Economic Effects of Crop Rotations for Cotton, Corn and Peanuts under Risk

By

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Abstract

This study provides an economic analysis of crop rotations for cotton, corn and peanuts under varying degrees of producer risk. Data for the study come from two experiments located in Alabama. Irrigation and crop insurance are examined to determine their efficacy for reducing risk. Enterprise budgets for each rotation were developed to determine the economic value of the different rotations. A Target MOTAD model was then used to determine optimal cropping strategies. Results of this study, although limited to the experimental data compiled, indicate that under irrigation, continuous cotton may be the most profitable alternative without crop insurance, but that a risk-averse farmer using crop insurance to protect against losses may prefer rotations with peanuts. For dryland, continuous peanuts were the most profitable without crop-insurance, but with crop-insurance, a cotton-peanut rotation would be preferred. Corn, or corn in rotation with peanuts, was not economically competitive with cotton based on the assumptions used in this study even though it had an important effect on increasing peanut yields.

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I. INTRODUCTION

Agricultural production has historically been extremely important to the Southeastern United States, especially so with Alabama. Alabama is well suited to a large variety of agricultural commodities and practices thanks in large part to its diverse climate and soil conditions. These factors allow for a wide range of agricultural practices, including the production of row crops such as cotton, corn and peanuts.

In 2010 cotton ranked number one among row crops grown in Alabama in total cash receipts, amassing $138.6 million in sales revenue. Cotton cash receipts accounted for approximately 17% of total crop receipts and 3% of total agricultural commodity receipts for Alabama. Production of 480,000 bales of cotton on 340,000 acres placed Alabama tenth in the nation in cotton production, accounting for 2.7% of total U.S. production, with a value of production of $199,066,000. Additionally, cotton seed was valued at $20,856,000 (USDA/NASS 2013).

Corn and peanuts were chosen in addition to cotton in this study since both are highly important row crops in Alabama. Crop rotation is also a major aspect of this study, and these three crops are major components of some of the most popular crop rotations used by producers in Alabama.

Corn ranked third among Alabama's row crops with total cash receipts in 2010 of $115 million, accounting for 14% of the state's total crop receipts. While only accounting for 0.2% of the total U.S. corn production, Alabama ranked twenty-eighth among the fifty states by producing 29 million bushels of corn on 270,000 acres. The value of production for corn was $139,200,000 (USDA/NASS 2013).

Peanuts ranked fourth among Alabama's row crops in 2010 with cash receipts totaling $82.6 million. This figure represents roughly 10% of the state's total crop receipts. Although peanuts ranked fourth in the state's row crops, Alabama was ranked third in the nation in peanut production with 481 million pounds produced valued at $89,947,000. This represented 11.6% of the total U.S. peanut production (USDA/NASS 2013).

Cotton, corn and peanuts represent three of the four crops in Alabama that currently occupy the most acreage, with the fourth being soybean. In 2012 cotton acreage was 378,000; corn acreage was 295,000; and peanut acreage was 219,000. These three crops account for roughly 40% of all harvested crop acreage within Alabama, making them extremely important commodities. The average annual values of production for cotton, corn and peanuts over the period 2008-2012 are: $221,608,800 for cotton (includes value of production for cottonseed), $152,910,000 for corn, and $158,553,000 for peanuts (USDA/NASS 2013).

Research Objectives

Crop rotation is one of the most effective tools for increasing the yields of agronomic crops, including cotton, corn and peanuts. Crop rotation can also minimize the impact of diseases and nematode pests in these three crops (Rodriguez-Kabana et al. 1991; Jordan et al. 2008;

Hagan et al. 2008; Martin and Hanks 2009). The economic value of the rotation, however, depends not only on the yield increase, but also on the market price for the crops. Irrigation can be used to mediate the risk of poor climate conditions such as drought on crop yields, but irrigation costs can be substantial.

Because both price and yield are highly variable, producers make decisions under risk. The volatility of crop prices in today's economy, along with weather variability, necessitates this study. This study has four primary objectives. First, data will be analyzed from cotton-corn-peanut rotations to determine the economic value of different cropping patterns. Second, the impact of irrigation on reducing yield variability will be examined as a means of reducing risk. Third, crop insurance will be evaluated as a means of reducing risk.

Enterprise budgets were developed to provide a means of assessing the economic value of different crop rotations. Both fixed and variable costs associated with production were included in the budgets. Irrigation costs were included in the budgets related to the irrigated rotations. To assess the value of crop insurance, all rotation patterns were analyzed through enterprise budgets that included crop insurance to compare them to those that were uninsured.

A final objective of this study is to find optimal decision strategies for producers at various levels of income risk, with and without irrigation. A Target MOTAD model will be used to determine the optimal combination of enterprises (rotations) based on returns calculated from the enterprise budgets that will maximize producer profits while minimizing deviations from a "target" income. The results of the Target MOTAD analysis will provide a means to determine how producers will operate given different levels of risk tolerance.

Thesis Organization

This thesis includes six major chapters. Chapter I includes an introduction to some of the most important agronomic crops in Alabama as well as some basic principles related to crop rotation and irrigation. Chapter II presents a review of relevant literature relating to crop rotation, irrigation and Target MOTAD. Chapter III provides a discussion of the theory that forms the basis of the study. Chapter IV discusses the data used in the study. The latter part of chapter IV discusses the methods used in conducting the study, including enterprise budgets and Target MOTAD. Results from the economic analysis of the crop rotations and Target MOTAD model are presented in chapter V. Chapter VI presents a summary of the study and the main conclusions drawn from it.

II. LITERATURE REVIEW

Crop Rotation

Many studies have been performed to determine the benefits of crop rotation. Crop rotations are an effective way to increase crop yields. Another important benefit of crop rotation is nematode and disease suppression (Hague and Overstreet 2002). Crop rotation may also lead to increased returns and lower risk.

In their 1990 study, Novak, Mitchell and Crews used Target MOTAD to assess the risks and returns of sustainable crop rotations. Their study included an analysis of continuous cotton, with and without winter legumes; two years of cotton-winter legumes-corn, with and without nitrogen fertilization; and three years of cotton-winter legumes-corn and rye-soybean double cropped rotations. Their findings indicate that diversification of rotations results in the least risk for a given level of target income. Specifically, rotations including winter legumes outperformed rotations with only nitrogen fertilizer by providing higher expected returns with less risk.

