Comparative Economic Factors Impacting Cotton Acreage in the Mississippi Delta

L.L. Falconer
S.W. Martin
Mississippi State University Extension Service
Stoneville, MS

Abstract

This paper uses Mississippi Agricultural and Forestry Experiment Station (MAFES) Cropping Practice Survey data from the Mississippi Delta region to develop yield distributions for dryland and irrigated cotton, corn and soybeans. These results are incorporated into enterprise budgets (MSU) to develop distributions of returns above total specified expenses and provide estimates of the expected risks and returns associated with those crops. Mean results indicate that at the current market price for soybeans, cotton price would need to increase to 79 cents per pound for dryland cotton to be competitive with dryland soybeans. Cotton price would need to increase to 94.4 cents per pound for irrigated cotton production to be competitive with irrigated soybeans. Mean results indicate that at the current market price for corn and cotton, dryland cotton production is competitive with dryland corn. However, cotton price would need to increase to 96.5 cents per pound for irrigated cotton production to be competitive with irrigated corn.

Introduction

Cotton acreage in the Mississippi Delta region fell sharply from an average of 810,060 acres during 2002 through 2006 to an average of 304,700 acres from 2007 through 2011, an average decrease of 505,360 acres (Figure 1). Over the same period, the five year average soybean planted acreage increased by 197,460 acres to 1.34 million acres and the five year average corn planted acreage increased by 279,560 acres to 517,200 acres (USDA-NASS). For this study, the Mississippi Delta region is defined as Mississippi Crop Reporting Districts 10 and 40, including Bolivar, Coahoma, Humphreys, Issaquena, Leflore, Quitman, Sharkey, Sunflower, Tallahatchie, Tunica, Washington and Yazoo counties.

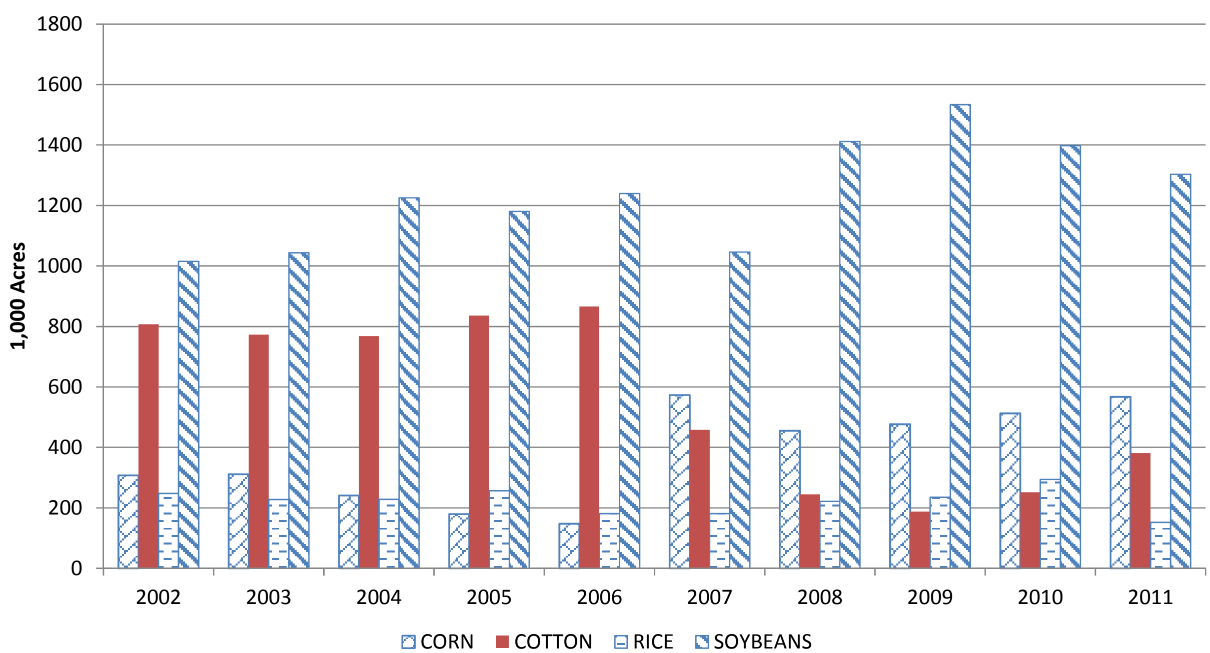

Figure 1. Crop Acreage Planted to Major Crops – Mississippi Delta (USDA-NASS).

