MEASURING THE RISK OF CROP ROTATION ALTERNATIVES IN THE LOUISIANA DELTA

Michael A. Deliberto
Michael E. Salassi
Louisiana State University Agricultural Center
Department of Agricultural Economics and Agribusiness
Baton Rouge, LA

Abstract

This on-going research project measures the impact that alternative corn, cotton, and soybean-based rotational production systems have on the risk-return framework of producers located in the Mississippi River delta region of Louisiana. By using multiple price and yield scenarios from the 2013 crop year, distributions of the net returns above variable costs are used to provide comparative estimates of the expected risk associated with each crop rotation selection. Simulation of prices, yields, and input parameters are based on the previous ten-years of production data which are representative of a typical farming operation located in north Louisiana.

Introduction

With corn prices forecasted to decline into 2014, there is hope that cotton can once again compete for acreage in the Mississippi delta region of northeastern Louisiana. The net returns of competing crops will be a determining factor in the decision to increase cotton acreage at the expense of corn acres moving into the 2014 crop year. Although a net return comparison can assist the farm manager in evaluating alternative crop selections, income risk should also be examined. A crop rotation system comprised of cotton, corn, and soybeans are evaluated over a two-year cycle to evaluate the average net return per farm acre per year.

Materials and Methods

Economic income calculations were made across a variety of cropping alternatives in the northeastern region of Louisiana. Yield level, market price, land rent charges, and production costs were assessed for mono-crop cotton, corn, and soybean cropping systems. Realizing that these crops are commonly produced in a rotation-based system, a two-year crop mix of cotton/corn, cotton/soybean, and corn/soybean were also evaluated. When considering a rotational-based system, yield increases from the second year crop are also considered. For cotton following a corn crop, a 15% cotton yield increase in the second year is assumed. When corn is produced in the second year, a 10% yield increase is considered; likewise for a second year soybean crop. Yields for the mono-cropped system were set at 900 pound per acre of cotton lint, 130 bushels per acre for corn, and 40 bushels per acre for soybeans. Rotational yields were reflective of 1,035 pounds, 143, and 44 bushels per acre for cotton, corn, and soybean crops in their second year. Production cost for herbicides, fungicides, insecticides, custom operations, drying, hauling, labor, and maintenance were obtained from 2013 projected commodity costs and returns for the region. Fuel and fertilizer prices were set to vary based on historical trends, as these two input categories comprise a significant percentage of variable production costs per acre.

Simulated random variables used in this analysis are representative to Tensas Parish, Louisiana cotton, corn, and soybean production data. These values were detrended from historical production data spanning from 2003 to 2012. Each parameter specified was simulated for 1,000 iterations using the SIMETAR software package (Richardson, Schumann, and Feldman 2008). Variable costs per acre were simulated over the individual iteration contained in the data set to capture the volatility of energy-related inputs used in the production process. Mean values selected for diesel fuel was $3.50 per gallon. Nitrogen fertilizer, phosphorus fertilizer, and potash fertilizer were given means values of $0.56, $0.65, and $0.47 per pound respectively. A weighted irrigation cost, representing cost per acre, was assigned to each crop relative to the percent of irrigated cropland in the parish. Another adjustment made to the crop mix system was the alteration of the fertilizer requirement in year two of the rotation. A standard 20% land rent charge is customary in the region. Market prices selected for this analysis reflect expected prices moving into 2014. Price parameters selected are: $0.80 per pound lint price, a $5.50 per bushel corn price, and a $13.00 per bushel soybean price. Another factor that is considered in this research is availability of on-board module cotton harvesting systems. A six row module-builder is considered in this crop mix analysis as well as a traditional six-row basket harvester.

Results and Discussion

In order to determine the net return for the selected crop rotation alternative, a calculation was made for each rotation pattern over the entire 1,000 iteration set. In the example that follows, a cotton-corn (CT1-CR2) rotational farm plan is examined with a corn crop following cotton. Results are presented for a traditional six-row cotton basket picker in addition to an on-board module cotton harvester. The mean return level is presented for the first year (cotton) and represents the average value obtained across the iteration set. The same procedure is applied for year two of the rotation (corn). Tables 1 to 2. Returns for each crop were then averaged by dividing by the total number of year in the rotation plan, e.g. two. This method is then duplicated for a CT1-SY2 (cotton in year one followed by soybeans in year 2) rotation. Tables 3 and 4. In an attempt to measure risk, a certainty equivalent (CE) is calculated for an exponential utility function relative to a set of risk aversion coefficients (RAC). At varying levels of risk, net returns per farm acre are presented for each type of cotton harvest system technology.

Table 1. Return data for a six-row basket harvesting system in a cotton-corn rotation.

Mean First Year Return ($ per farm acre) Cotton in Year 1	$135.78
Mean Second Year Return ($ per farm acre) Corn in Year 2	$135.13
Averaged Combined Net Return per acre per year	$135.46

Table 2. Return data for an on-board module harvesting system in a cotton-corn rotation.

Mean First Year Return ($ per farm acre) Cotton in Year 1	$150.51
Mean Second Year Return ($ per farm acre) Corn in Year 2	$135.13
Averaged Combined Net Return per acre per year	$142.82

Table 3. Return data for a six-row basket harvesting system in a cotton-soybean rotation.

Mean First Year Return ($ per farm acre) Cotton in Year 1	$135.79
Mean Second Year Return ($ per farm acre) Soybeans in Year 2	$107.72
Averaged Combined Net Return per acre per year	$121.75

Table 4. Return data for an on-board module harvesting system in a cotton-soybean rotation.

Mean First Year Return ($ per farm acre) Cotton in Year 1	$150.51
Mean Second Year Return ($ per farm acre) Soybeans in Year 2	$107.72
Averaged Combined Net Return per acre per year	$129.11

Summary

Given a range of risk aversion coefficients from 0 to 0.05, certainty equivalents are expressed as the average combined net return per farm acre per year for different type of cotton harvesting systems; assuming cotton is selected to be a rotation crop on the farm. The objective of this analysis was to determine the level of net returns per rotational acre as the producer's risk level increased. Results are listed in Tables 5 and 6 for a cotton-corn (CT-CR) and cotton- soybean rotation (CT-SY). Again, alternative cotton harvesting technology is considered. Results indicate that return levels are higher as the level of risk increases for producers who employ on-board module builders in their cotton operations with corn and soybean in their rotation. This is partly attributed to the reduction is harvesting costs and labor charges per acre.

Table 5. Return data for a six-row basket harvesting system in a cotton-corn rotation and a cotton-soybean rotation.

RAC	CT-CR CE (return level per farm acre)	CT-SY CE (return level per farm acre)
0.0	$135.46	$121.75
0.01	$100.05	$86.64
0.02	$64.72	$53.00
0.03	$30.00	$22.63
0.04	$0.22	-$2.01
0.05	-$22..74	-$20.94

Table 6. Return data for on-board module harvesting system in a cotton-corn rotation and a cotton-soybean rotation.

RAC	CT-CR CE (return level per farm acre)	CT-SY CE (return level per farm acre)
0.0	$142.82	$129.11
0.01	$107.43	$94.01
0.02	$72.16	$60.83
0.03	$37.53	$30.05
0.04	$7.85	$5.47
0.05	-$15.03	-$13.41

References

Richardson, J.W., K. D. Schumann, and P.A. Feldman. Simulation and Econometrics to Analyze Risk (SIMTEAR). College Station, Texas. 2008