Rodriguez-Kabana et al. (1991) conducted a six year study in southeast Alabama to determine the value of cotton in rotation with peanut for the management of root-knot nematode and stem rot. Their findings indicate that peanut yields following either one or two years of cotton were higher than those of continuous peanuts. Populations of root-knot nematodes determined at harvest time were lowest in plots with cotton. The incidence of stem rot was also lower in peanut cropped behind cotton than in continuous peanut.

Jordan et al. (2008) conducted a study in North Carolina to study the effects of crop rotation on yield in corn, cotton, and peanuts. Their findings indicate that crop rotation affected peanut yield but not corn or cotton yield. Increasing the number of times corn or cotton, or a combination of the two were planted between peanut increased peanut yields.

Katsvairo et al. (2009) examined the effect on plant growth and development in two cotton rotations. In their study, they compared the traditional cotton-peanut rotation pattern prevalent in the southeast to a bahiagrass-cotton-peanut rotation. Field studies were performed in Quincy, Florida over the years 2000 to 2006. They found that plant height was typically greater in the bahiagrass rotation compared to the cotton-peanut rotation. Weed density was less in the bahiagrass rotation. Despite increased plant height, overall cotton yield did not improve in a bahiagrass rotation compared to the cotton-peanut rotation.

Irrigation

Agriculture is subject to various risks. Kansal and Suwarno (2010) categorize agricultural risk under five headings: production risk, price risk, income risk, financial risk and institutional risk, with the main one being production or yield risk caused by uncontrollable factors such as weather and disease. Irrigation represents a technology that may be used to reduce the production risk associated with yield variability due to drought. However, there are additional risks associated with irrigation. Initial installation costs are typically high and there are also associated variable costs. Producers typically make planting decisions without knowing the price of the yield and must deal with price fluctuations; hence there is an income risk. Uncertainty about future income makes it difficult for farmers to make commitments for future payment obligations to investments such as irrigation, so there is a financial risk.

In their 1989 study on irrigation in humid climates, Vandeveer, Paxton and Lavergne present irrigation as a risk-management strategy that offers potential diversification benefits. Their study used a portfolio approach for evaluating the impact of irrigation on farm income and variability of farm income. They also utilized MOTAD and Target MOTAD programming to estimate a farm's risk-return frontier under dryland and irrigated conditions. Target MOTAD was used to analyze and evaluate the effects of irrigation on the financial performance of the farm. Target incomes were estimated for dryland and irrigated scenarios and defined as the minimum income necessary for the farm to meet its fixed cash obligations. Results of the Target MOTAD analysis revealed no feasible solution for dryland when risk is at a minimum level, while a solution was found for irrigated. The irrigated scenario resulted in a diversified portfolio that was able to meet all farm cash obligations. Study results show that irrigation may be used as a risk management strategy, and that irrigation has income stabilizing and diversification effects that improve the risk-return position of the farm.

Farmers invest in irrigation to manage risk in drought years. Durham (2005) reported on a 15-year, ongoing study located in Dawson, Georgia in 2001 to determine the impact on profitability of irrigation, crop rotation and price. In the study corn, cotton and peanuts are grown in six rotation sequences and with four irrigation methods to determine which scheme can achieve the highest yields compared to the water applied while maximizing profit. Water is applied at 100 percent, 66 percent, or 33 percent of the estimated crop needs. It was shown that in 2002, a drought year, peanut yields were slightly higher with 100 percent irrigation than 66 percent, but that the extra water cost wiped out the higher yield benefit. When consistent rainfall was available in 2004, per-acre profit was $64 higher with 100 than with 66 percent irrigation. For cotton in 2002, a small positive return was obtained with 66 and 100 percent irrigation. In

2004, returns were much better: $140 per acre for 100 percent irrigation and $76 per acre for 66 percent irrigation. Overall results of the study thus far reveal that irrigation raises yield, quality and returns.

The study of crop rotations found that under various rotations, price determines profitability. It found that a rotation of cotton-cotton-peanut provides higher profit than other rotations. Cotton-corn-peanut was the second-most profitable rotation. The study found that if crops are receiving low prices, a rotation of cotton-cotton-peanut is about $57 per acre more profitable than the cotton-corn peanut rotation. At medium prices, cotton-cotton-peanut realizes $46 more per acre than cotton-corn-peanut. When prices are high, cotton-cotton-peanut generates $24 per acre more.

Crop Insurance

Crop insurance is commonly used to alleviate yield and income risk. Crop insurance reduces income variability by providing payments to producers if revenues fall below a guaranteed level. Many studies have been done to study the effectiveness of crop insurance as a means of reducing risk.

Carriker et al. (1991) used farm-level yield data to determine the effectiveness of several crop insurance programs for reducing income and yield risk. Results showed that risk-averse producers prefer and individual farm-yield insurance program with 100% coverage level over an area-insurance plan with 100% coverage. The individual farm-yield plan was also the most effective at reducing relative yield-equivalent variability, where variability was reduced between 36.1% and 63.8% for all corn farms in the study. This plan was also the most effective for combating income variability. While income variability was reduced by the insurance plan, the reduction was not as significant as the yield variability reduction. This was due to the additional risk associated with price variations.

Participation in crop insurance is determined by several factors. Sherrick et al. (2004) analyzed the factors influencing a farmer's crop insurance decisions. The likelihood of a producer purchasing crop insurance was influenced by the size of the farm, age of the farmer, and the perceived yield risk of the farms.

Barnett et al. (2005) compared risk reduction from Multiple Peril Crop Insurance (MPCI) and Group Risk Plan (GRP) crop insurance contracts and found that at least for some crops and regions, GRP is a viable alternative to MPCI. Both plans were found to reduce yield and income risk, however, the GRP plan had a smaller "wedge" than the MPCI, and therefore was favorable in many cases. The term "wedge" is used to describe the positive difference between premium cost and the expected indemnity payment.

III. THEORY

This study is driven by the economic theory of profit maximization, specifically profit maximization under risk. Profit maximization is a fundamental theorem in economics, whereby producers seek to maximize their utility by maximizing profits. Profit maximization is one of the most important goals of a firm. However, in some cases, profit maximization is not the only, and perhaps not even the primary, goal of a producer. Some producers may seek to minimize their detrimental effects on the environment, for example. However, for the purposes of this study, profit maximization is assumed to be the primary goal of the producer.

