bushels for wheat, 26 bushels for soybeans (N.C. Statistics). There is no tobacco or peanut acreage in the area, which could potentially affect crop rotations. Union County cotton acreage has grown from 80 acres in 1990 to 8,900 acres in 1999, with eighty percent of the cotton acreage being UNR cotton (N.C. Statistics). Cotton growers within the area are aware of the potential benefits of crop rotations such as reducing disease, weed and nematode problems. Despite these potential benefits, cotton is usually grown on a continuous basis.

Objective

UNR cotton acreage in the Southern Piedmont has increased significantly in the past five years. Much of the area has marginal cropland. Eighty percent of the cotton acreage is continuous cotton. The objective of this study is to examine the effects on farm income of the adoption of various crop rotations versus continuous cotton.

Previous Studies

Due to the potential cost and length of a crop rotation study there are limited studies that attempt to address the farm level effects of crop rotations. A Louisiana State University study compared the profitability of continuous cotton with six cotton rotations (Bechtel et al). Ten years of experimental plot yield data were used to establish mean rotation yields and gross revenues and returns over direct costs. The study found that all six rotations increased the crop yields resulting in \$50 per acre higher returns for the cotton-cotton-soybeans rotation. Yields in the rotations increased three percent to twelve percent. Cotton-cotton-corn and cotton-soybean rotations provided similar returns as continuous cotton. A 1999 Mississippi State University study analyzed the cost of continuous cotton vs. a cotton-corn rotation (Parvin D., F.T. Cook). The study evaluated possible equipment savings. The study found that a cotton-corn rotation might require fewer tractors than continuous cotton. A two-year farming systems

study by the ARS Soils Laboratory and Auburn University compared tillage systems, conventional, and UNR cotton and two different crop rotations (Reeves et al). Yields were similar across all systems for 1998. A drought in 1999 reduced the yields of the UNR cotton double cropped with wheat to 395 Lbs. per acre. The average net returns were the highest for continuous UNR cotton over the two years. The returns for continuous UNR cotton were highly variable, ranging from \$29 to \$124 per acre.

Model UNR Cotton Farm

The model farm data was developed for Union County in the Southern Piedmont by visiting cotton growers in the area. The model farm has 1200 acres of cropland, and assumes one stripper can harvest approximately 800 acres of cotton. The additional 400 acres is planted to wheat, corn, and wheat-soybean double crop, soybean or UNR cotton. Each rotation includes two years of cotton and a third year that rotated out of cotton into one of the four other possible crops. Detailed balance sheets and machinery components were developed for the model farm. Previous studies developed costs and returns using university budgets, which assumes the machinery components will be fully utilized. In practice, this is very difficult to achieve, particularly in the short run. In order to relax this assumption and make the study more realistic, FinPack, a financial planning software package was used to obtain the whole farm effects of different crop rotations. FinPack develops total fixed costs of depreciation, insurance, taxes and interest, which are spread over the total farm acreage. The machinery component was adjusted for the different rotations. It was assumed that an additional stripper would be purchased and surplus grain equipment would be sold, if continuous cotton were grown. The continuous UNR cotton system included custom harvesting an additional 200 acres of cotton. Actual yields and prices were utilized in the crop budgets. Union County crop yields for 1995 to 1999 were used in the enterprise budgets. Yearly average price data was collected from the North Carolina Statistical Service. A three-cent price discount was assumed for the UNR cotton. The market transition payment was estimated for the farm and included in the farm data. In 1999 cash prices fell below the market loan for three of the crops. Prices used in the study are shown in Table 1. It was assumed that minimum prices received would be at least the market loan rate. The model farm had a debt to asset ratio of twenty to thirty percent, owning approximately one-third of the land farmed. The remainder of the land was rented for \$45.00 per acre. Most of the UNR cotton acreage is no-till, roundup ready, BT. Due to the unique management system used in the area, a UNR cotton budget for the Southern Piedmont was compiled for the study. The Southern Piedmont UNR cotton budgets had lower total costs than conventional cotton budgets. Total costs were \$419 per acre for UNR cotton compared to \$437. Operating costs are \$358 per acre compared to \$322 for conventional cotton. Currently there is little insect or weed pressure in the region, with average insecticide costs are under \$10.00 per acre. Machinery repair costs are \$25 for UNR cotton compared to \$36 for conventional cotton.

Results

Net Farm Income Results of Crop Rotations

The net farm income for each crop rotation is shown in Table 3. Actual yields and prices for each of the five years were incorporated into the whole farm analysis. Each alternative resulted in highly variable net farm incomes from year to year. All crops showed negative net farm incomes in 1999, which was difficult crop year, starting out with a drought followed by heavy rain in the fall. The continuous cotton alternative returned a five-year average net farm income of \$40.80 per acre. Continuous cotton net farm income ranged from \$144,896 in 1996 to (\$70,028) in 1999. The wheat-soybean alternative returned a five-year average net farm income of \$31.60 per acre. The wheat-soybean rotation had higher net farm income in two of the past five years. The soybean alternative returned a five-year average net farm income per acre of \$20.50. The wheat rotation returned an average of

\$5.40 per acre over the five-year period. The corn rotation had negative net farm incomes for three of the five years. This resulted in a five-year average negative net farm income of \$0.30 per acre.