Cotton acreage in the Mississippi Delta continued to decline in 2012. As shown in Table 1, cotton acreage insured in the region showed a year-over-year decrease of 28% in 2012. Insured acreage is presented in Table 1 because a breakdown by irrigated-dryland practice is not available from USDA-NASS. Since the cost structure and expected revenue are significantly different for these crops in dryland and irrigated production systems, this distinction is important in explaining acreage shifts. While not all planted acres are insured, net reported acres insured in this region of these selected crops were 97.9% of FSA certified acres in 2011 and 98.8% of FSA certified acres in 2012.

Table 1. Net Reported Acres Insured for Selected Crops in Mississippi Delta (USDA-RMA).

	2011				2012				Percentage Change		
	Irrigated	Dry Land	Total		Irrigated	Dry Land	Total		Irrigated	Dry Land	Total
Corn	285,179	269,196	554,375		386,341	136,295	522,636		35%	-49%	-6%
Cotton	223,362	145,303	368,665		162,527	104,425	266,952		-27%	-28%	-28%
Grain Sorghum	2,079	28,313	30,392		3,615	25,746	29,361		74%	-9%	-3%
Soybeans	696217	532,303	1,228,520		834,943	504,913	1,339,856		20%	-5%	9%
Total	1,206,837	975,115	2,181,952		1,387,426	771,379	2,158,805		15%	-21%	-1%

There is concern regarding the decline in cotton acreage in the Mississippi Delta, as acreage reductions put pressure on industries supporting cotton production. This paper examines the returns of dryland and irrigated cotton, corn and soybeans in this region to help explain acreage shifts and price levels needed to attract cotton acreage.

Methods and Procedures

In this paper “returns above total specified expenses” is used as a proxy for the economic concept of net returns above variable plus fixed costs. Some items are intentionally excluded from this calculation, i.e., costs for land or land rent, taxes, insurance premiums (other than for crop insurance), general farm overhead, and expected incomes from government payments or insurance payments. This measure is valid to use in determining intra-farm allocation of resources between cotton, corn and soybean production in this case as crop prices are high enough to ignore government payments.

In this study, dryland cotton returns above total specified expenses are based on the 2012 Delta Area enterprise budget for a production system that has a 900 pound yield goal using 12 row equipment, planted on 38" rows in a solid pattern, employing conservation tillage with a Bollgard II Roundup Ready Flex variety (MSU). Total specified expenses for dryland cotton production were estimated at $668.01 per acre in this budget. Irrigated cotton returns above total specified expenses are based on the 2012 Delta Area enterprise budget for a production system that has an 1,100 pound yield goal using 12 row equipment, planted on 38" rows in a solid pattern, employing conservation tillage with a Bollgard II Roundup Ready Flex variety and is furrow irrigated with 10.5 acre inches of water (MSU). Total specified expenses for irrigated cotton production were estimated at $831.61 per acre in this budget. In the model, both irrigated and dryland harvest and ginning costs are yield adjusted. Seed yields are adjusted based on lint yields. Revenue estimates are based on 68.00 cent per pound lint price and $240 per ton seed price.

Dryland corn returns above total specified expenses are based on the 2012 Delta Area enterprise budget for a production system that has a 135 bushel yield goal using 8 row equipment, planted on 38" rows, employing conventional tillage with a Roundup Ready variety (MSU). Total specified expenses per acre for dryland corn production were estimated at $453.65 per acre. Irrigated corn returns above total specified expenses are based on the 2012 Delta Area enterprise budget for a production system that has a 185 bushel yield goal using 8 row equipment, planted on 38" rows , employing conventional tillage with a Roundup Ready variety and furrow irrigated with 13 acre inches of water (MSU). Total specified expenses for irrigated corn production were estimated at $659.45 per acre in this budget. In the model, both irrigated and dryland corn harvest costs are yield adjusted. Revenue estimates are based on $6.80 cent per bushel corn price.

Dryland soybean returns above total specified expenses are based on the 2012 Delta Area enterprise budget that represents a production system that has a 30 bushel yield goal using 12 row equipment, planted on 20" rows, employing conventional tillage with a Roundup Ready variety. Total specified expenses for dryland soybean production were estimated at $223.53 per acre in this budget. Irrigated soybean returns above total specified expenses are based on the 2012 Delta Area enterprise budget representing a production system that has a 53 bushel yield goal using 12 row equipment, planted on 20" rows, employing conventional tillage with a Roundup Ready variety and flood irrigated with 13.5 acre inches of water. Total specified expenses for irrigated soybean production were estimated at $357.70 per acre in this budget. In the model, both irrigated and dryland soybean harvest costs are yield adjusted. Revenue estimates are based on $16.00 per bushel soybean price.