Profit Maximization

Long-run profit is defined as total revenue minus total cost. In order to maximize profit, a farmer must produce at the point where the difference in total revenue and total cost is greatest. More intuitively, a farmer will produce where marginal revenue is exactly equal to marginal cost. Marginal revenue is simply the added benefit of producing and selling one more unit of output, while marginal cost is the additional cost associated with producing one additional unit of output.

Beattie and Taylor (1985) define strict profit maximization for a multiproduct, multifactor firm (exclusive of fixed cost) mathematically as:

,

where π is the profit of the firm; p_j is the price received for product j; y_j is the level of output of product j; is the cost associated with the variable inputs used to produce the variable output .

For this optimization to hold, there are certain necessary and sufficient conditions that must be met to ensure true profit maximization. By taking first-partial derivatives of the profit function above and setting each equal to zero, we obtain the first-order necessary conditions:

for $j = 1, \ldots, m$

which imply

for $j = 1, \ldots, m$

or the profit-maximizing requirement that

for $j = 1, \ldots, m$

The second-order sufficiency conditions for maximum profit requires that the principal minors of the unbordered Hessian alternate in sign, beginning with a negative sign. Thus:

for $k = 3, \ldots, m$

which is equivalent to requiring that marginal cost of any output increase at an increasing rate and that the variable and/or total cost equation is strictly convex in all *y* in the neighborhood of the *y* values that satisfy the first-order conditions (Beattie and Taylor 1985, pp. 205-206).

Decision Making Under Risk

Pure profit maximizing behavior of the producer implies that the producer has perfect knowledge of future events. This is almost never true, and especially so concerning farming. Generally, agricultural production and prices are not known with certainty when decisions are made (Penson, Pope and Cook 1986, pp.201). This uncertainty leads to farmers making decisions under risk. The goal of the farmer is still to maximize profits; however, due to the uncertainty associated with farming, it is now done under risk.

The behavior of the farmer concerning production decisions under uncertainty hinges on farmers' individual risk preferences, or their propensity to take risks. A very important factor affecting a farmer's behavior is their assessment of the chances that different events have of occurring. For the risk-averse (preferring) farmer, the marginal utility of wealth decreases (increases) as wealth increases. The risk-averse (preferring) farmer will require a positive (negative) risk premium or additional return before accepting the risk associated with a particular decision. The marginal utility of wealth for the risk-neutral farmer is constant; every additional dollar gained has the same utility (Penson, Pope and Cook 1986, pp. 207).

Expected Utility Theory

A commonly held theory regarding behavior under uncertainty is expected utility theory. This concept is based on the assumption that the farmer will choose actions that will maximize his or her expected utility, where the term "expected" denotes uncertainty. Expected utility theory states that the decision maker chooses between risky or uncertain prospects by comparing their expected utility values, i.e., the weighted sums obtained by adding the utility values of outcomes multiplied by their respective probabilities (Mongin 1997). The action with the maximum utility is selected. Expected utility theory judges actions in relation to a fixed asset position, and producers make decisions based on the change in final value of the choices in relation to the fixed asset position. Key assumptions to expected utility theory are diminishing marginal utility and risk aversion (Rabin 2000).

In 1947, von Neumann and Morgenstern provided necessary and sufficient conditions (axioms) of "rationality" describing when the expected utility theorem holds. This simply states that any agent satisfying these axioms is considered von Neumann-Morgenstern (VNM) rational and has a utility function. The four axioms are: completeness, transitivity, continuity, and independence.

Axiom 1 (Completeness) For any lotteries *L*, *M*, exactly one of the following holds:

(either L is preferred, M is preferred, or there is no preference). Completeness assumes that an individual has well defined preferences.

Axiom 2 (Transitivity) If and , then **.** Transitivity assumes that preference is consistent across any three options.

Axiom 3 (Continuity) If , then for any *N* and , such that

. Continuity assumes there is a "tipping point" between being better than and worse than a middle option.

Axiom 4 (Independence) If , then for any N and ,

. Independence assumes that a preference holds independently of the possibility of another outcome.

The Von Neumann-Morgenstern (VNM) utility theorem states that for any VNM-rational agent (i.e. satisfying axioms 1-4), there exists a function *u* assigning to each outcome *A* a real number *u(A)* such that for any two lotteries,

,

where denotes the expected value of *u* in *L*:

.

As such, *u* can be determined by preferences between simple lotteries. This type of function is called an agents *von Neumann-Morgenstern (VNM) utility.*

Portfolio Theory

Another method of decision making under risk is portfolio theory. It was originally developed in 1952 by Harry Markowitz as a theory of finance that attempts to maximize portfolio expected return for a given amount of portfolio risk by carefully choosing the proportions of various assets. Essentially, portfolio theory is an investment framework for the selection and construction of investment portfolios based on the maximization of expected returns of the portfolio and the simultaneous minimization of investment risk (Fabozzi, Gupta and Markowitz 2002). Although this theory originated for use in the field of finance, it has also been used to study a producer's decision making under risk. The theory defines risk in terms of the standard deviation of return and models the portfolio as a weighted combination of assets. The theory rests on the assumptions that investors or agents are rational and that the markets in which they operate are efficient. In addition to this, the theory assumes that investors are risk averse.

Portfolio theory utilizes the expected returns-variance of returns (E,V) rule. The E-V rule states that an investor would (or should) want to select a portfolio which gives rise to the (E,V) combinations indicated as efficient; i.e., those with minimum variance for given expected return or more and maximum expected return for given variance or less. Markowitz (1952) defines the expected return *E* and the variance *V* of a portfolio as a whole mathematically as:

,

where E is the expected return; X_i is the percentage of the investor's assets allocated to the i^{th} security; μ_i is the expected return of the random variable R_i; V is the portfolio variance; σ_{ij} is the covariance between random variables R_i and R_j; and X_j is the percentage of the investor's assets allocated to the j^{th} security.

