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ACREAGE ALLOCATION OF COTTON AND ROTATION CROPS IN GEORGIA

Archie Flanders, W. Don Shurley, and Nathan B. Smith
Department of Agricultural and Applied Economics
University of Georgia
Athens, GA

Abstract

Whole farm analysis with a representative farm is specified for linear programming analysis. Alternative scenarios show changes in acreage allocation as prices and yields change. Inclusion of fixed costs allows measures of profit for each solution. Returns to land that are below prevailing rental rates demonstrate low returns for a typical farm. Loan deficiency payments (LDP) enable the farm to have a positive profit in years when commodity prices are low. These payments are important in some years, but market prices are adequate for profitability in other years. Government payments provide a "safety net" for Georgia cotton producers in years with low prices.

Introduction

Changing market prices and production conditions present variable profit opportunities for cotton producers. Public policy affecting agriculture creates another realm in agricultural decision making. Researchers attempt to assist farmers by synthesizing all available information and presenting expected outcomes from alternative scenarios. A research method that involves a representative farm enables farmers to evaluate the profitability potential from a set of possible crop decisions.

Whole farm analysis includes a typical combination of production enterprises. Information is available for constructing enterprise budgets that contain variable costs and returns expected for the farm. Fixed costs for a production season are derived from a total capital investment and determined as the annual amortized value of the investment.

Representative Farm

A model farm is optimized for acreage allocation that maximizes profit under a linear programming specification. In Georgia, cotton and peanuts are typically produced as part of a rotation program. Peanuts have soil benefits as a legume, and each crop is affected by different nematodes. Thus, alternating fields with cotton and peanuts does not provide a host for nematodes that affect cotton in years when peanuts are planted in the field, and vice versa. The representative farm contains 1000 acres with both irrigated and nonirrigated acreage possible for the optimal solution. Cotton varieties include BtRR and RR. As a refuge requirement, a specification of the model is that at least 20 percent of cotton is planted in acreage that does not have Bt cotton.

Technical inputs and costs are derived from crop enterprise budgets developed by the University of Georgia (UGA). Time constraints for equipment are included in the published budgets, and along with estimated days available for fieldwork from the Georgia Agricultural Statistics Service (GASS), form constraints for equipment usage with labor. (Meeks) Field activities are separated into five seasonal categories with unique time constraints. Seasonal categories are 1) preplanting cultivation, 2) planting 3) postplanting management, 4) high-clearance spraying, and 5) harvesting. Commodity prices received are based on the 2002 production year, and expected yields are from the UGA budgets. Commodity prices that include loan deficiency payments (LDP) from the Farm Service Agency, as well as expected yields are presented in Table 1.

Results

Table 2 contains results for the optimal acreage allocation. There are 721 acres of cotton planted, and the ratio of cotton to peanut acreage is indicative of state levels in recent years. Cotton meeting the refuge requirement is planted in acreage that is not irrigated, and this agrees with reports from crop scientist that RR does not perform well in high yield situations, such as would be expected with irrigation. Capital investment for the farm is $988,421 with an annual payment of $168,032. Variable cost total $366,804. These are substantial investments for the farm to realize a profit of only $18,716.

Since land charges are not included in the budget, profit of $18,716 is more accurately described as return to land. With current land rental rates in Georgia at approximately $30 per acre, the model farm only realizes $19 per acre. Even with LDP included in the price of cotton and peanuts, returns for the farm are low. These low returns provide support for provisions in the 2002 Farm Bill that makes direct payments to farmers based on historical acreage and yields.

Market prices for cotton during the 2003 production year were much improved over 2002 average annual prices. Expected prices at the time of 2004 planting will probably not be at the high levels of the 2003 season, but will likely be higher than $0.60. For an alternative model scenario, optimization is with a cotton price of $0.62. Note that this expected price does not

include a LDP because of anticipated strong market conditions. Table 2 presents results for the model with an increased cotton price. Cotton acreage increases relative to peanuts under the assumption that peanut prices are unchanged from 2002. With a $0.02 increase in cotton price that is only a 3.3 higher than the original price, profit increases by 74 percent to $32,658. This demonstrates great sensitivity to farm income due to changes in market prices.

Georgia cotton yields are negatively impacted by nematodes. Nematodes do not present the appearance of crop stress, but realized yields are diminished. With the existence of other nematodes that affect peanuts, as well as Tomato Spotted Wilt Virus in peanuts, there is increased profit potential for research that can minimize yield reductions. A third scenario of the model returns to the original cotton price, but increases yields of cotton and peanuts by 2.5 percent. Results are presented in Table 2. Acreage allocation is identical to the original solution. Profit increases by 68 percent to $31,385. This shows tremendous profitability increases from research that leads to only a minimal increase in expected yields.

LDP and a Safety Net

Profit from the original solution was previously discussed as low when compared to potential earnings from land rental. Model cotton prices of $0.60 were based on a 2002 Georgia market price of $0.45 (GASS) and an LDP of $0.15. Market price of $350 (GASS) per ton for peanuts has an LDP of $25 per ton added in order to obtain a season average price of $375 per ton. Table 3 shows the quantities of cotton and peanuts produced in the original solution. Multiplying quantities by respective LDP amounts calculates the amount of government payments paid to the representative farm. A total payment of $112,748 is composed of $100,524 from cotton and $12,224 from peanuts.

Most of the total government payment is from cotton because of depressed market conditions in 2002. Preliminary reports indicate that LDP amounts were virtually nonexistent for Georgia cotton during the 2003 production year, and expectations are for similar circumstances in the upcoming 2004 year. Thus, government payments in the form of an LDP provide a "safety net" in years of low prices, but as prices improve, markets provide all of the revenue for cotton production.

Summary

Cotton and peanuts are common Georgia field crops produced in a rotation program. A representative farm provides a tool for analysis of market conditions, as well as aspects of public policy. Linear programming results show that profitability per acre of the representative farm is below the land rental rate. Direct payments contained in the 2002 Farm Bill provide additional revenue that enhances profitability of the farm. Research that only marginally increases yields has the potential for returning significant profit increases. Government payments in the form of an LDP create a "safety net" for farmers in years of depressed prices. As prices improve, loan deficiency payments are not needed, and market conditions lead to profitability.

References

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Table 1. Price Received and Yield

	Unit	Price[1]	Yield
Nonirrigated RR Cotton	lb.	$0.60	650
Irrigated RR Cotton	lb.	$0.60	900
Nonirrigated BtRR Cotton	lb.	$0.60	650
Irrigated BtRR Cotton	lb.	$0.60	1000
Nonirrigated Peanuts	ton	$375	1.25
Irrigated Peanuts	ton	$375	1.75

[1]Price includes loan deficiency payments (LDP)

Table 2. Acreage Allocations and Profit

	Original	Increased Cotton Price	Increased Yields
Nonirrigated RR Cotton	144.1	152.5	144.1
Irrigated RR Cotton	0.0	0.0	0.0
Nonirrigated BtRR Cotton	0.0	0.0	0.0
Irrigated BtRR Cotton	576.5	610.0	576.5
Nonirrigated Peanuts	0.0	0.0	0.0
Irrigated Peanuts	279.4	237.5	279.4
Profit	$18,716	$32,658	$31,385

Table 3. Quantities Produced, LDP, and Payments Received, Orignal Model Yields and Prices

		Market Price	LDP	Payment
Cotton	670,159 lbs.	$0.45	$0.15	$100,524
Peanuts	488.95 tons	$350	$25	$12,224
Total Payment				$112,748