Yields are the stochastic variable in the model. A multivariate empirical (MVE) distribution of yields was estimated based on 2011 MAFES Cropping Practice Survey results and used to simulate the returns above total specified expenses for dryland and irrigated production systems for cotton, corn and soybeans. A MVE distribution has been shown to appropriately correlate random variables based on their historical correlation (Richardson et al.). Additionally, the MVE is a closed form distribution, which eliminates the possibility of values exceeding reasonable values observed in history, i.e. negative yields. The model was simulated for 500 iterations to determine the expected the returns above total specified expenses for each crop and cropping system.

Results and Discussion

The summary statistics for the 2011 MAFES Cropping Practice Survey yields by crop and practice are shown in Table 2. The average values obtained from the survey match very well with the yield goals used in the corresponding crop budgets that were used to simulate the returns above total specified expenses for both cotton and soybeans. However, average dryland and irrigated corn yields from the survey were considerably lower than the budget targets. Examination of the respective coefficients of variation reveals that dryland corn yields from the survey show considerably more variability than dryland soybean yields, while irrigated corn and soybean yields reported in the survey have about the same level of variability. The cotton yields reported in the survey show considerably less variation, both dryland and irrigated than either corn or soybeans.

Table 2. Summary MAFES 2011 Cropping Practice Survey Yield Statistics.

	Cotton (lbs/acre)		Corn (bu/acre)		Soybeans (bu/acre)	
	Dryland	Irrigated	Dryland	Irrigated	Dryland	Irrigated
Minimum	480.0	520.0	0.0	0.0	5.0	15.0
Maximum	1230.0	1500.0	168.0	210.0	62.0	82.0
Average	949.1	1120.2	75.8	160.1	30.1	49.2
Median	966.5	1125.0	75.0	167.5	29.0	47.0
Std. Dev.	201.1	203.9	46.3	40.0	11.3	12.0
C.V.	21.2%	18.2%	61.1%	25.0%	37.5%	24.4%
Observations	36	27	31	30	39	35

Summary statistics for the model simulation results are shown in Table 3. Mean returns above total specified expenses per acre for both dryland and irrigated cotton are substantially lower than those for soybeans, by $107.41 and $295.54 respectively. At the average cotton yield levels reported for cotton in the MAFES Cropping Practice Survey, cotton price would need to be $0.79 per pound to match the dryland soybean return above total specified expenses per acre and $0.944 per pound to match the mean irrigated soybean return above total specified expenses per acre. While mean returns above total specified expenses per acre for dryland cotton production are above those for dryland corn, the mean returns above total specified expenses for irrigated corn are $318.78 per acre above cotton. Cotton prices would have to increase to $0.965 per pound for the mean irrigated cotton returns above total specified expenses would equal those of irrigated corn.

Table 3. Summary of Dryland and Irrigated Simulated Returns Above Total Specified Expenses in Dollars per Acre.

	Corn			Cotton			Soybeans	
	Dry Land	Irrigated		Dry Land	Irrigated		Dry Land	Irrigated
Mean	$73.03	$455.42		$ 148.37	$ 136.84		$255.78	$432.83
StDev	$273.33	$187.91		$ 139.64	$ 126.13		$152.65	$155.64
CV	374.26	41.26		94.11	92.17		59.68	35.96
Min	($421.25)	($582.25)		$ (217.42)	$ (325.30)		($137.78)	($92.86)
Max	$680.83	$762.55		$ 359.31	$ 416.98		$760.54	$931.54

The simulated cumulative distributions of returns above total specified expenses for dryland cotton, corn and soybeans are shown in Figure 2. These results indicate dryland soybean production exhibits first degree stochastic dominance over dryland cotton production measured by simulated returns above total specified expenses per acre. The results also indicate that dryland soybean production displays second degree stochastic dominance relative to corn production. These results are consistent with the rankings of the 2012 dryland planted acres insured shown in Table 1.