The investor's problem when choosing a portfolio is to pick a portfolio with the highest expected returns for a given degree of risk. Alternatively, the investor can minimize portfolio variance for varying degrees of expected return. This decision can be made by optimizing the following minimization:

subject to

Prospect Theory

In addition to expected utility theory and portfolio theory, prospect theory is a theory that explains behavior under risk. Prospect theory is an alternative to expected utility theory. Prospect theory assigns values to losses and gains rather than to final assets and replaces probabilities with decision weights. Prospect theory differs from expected utility theory in that relative wealth in any given situation is evaluated rather than absolute wealth. Decisions are made based on gains and losses from a reference point instead of final outcome from a beginning asset position. Another important implication of prospect theory is that the manner in which producers subjectively frame an outcome in their minds affects the utility they expect to receive (Kahneman and Tversky 1979).

Stochastic Dominance

Stochastic dominance is a form of stochastic ordering used in decision theory to refer to situations where one action can be ranked as superior to another. The concept of stochastic dominance is extremely important to this study, as the theory of MOTAD and Target MOTAD rests on it. There are three degrees of stochastic dominance: first, second and third degree stochastic dominance – FSD, SSD, and TSD, respectively. Porter and Gaumnitz (1972) state the principles of the stochastic dominance model as follows:

FSD: The probability function $f(x)$ is said to dominate the probability function $g(x)$ by FSD if, and only if, $F_1(R) \leq G_1(R)$ for all values of $R \in [a, b]$ with strict inequality for at least one value of $R \in [a, b]$;

SSD: The probability function $f(x)$ is said to dominate the probability function $g(x)$ by SSD if, and only if, $F_2(R) \leq G_2(R)$ for all values of $R \in [a, b]$ with strict inequality for at least one value of $R \in [a, b]$;

TSD: The probability function $f(x)$ is said to dominate the probability function $g(x)$ by TSD if, and only if, $F_3(R) \leq G_3(R)$ for all values of $R \in [a, b]$ with strict inequality for at least one value of $R \in [a, b]$, and $F_2(b) \leq G_2(b)$;

where R varies continuously on the closed interval [a, b], $F_n(R) = \int F_{n-1}(x)dx$, and $F_0(R) = f(x)$.

First degree stochastic dominance assumes that the probability of more is preferred to less ($u'(x) > 0$ for all x). Second degree stochastic dominance combines the idea that more is preferred to less with the concept of risk aversion. It assumes diminishing marginal utility and risk aversion ($u'(x) > 0$ and $u''(x) < 0$ for all x). Risk averse producers who prefer more to less will always prefer an asset that exhibits second degree stochastic dominance over the alternative, regardless of whether first degree stochastic dominance is present. Third degree stochastic dominance incorporates the assumptions of FSD and SSD adding only the assumption that $u'''(x)$ be everywhere positive ($u'''(x) > 0$ for all x).

To summarize, for any two actions *A* and *B*, action *A* will have first degree stochastic dominance over action *B* if for any good outcome *X*, the probability of receiving *X* is at least as high in action A as in action *B*. Action *A* will have second degree stochastic dominance over action *B* if action *A* is more predictable (involves less risk) and has at least as high a mean.

Equivalently, if the expected utility of *A* is greater than or equal to the expected utility of *B*, *A* second degree stochastically dominates *B*.

Target MOTAD

Target MOTAD is a mathematical programming model used to address risk in decision making. It is a variation of another programming model, MOTAD (minimization of total absolute deviations). Target MOTAD, as described by Tauer (1983), generates solutions meeting the second-degree stochastic dominance (SSD) test. Stochastic dominance techniques have an advantage in that they require only the utility function properties be specified, rather than a specific form. The SSD characteristic of Target MOTAD is extremely important and differentiates Target MOTAD from other programming models. The second-degree stochastic dominance of the Target MOTAD model allows it to be consistent with expected utility theory, whereas MOTAD is not.

Target MOTAD is a two-attribute risk and return model. Return is measured as the sum of the expected returns of the activities multiplied by their activity level. Risk is measured as the expected sum of the negative deviations of the solution results from a target return level. Target MOTAD is useful because it incorporates a target level of return and probabilities of returns. This is important when producers desire to maximize expected returns but are concerned about net returns falling below a critical level. Because Target MOTAD has a linear objective function and linear constraints, it can be easily solved using a linear programming algorithm.

Tauer (1983) states the Target MOTAD model mathematically as:

Max

subject to

, where $k = 1,\ldots, m$

, where $r = 1,\ldots, s$

, where $\lambda = M \rightarrow 0$

for all x_j and $y_r \geq 0$, where $E(z)$ is expected return of the plan or solution; c_j is expected return of activity j; x_j is the level of activity j; a_{kj} is the technical requirement of activity j for resource or constraint k; b_k is the level of resource or constraint k; T is the target level of return; c_{rj} is the return of activity j for state of nature or observation r; y_r is the deviation below T for state of nature or observation r; p_r is the probability that state of nature or observation r will occur; λ is a constant parameterized from M to 0; m is the number of constraint and resource equations; s is the number of state of nature or observations; and M is a large number.

In summary, there are many different methods that producers or farmers may utilize when making decisions under uncertainty or risk. Profit maximization is a major assumption of this study; however, pure profit maximization implies perfect knowledge of future events, which virtually never happens. For the purpose of this study, we will assume that farmers wish to maximize their profits, but due to the uncertainty associated with the agricultural industry, the expected utility theorem will be used for decision-making purposes because the Target MOTAD model used to examine production decisions under risk follows the assumptions of utility theory, whereas the other methods do not.

IV. DATA AND METHODS

Two experiments were chosen for use in the crop rotation analysis for this study. The experiments were located at two separate research centers in two different areas of south Alabama. The first experiment was located at the Gulf Coast Research and Extension Center (GCREC) in Fairhope, Alabama over the years 2003 to 2010, and the second was from the Wiregrass Research and Extension Center (WREC) located in Headland, Alabama over the years 2004 to 2011. Collected data includes yields for cotton, corn, and peanuts under various rotations, including continuous cropping. Production at the GCREC was dryland, while the WREC study area was irrigated.

These specific experiments were chosen due to their location providing an accurate representation of the agronomic crops grown in their respective areas. Cotton, corn and peanuts are all major row crops associated with south Alabama. The climate, soil conditions and land topography make these experiments an accurate representation of areas where these three crops might be grown in the southeast, specifically Alabama. The remainder of this chapter is devoted to a discussion of the study areas, data used in the study obtained from these experiments, and the methodology behind the overall analysis.