Results of Increased Cotton Yields of Crop Rotations

It is assumed that crop rotations will increase yields. A Louisiana State University study, analyzed ten years of yield data reported a five to twelve percent yield increase of a rotation crop compared to continuous cotton (Bechtel et al). Since UNR cotton is new to the area, rotation yield data is not available. The actual yields were increased five percent for all crops. Prices were not adjusted for this analysis. With a five-percent increase in all crop yields, the wheat-soybean rotation five-year average net farm income per acre increased from \$31.60 to \$45.81 per acre. The soybean alternative five-year net farm income per acre increased \$20.50 to \$34.61. This compares to the continuous cotton returns of \$40.80 per acre. With the five-percent increase in yields, corn and wheat returned a five-year average net farm income of \$13.80 and \$19.51 per acre respectively. The results of increasing cotton yields five percent are presented in Table 4.

Networth Results of Crop Rotations

The net worth results shows the importance of selecting a crop rotation. Three of the alternative resulted in reducing the farm's net worth over the five-year period. Continuous cotton resulted in an average net worth increase of \$51,836 for the farm operation. The results are summarized in Table 5.

Summary

The Southern Piedmont area has developed a UNR cotton system that is very competitive with the traditional crops grown in the area. Cotton growers are aware of the agronomic benefits of crop rotations. However, most UNR cotton in the Southern Piedmont is grown on a continuous basis. Choosing a crop rotation is a difficult decision. Cotton growers must address many factors before adopting a new rotation. Growers must consider yield and price variability of the potential crop, possible chemical carryover, machinery and labor requirements of the crop. The study incorporated price, and yield variability into a farm model, examining the effects on farm income of the adoption of four crop rotations versus continuous. With the actual yields for Union county used in the farm model wheat-soybean double crop rotation resulted in a average five-year net farm income of \$31.60 compared to \$40.80 net income per acre. With a five-percent increase in cotton yields the wheat-soybean rotation returned an average of \$45.81 net income per acre. The soybean rotation net farm income increased to \$34.61 per acre. Assuming even a small yield increase the wheat-soybean and the soybean rotation are competitive with continuous UNR cotton. Since UNR cotton is relatively new to the Southern Piedmont there is not yield data to verify the benefits of crop rotations. Choosing a crop rotation is a difficult decision. This study offers one method that may aid in the decision making process.

References

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Table 1. Price For Model UNR Cotton Farm.

Year	Cotton	Corn	Wheat	Soybean
95	0.75	3.54	3.65	6.95
96	0.68	3.43	4.2	7.07
97	0.62	2.83	3.2	6.68
98	0.61	2.33	2.6	5.3
99	0.51	2.35	2.6	5.3
Average	0.63	2.87	3.25	6.26

Table 2. Yields For Model UNR Cotton Farm.

Year	Cotton	Corn	Wheat	Soybean
95	584	130	49	33
96	745	95	39	34
97	671	90	58	26
98	754	64	34	32
99	599	76	53	22
Average	670	91	47	29

Table 3. Net Farm Income of the various Crop Rotations.

Year	Con. Cotton	C-C-Corn	C-C-Wheat	C-C-W/S	C-C-Soybean
95	32160	53814	-3199	44127	-9904
96	144,896	85772	76379	127305	118986
97	34978	-22306	5581	35707	12787
98	103107	-7344	23095	41161	67049
99	-70028	-111677	-69430	-58104	-65935
5 yr. average return	\$49,024	\$348	\$6,485	\$38,039	\$24,597
acre	\$40.8	\$-0.3	\$5.4	\$31.6	\$20.5

Table 4. Net Farm Income of the various Crops. Rotations with 5% Cotton Yield Increase.

Year	Con. Cotton	C-C- Corn	C-C- Wheat	C-C- W/S	C-C- Soybean
95	32,160	71214	-14201	61527	7496
96	144896	105800	96507	147433	139114
97	34987	-5442	22445	52571	29651
98	103107	10712	41151	59217	85105
99	-70028	-99437	-57190	-45864	-53695
5 yr. average return	\$49,024	\$16,560	\$23,412	\$54,972	\$41,532
acre	\$40.8	\$13.80	\$19.51	\$45.81	\$34.61

Table 5. Net Worth Changes of Various Crop Rotations.

Year	Con. Cotton	C-C- Corn	C-C- Wheat	C-C- W/S	C-C- Soybean
95	6247	17263	-16045	12335	-21342
96	70966	36389	30655	60821	55948
97	7681	-31984	-9961	8051	-5358
98	46648	-19320	1225	10826	24841
99	-79706	-121354	-73233	-67781	-75613
5 yr. net worth changes	51836	-119006	-67359	24252	-21524