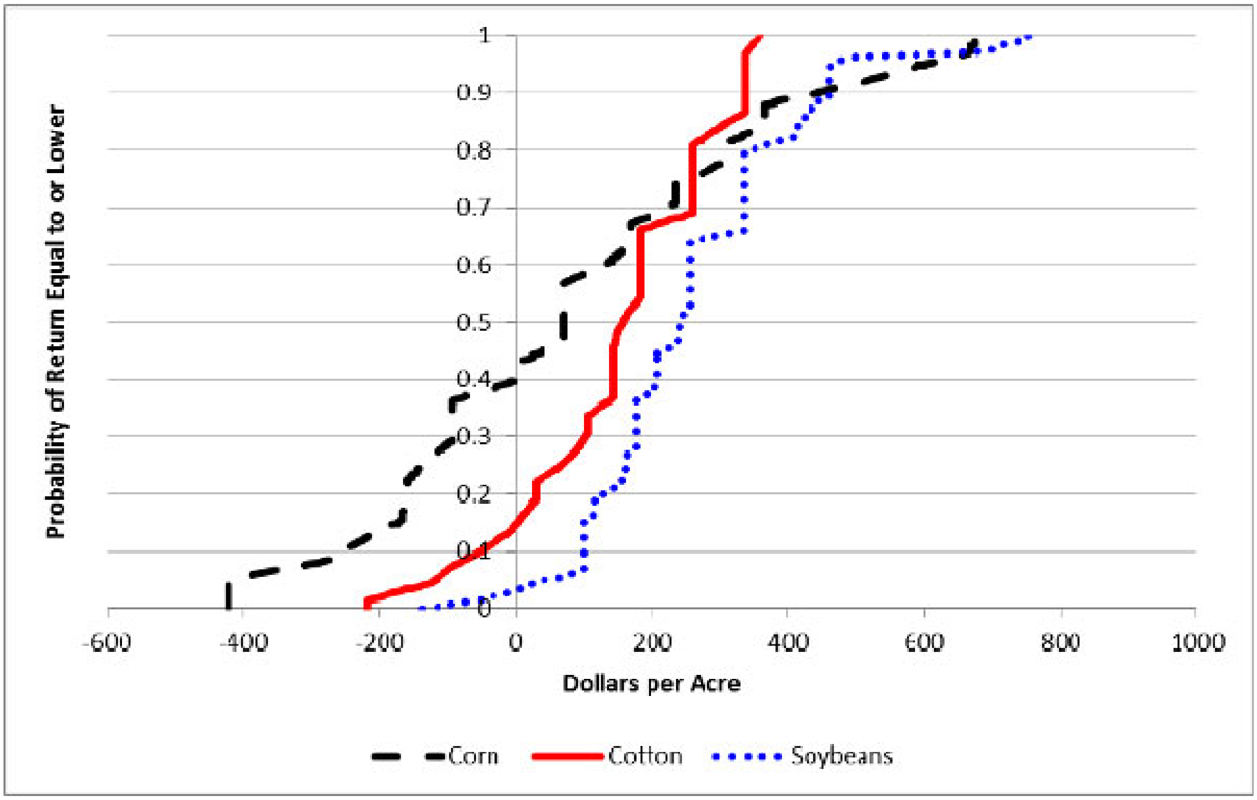

Figure 2. Cumulative Distributions of Simulated Returns Above Total Specified Expenses Per Acre for Dryland Cotton, Corn and Soybeans in the Mississippi Delta.

The simulated cumulative distributions of returns above total specified expenses for irrigated cotton, corn and soybeans are shown in Figure 3. These results indicate irrigated soybeans production exhibits first degree stochastic dominance over irrigated cotton production measured by simulated returns above total specified expenses per acre. The results also indicate that irrigated corn production displays first degree stochastic dominance relative to irrigated cotton production. These results are also consistent with the rankings of the 2012 irrigated planted acres insured shown in Table 1.

Conclusion

The increase in acres planted to irrigated corn and soybeans at the expense of cotton acreage in the Mississippi Delta region is consistent with the results from the simulation performed in this study. At the market prices and cost structures used to calculate total returns above specified expenses per acre, irrigated corn production and irrigated soybean production display first degree stochastic dominance over irrigated cotton production. Stochastic efficiency decision analysis would eliminate irrigated cotton production from the efficient set of alternatives for a risk neutral, profit maximizing decision maker (Anderson et al.).

The ranking of dryland planted acreage is also consistent with the simulation results in this study. The simulated net returns above total specified expenses for dryland soybean production exhibit first degree stochastic dominance relative to cotton production and second degree stochastic dominance relative to dryland corn production. These results would help explain the roughly 5:1 ratio of dryland soybean acres to dryland cotton and dryland corn acres in 2012.

At the average cotton yield levels reported for cotton in the MAFES Cropping Practice Survey, cotton price would need to be $0.79 per pound to match the dryland soybean return above total specified expenses per acre and $0.944 per pound to match the mean irrigated soybean return above total specified expenses per acre. Cotton prices would have to increase to $0.965 per pound for the mean irrigated cotton returns above total specified expenses would equal those of irrigated corn.