Study Areas

Gulf Coast Research and Extension Center (GCREC)

The study area at the GCREC was bedded in either February or March. The experimental design was a randomized complete block with four replications. Plots for individual rotation sequences consisted of eight rows on 38 inch centers that were 30 feet in length. Annual soil samples were taken to monitor soil fertility. Fertilization and weed control practices were according to the recommendations of the Alabama Cooperative Extension System (ACES). The study was not irrigated. 'DKC 69-71' corn was planted in mid to late March, 'DP 555' or 'DP 1048' cotton and either 'Georgia-03L' or 'Georgia Green' peanut were sown at recommended rates in May. Corn plots were split with one subplot treated with the insecticide/nematicide Counter 15G at 6.5 pounds per acre while the second subplot remained untreated. Temik 15G was applied in-furrow to cotton and peanut for thrips control. The plant growth regulator Pix was applied as needed to cotton. Cotton was prepared for harvest with Diuron + Dropp 50W + Prep or similar products. Cotton plots were picked in September or October, while the corn was combined in August. Full canopy sprays of Bravo Weather Stik 6F were made for leaf spot and rust control. Peanut plots were inverted in October. Pod yields are reported at 10% moisture.

Rotations at the experiment utilized corn, cotton and peanuts as rotation partners in several patterns. Corn focused rotations included continuous corn, peanuts every second year, peanuts every third year, and peanuts every fourth year. Peanut-focused rotations included continuous peanuts, corn every second year, and corn every third year. Cotton-focused rotations used both peanuts and corn as rotation partners. Cotton-focused rotations included continuous cotton, peanuts every second year, peanuts every third year, and peanuts every fourth year. Other cotton-peanut rotation patterns were two consecutive years of peanuts followed by one year of cotton, one year of peanuts followed by one year of cotton, and one year of peanuts followed by two consecutive years of cotton. Cotton-focused rotations involving corn in addition to continuous cotton are corn every second year, corn every third year, and corn every fourth year.

Other cotton-corn rotation patterns were one year of cotton followed by two consecutive years of corn and one year of cotton followed by three consecutive years of corn. Table 1 presents the rotation patterns by year for the GCREC. The rotations used for this study are continuous corn, peanuts, and cotton; corn followed by one year of peanuts; and cotton followed by one year of peanuts.

Wiregrass Research and Extension Center (WREC)

The study site at the Wiregrass Research and Extension Center in Headland, Alabama, has been maintained in various crop rotations involving corn, cotton, peanuts, soybeans, bahiagrass, velvet bean, ryegrass, grain sorghum, pearl millet, and summer fallow. For the purpose of this study, only rotations involving corn, cotton, and peanuts, or a combination of the three, were analyzed. The rotations used for this study are continuous corn, peanuts, and cotton; corn followed by one year of peanuts; and cotton followed by one year of peanuts. Table 2 presents the rotation patterns by year for the WREC. Conservation tillage plots were laid out in rye killed with Roundup Weathermax at 22 fluid ounces per acre in early March with a KMC subsoiler + coulter + rolling basket rig, while the conventional tillage plots were turned with a moldboard plow on April 13 and worked to seed bed condition with a disk harrow. Peanut cultivars Georgia Green and Tifguard were planted on April 21, May 18, and June 7, 2010 in a Dothan fine sandy loam (organic matter <1 percent) soil. Temik 15G at 6.5 pound per acre was applied in-furrow for thrips control. Weed control was obtained with a preplant application of Sonalan at 1 quart per acre + 0.45 ounce per acre of Strongarm on April 13 followed by a broadcast application of Fusilade at 12 fluid ounces per acre on June 22 and Classic at 0.5 ounce per acre on August 12. A center pivot irrigation system was used to apply 1.0 acre inches of water on July 27, August 10, and August 30. Due to the timing of irrigation, corn was dryland rather than irrigated. Row spacing included single 36-inch or twin rows spaced 7 inches apart on 36-inch centers. The experimental design was a split-split-split plot design with tillage as the whole plot, planting date as the split plot, peanut cultivar as the split-split plot and row spacing as the split-split-split plot. Plots consisted of four 30-foot rows in four replications. Seven applications of Bravo Weather Stik 6F at 1.5 pints per acre at 14-day intervals were made to all plots for leaf spot control with a tractor-mounted boom sprayer with three TX-8 nozzles per row calibrated to deliver 15 gallons of spray volume per acre at 45 psi.

Data

Crop Yields

Yields were collected each year for cotton, corn and peanuts at both experiments for five different rotation patterns: continuous corn, cotton, and peanuts, as well as peanuts in rotation with corn and peanuts in rotation with cotton. Cotton yields were initially measured in pounds of seed cotton per acre. Seed cotton refers to the cotton fiber with seeds still attached prior to ginning. Because both cottonseed and lint have economic value, the reported seed cotton yields required conversion to cottonseed and cotton lint yields. Cotton lint yield was estimated by multiplying the seed cotton yield by 0.40. Cottonseed yield was estimated by multiplying the seed cotton yield by 0.60. The justification behind these conversion factors is that cotton lint represents approximately 40 percent of the weight of seed cotton and cottonseed represents the remaining 60 percent. Cotton lint yield was reported in pounds per acre, while cottonseed yield was reported in tons per acre. Corn yield was reported in bushels per acre. Peanut yields were reported in pounds per acre. All per acre yields are estimates that were extrapolated from the experiment yield. Table 3 presents the compiled yield data for the GCREC experiment, while Table 4 presents yield data for the WREC experiment.

Prices

Data for crop prices used in the study was obtained through the National Agricultural Statistics Service, a division of the United States Department of Agriculture. Prices were found for cotton, peanuts, and corn over the years 2003 to 2011. For the purpose of this study, all crop prices were inflated to base year 2011 values using the Producer's Price Index for farm products, obtained from the Bureau of Labor and Statistics. To inflate the yearly prices to 2011 values, each year's PPI value was divided into the PPI for 2011 and then multiplied by the corresponding nominal price. Table 5 presents the price of each crop for the years 2003 to 2011, in both real and nominal terms, along with the PPI for the years.

Methods

Various methods were used to determine the economic effect of crop rotations on cotton, corn and peanuts, as well as to determine optimal cropping patterns for producers based on their risk preferences. The economics of the rotations was analyzed both with and without irrigation and with and without crop insurance, and under different cases of risk preference, the original case being no consideration of risk. Enterprise budgets for selected rotations were created to examine the returns associated with the various rotations. A mathematical programming model, Target MOTAD, was then used to determine the optimal cropping pattern for the farmer for different levels of risk tolerance.

Enterprise Budgets

The enterprise budgets used in this study were modified from enterprise budgets created by the Alabama Cooperative Extension System (ACES 2011). Budgets for each crop were obtained for the year 2011. The budgets were then modified to accurately reflect the experimental enterprises, which in this case were the different rotation patterns, including continuous cropping. Two different sets of enterprise budgets were used for each experiment; one set that assumed no participation in crop insurance by the farmer, and one set that assumed the farmer did participate in crop insurance as a means of reducing risk. This study also looked at the effect of irrigation in reducing risk. The experiment at the GCREC study area was dryland while the experiment located at the WREC was irrigated. The exception to this was rotations involving corn at the WREC. Due to irrigation timing, corn was dryland rather than irrigated. The GCREC study was used to assess the effect of crop rotation without irrigation, and the WREC study was used to assess the effect of crop rotation with irrigation. The budgets were modified to account for these differences.

The first step taken to modify the enterprise budgets for use in the study was to replace the crop prices in the income section of the original budgets with the inflation adjusted crop prices from Table 5. Each year's inflation adjusted price corresponded to that year's enterprise budget for all the crops and rotations.

The variable costs contained within the budgets were also modified. While the majority of the costs reflected the experiment production conditions, several needed to be adjusted to the specifics of the experiment. For example, the pesticide cost associated with peanut production was very high in the original enterprise budgets compared to the experiments. This was caused by the use of name-brand pesticides in the original budgets, while the pesticides used at the experiment were generic products.

To account for the use of irrigation in the analysis, irrigated budgets were obtained from ACES for cotton and peanuts. These irrigated budgets formed the basis for all the budgets used in the irrigated portion of the study. The irrigated budgets included both the variable and fixed costs associated with the use of irrigation. Tables 6 through 10 are the base budgets for each crop rotation pattern that illustrate the use of irrigation in the analysis without crop insurance participation. The budgets are for the experiment located at the WREC. Table 6 is slightly different from Tables 7 through 10. Table 6 is the base budget for continuous corn and includes no irrigation costs. While the entire experiment at the WREC was irrigated, the corn plots were assumed to be dryland. This was due to the timing of planting for cotton and peanuts. Corn was planted prior to both cotton and peanuts, and its critical watering stage occurred simultaneously with the planting of cotton and peanuts. Due to cotton and peanuts being susceptible to disease right after planting, irrigation was withheld from the experiment to protect these crops.

For the dryland study that did not use irrigation, dryland budgets were obtained from ACES for each crop. These budgets differed from the irrigated budgets in variable and fixed costs. There were no irrigation costs, fixed or variable, included in these budgets. In addition, certain other variable costs were different due to the effect irrigation has on production practices. For example, the application requirements and costs for specific chemicals differ depending on whether or not irrigation is applied. Tables 11 through 15 are the base budgets for each crop rotation pattern without irrigation for the experiment located at the GCREC. There is also no participation in crop insurance.

The base budgets discussed above and illustrated by Tables 6 through 15 represents the rotation average for each experiment. The yields used in the base budgets were the average for each rotation over the course of the study. The prices used were also averages, found by averaging the PPI inflated prices over the years of the study. These base budgets were a starting point for the analysis. Upon completion of the base budgets, yearly prices and experimental yields were entered into the budgets for each rotation to develop yearly budgets.

One other important aspect of this study is the use of crop insurance to reduce risk. Crop insurance reduces income variability by providing payments if revenues fall below a guaranteed level. To include crop insurance in the analysis, a set of budgets was developed for both experiments that included participation in a crop insurance program with a 65% coverage level. Crop insurance premiums and deficiency payments were calculated for each crop and rotation for each year. The crop insurance provisions used were Crop Revenue Coverage (CRC) for corn and cotton, and Actual Production History (APH) for peanuts. The CRC provisions included both price and yield protection, while the APH provisions only included yield protection. The price protection in the CRC is tied to the futures market. Payments are made based on the higher of the futures price or the market price. The 65% coverage level was chosen because the majority of producers in the study areas used this coverage level. A higher coverage would give more risk protection, but it would also cost more, leading to the potential to over-insure risks.

The crop insurance premiums were calculated using the actual production history (APH) of the experiment. The APH yield is used to set the guarantees for most of the Federal Crop Insurance Corporation (FCIC)-backed insurance plans. The APH requires that at least four years, and no more than ten, of production history are needed to set an approved APH yield. After ten years has been reached, the earliest year's yield is dropped. Study data were analyzed starting with the years 2003 and 2004 for the GCREC and WREC experiments, respectively. To determine an APH approved yield for the first four years of the study, crop yields for the county where the experiments were located in Alabama were obtained from the USDA/NASS for the four years prior to the study's beginning. These yields were then converted to the norm for the experiment using the percentage changes from the study yields. Tables 16 and 17 present the calculated crop insurance premiums for the WREC experiment and GCREC experiment, respectively.

Crop insurance payments were calculated for the crops that had bad years in terms of production. There were only three indemnity payments made for the WREC study; two for corn under the continuous corn rotation, and one for corn under the peanut-corn rotation. Four payments were made for the GCREC study; two for the continuous cotton, and two for cotton under the peanut-cotton rotation.

After the crop insurance premiums and indemnity payments were calculated, the enterprise budgets were modified to illustrate participation in crop insurance. The premiums were inserted into the variable costs, and any indemnity payments made were included as revenue. Tables 18 through 22 are the base budgets for the WREC experiment that include crop insurance participation; tables 23 through 27 are the base budgets for the GCREC. Premiums used in the base budgets were found by average the premiums over the years of the study. Crop insurance payments included in the base budgets are the average of any payments made.

The most basic economic analysis of the rotations was performed using only the enterprise budgets. A simple examination of the net returns above variable costs was performed to determine the most economical strategy when risk preference is not a concern. The most economical strategy for the WREC when there is no crop insurance is a continuous cotton rotation with an expected returns above variable costs of $516.44; for the GCREC the best strategy is a continuous peanut rotation with expected returns of $430.36. When there is participation in crop insurance, for the WREC, the most economical strategy is a cotton-peanut rotation with expected returns of $481.20; for the GCREC, it is also a cotton-peanut rotation with returns of $433.95. Table 28 presents the expected returns from each crop rotation pattern for both experiments for the scenario with no participation in a crop insurance program. Table 29 presents the expected returns when there is participation in crop insurance. The expected returns for each rotation were found as the average of the returns above variable costs for all of the study years.