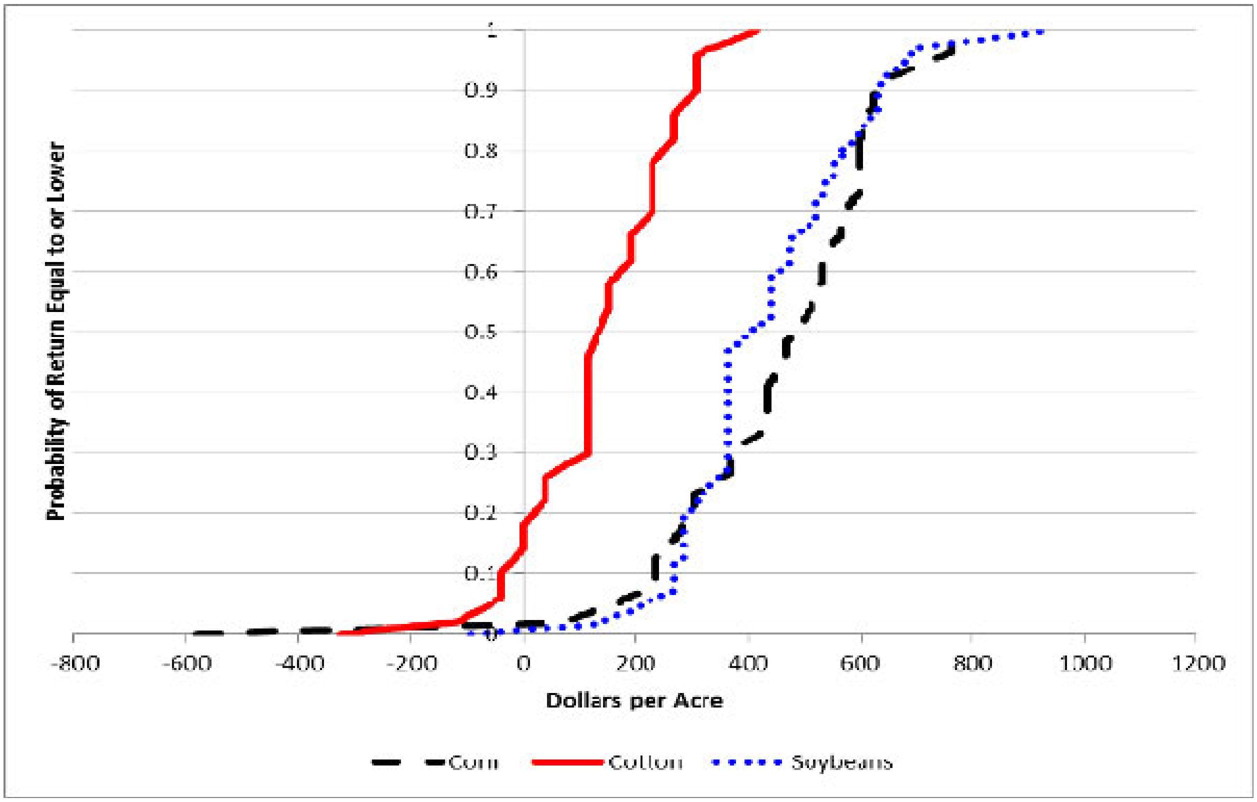

Figure 3. Cumulative Distributions of Simulated Returns Above Total Specified Expenses Per Acre for Irrigated Cotton, Corn and Soybeans in the Mississippi Delta.

This study did not include any impacts that crop insurance would have on the distributions of total returns above specified expenses, which is a possible topic for further study. Due to the lack of crossing by distributions of returns above total specified expenses per acre at the low end of returns it is not likely that this omission would lead to different conclusions from this study.

References

Anderson, J.R., J.L. Dillon and B. Hardaker. 1977. Agricultural Decision Analysis. p. 281-295. The Iowa State University Press. Ames, IA.

MSU. Mississippi State University Department of Agricultural Economics Budget Report 2011-05. December, 2011. Starkville, MS.

Richardson, J. W., K. Schumann and P. Feldman. "SIMETAR, Simulation for Excel To Analyze Risk". Simetar, Inc.
College Station, Texas. July 2008.

USDA-NASS. National Agricultural Statistics Service (NASS) Quick Stats 2.0 data base. October, 2012.

USDA-RMA. Private communication with Risk Management Agency Jackson Field Office. October, 2012.