In addition to using the budgets as a means of assessing the economics of the rotation patterns, they were also used in the Target MOTAD analysis that determined optimal production strategies. A more thorough discussion of the role of the budgets in the Target MOTAD analysis will be included in the discussion of the Target MOTAD model.

Target MOTAD

In addition to assessing the economic value of crop rotations, optimal production strategies were found for farmers under different levels of risk. A Target MOTAD model was used to accomplish this objective. The model utilized the returns above variable costs for each rotation obtained from the enterprise budgets. Tables 30 and 31 present the returns above variable costs for the WREC and GCREC experiments, respectively. Two separate Target MOTAD analyses were performed for each experiment. The first was performed under the assumption of no participation in crop insurance, and the second assumed the producer did participate in crop insurance programs.

Target MOTAD is a method to optimize some objective function subject to a constraint set. The objective function is comprised of the returns above variable costs for each production option, which in this case are the different rotations. The constraint set represents the factors that limit a farmer's production. The model used in the study had several different constraints. The model was ran for a farm that had 1000 acres of cropland available for production, an arbitrary value chosen as it was large enough for economies of size in fixed costs, and provided a simple base for percentage calculations. An acreage limit was the only resource constraint that was imposed on this analysis; however, additional constraints on other resources, such as capital or labor, may be applicable for some farms.

In addition to resource constraints, Target MOTAD incorporates income constraints that measure the revenue of a solution for a given time period; in the case of these experiments, the years. These constraints measure and sum the weighted negative deviations from the target return. This is useful because decision makers often wish to maximize expected return but do not want net returns falling below a critical level, or target. For this study, two different target values were used for each model. The target values were chosen based on what the most profitable rotation pattern was for that analysis. The most profitable (risk neutral) rotation was the rotation pattern that had the greatest average net returns above variable costs determined from the enterprise budgets. The target income was set on the assumption that the most profitable rotation was planted on all 1000 acres of cropland. Then the target income was arbitrarily set first at 85% of the income from the above scenario, and then 75% for second analysis. Returns above variable costs for each rotation by year are also included in the model to act as a means of prediction for the target income occurring.

Finally, there is a risk measurement constraint that assesses the degree of risk for a producer. Risk is measured as the expected sum of the negative deviations of the solution results from a target level. This constraint sums the negative deviations after weighting them by their probability of occurring. The probabilities are the technical coefficients for this constraint. For this study the coefficients were determined by dividing the number of years in the experiments into one, yielding a probability of .125. This row is set less than or equal to a value lambda that represents the risk level of that individual. An arbitrary number was selected as the initial risk value. It was the smallest possible value that yielded a solution for the model. This is the point where the individual has the lowest propensity to take on risk. The risk value was then increased in increments and the model was rerun. As this value is increased, it represents an individual's willingness to take on more risk.

Mathematically, the Target MOTAD model is stated as:

(1) Max

subject to

(2) , where $k = 1, \ldots, m$

(3) , where $r = 1, \ldots, s$

(4) , where $\lambda = M \rightarrow 0$.

Equation (1) is the objective function of the model and, in this case, maximizes the returns above variable costs of the solution. Equation (2) represents the resource constraint set, and ensures that these constraints are fulfilled. Equation (3) is the income constraint and measures the revenue of a particular solution. If the revenue is less than the target return T, the difference is transferred to equation (4). Equation (4) is the risk measurement constraint that sums the negative deviations after weighting them by their probability of occurrence. Tables 32 and 33 present the base Target MOTAD model for the analysis with no crop insurance for the

WREC and GCREC, respectively. Tables 34 and 35 present the base models that include crop insurance participation for the WREC and GCREC, respectively.

V. RESULTS

The objective of this study was to assess the economic value of different crop rotations, both with and without crop insurance and irrigation, and to find optimal decision strategies for producers at varying levels of income risk. Enterprise budgets were developed using price, cost, and experimental yield data to assess the economic value of different the different cropping patterns. Data and budgets from the WREC experiment represent the irrigated condition, while the data and budgets from the GCREC are dryland. A Target MOTAD model was then used to determine the optimal decision strategies for producers. The Target MOTAD analysis utilized the returns above variable costs obtained from the enterprise budgets for the different rotation patterns. The price, cost, and yield data, as well as the base enterprise budgets, are detailed in chapter IV.

The economic analysis of the rotations was performed for irrigated and dryland conditions. Both the irrigated and dryland scenarios were analyzed initially assuming no participation in a crop insurance program, and then again assuming the producer did participate in crop insurance with a 65% coverage level. An examination of the returns above variable costs obtained from the enterprise budgets provided the means necessary to assess the value of the rotations.

The returns from the enterprise budgets were also used in the Target MOTAD analysis to find a producer's optimal decision strategy. The model was used to find optimal cropping patterns that maximize producer profits while satisfying a "target" income. The results of the analysis provide a means to determine how producers will operate given different levels of risk tolerance.

Economic Analysis of Crop Rotations

The enterprise budgets of the different rotations were used to analyze the economics of the rotation patterns. To reflect the maximum risk exposure, it was first assumed that the producer did not participate in a crop insurance program. This analysis was done for both irrigated (WREC) and dryland (GCREC) conditions. A second analysis was also performed that assumed the producer did participate in crop insurance.

In both study areas, peanut experienced a positive yield increase under both cotton and corn rotations. The yield increases to cotton and corn from rotation were not economically significant at either study site. At the WREC, peanut yields increased by roughly 21% from either cotton or corn in rotation. For the GCREC, peanut yields increased by 17% and 15% in a one year rotation with cotton and corn, respectively.

Irrigated Results (WREC)

When there was no participation in crop insurance, continuous cotton had the highest average returns above variable costs of $516.44 per acre followed by the cotton-peanut crop rotation at $472.41 per acre. The corn-peanut rotation had average returns above variable costs of $294.65 per acre, as compared with $253.34 per acre for continuous peanuts. Continuous corn had average returns above variable costs of $121.39 per acre. It is of note that due to irrigation timing, corn was dryland. The enterprises budgets were adjusted to account for this.

Participation in crop insurance changed the results slightly. Highest average returns above variable costs of $481.20 and $458.86 per acre were recorded for the cotton-peanut rotation and continuous cotton, respectively. The corn-peanut rotation had average returns of $301.87 per acre. Continuous peanuts and corn had average returns above variable costs of $232.28 per acre and $168.88 per acre, respectively. A full summary of the returns above variable costs for the WREC are recorded in Table 30.

Dryland Results (GCREC)

Under maximum risk exposure with no participation in crop insurance, continuous peanuts had the highest average returns above variable costs of $430.36 per acre, while the cotton-peanut rotation followed with average returns above variable costs of $428.94 per acre, nearly identical to the continuous peanut rotation. The corn-peanut rotation had average returns above variable costs of $376.66 per acre. Continuous cotton had average returns above variable costs of $306.02 per acre. Poorest average returns above variable costs of $158. 35 per acre were recorded for continuous corn.

When the producer did participate in a crop insurance program, the results were altered slightly. The cotton-peanut rotation had the highest average returns above variables costs of $433.95 per acre. Continuous peanuts had average returns of $413.30 per acre. The difference in these two values is slightly greater in this case than it was when there was no crop insurance participation. Following continuous peanuts was the corn-peanut rotation with average returns above variable costs of $359.05 per acre. Continuous cotton and corn had average returns above variable costs of $334.82 per acre and $142.41 per acre, respectively. Table 31 presents a full summary of the returns above variable costs for the GCREC.

Target MOTAD Results

Target MOTAD, a linear programming technique, was used to find the optimal cropping patterns for producers with consideration for their willingness to bear risk. Due to the yield and price variability, profits for cropping patterns are not known with certainty, but they do have an associated probability distribution. Risk programming methods, such as Target MOTAD, were developed to address the issue of decision-making under risk. In a Target MOTAD model, mean deviations from a target income are used as the risk measure.

For this study, four analyses were performed for each experiment site (WREC and GCREC). The model was initially run under the scenario of no crop insurance participation, and then again when there was participation. Both of these cases were run where the target income for each year was set first at 85%

and then 75% of the maximum average income. For all models, acreage was arbitrarily set to 1000 acres, as acreage does not influence the results.

Irrigated Results (WREC)

Results of the Target MOTAD analysis for the WREC under the condition of no crop insurance participation showed that risk is reduced by decreasing the amount of acreage in continuous cotton and converting that acreage to the cotton-peanut rotation. When risk is not a concern, the most profitable strategy based on the WREC data is to plant all acres in continuous cotton. As risk aversion increases, the cotton-peanut rotation entered the solution. The first model was run with the target income set at 85% of the maximum average income. This yielded a target income of $438,976. The second model with a target income at 75% of the maximum average income yielded a target income of $387,331. Both of these scenarios yielded the same results: when risk is not a factor, continuous cotton will be planted on all 1,000 acres. However, as risk aversion increases, the cotton-peanut rotation will enter the solution. Table 36 details the Target MOTAD solution for this case.

The second analysis performed assumed participation in a crop insurance program with a 65% coverage level. The target incomes for the WREC were $409,017 for 85% of the maximum average income, and $360,897 for 75% of the maximum average income. For the WREC, the addition of crop insurance made the cotton-peanut rotation slightly more profitable than continuous cotton. When risk is not a concern, all acreage will be planted in a cotton-peanut rotation. When risk aversion increases, continuous cotton will enter the solution. In this case, crop insurance mitigates the risk associated with continuous cotton. Due to the similarity in average profits for continuous cotton and the cotton-peanut rotation, risk may be reduced with minimal expected profit loss in this scenario. Results of this model are presented in Table 37.

Dryland Results (GCREC)

The same two scenarios that were analyzed for the WREC were also performed on the dryland study at the GCREC. Results of the analysis for the GCREC with no crop insurance participation indicate that risk is reduced by moving planted acreage from continuous peanuts to the cotton-peanut rotation. The target income for this scenario at the 85% level of maximum average income was $365,807. At the 75% level the target income was $322,771. When risk is not an issue, the most profitable solution is to plant all acreage in continuous peanuts. When the assumed risk aversion level is increased, the optimal planting solution included increasing acreage of the cotton-peanut rotation. Because of the similarity in average profits for continuous peanuts and the cotton-peanut rotation, risk can be reduced in this case with minimal expected profit loss. Table 38 presents the results of this model.

The second analysis assumed participation in a crop insurance program. The target incomes for this case were $368,861 at the 85% level, and $325,465 at the 75% level. The addition of crop insurance to the model resulted in the cotton-peanut rotation being more profitable than continuous peanuts. In this case, the rotation was not risk-reducing relative to continuous peanuts. When risk is not a concern, all acreage will be planted in the cotton-peanut rotation. As the risk aversion level increased, continuous peanuts entered the optimal planting solution. A full summary of results for this analysis is presented in Table 39.

Continuous corn or corn in rotation with peanuts failed to enter the solution of any analysis. This is due in part to the low experimental yields associated with this experiment. The low yield kept the returns for corn and corn in rotation well below those of continuous cotton, peanuts, and a peanut-cotton rotation. If the experimental yields were higher, resulting in higher returns, corn may enter the solution. However, with the large disparity between the returns for corn, cotton, and peanuts, corn will never enter the solution of the analysis based on the assumptions of the model.

VI. CONCLUSIONS

Enterprise budgets were developed to assess the economic value of five different crop rotations: continuous corn, peanut, and cotton; a corn-peanut rotation; and a cotton-peanut rotation. These rotations were analyzed under the condition of irrigated or dryland, and with or without participation in a crop insurance program. The enterprise budgets were modified using experimental data for yields, and information from the Alabama Cooperative Extension System budgets for costs of production. Alabama crop prices were obtained from USDA/NASS and adjusted for inflation using the Producer's Price Index for agricultural commodities. The WREC experiment was irrigated with the exception of corn, while the GCREC was dryland. The WREC study covered the years 2004 to 2011, and the GCREC study covered the years 2003 to 2010.

A linear programming model, Target MOTAD, was developed to determine the optimal cropping pattern for producers with consideration for their willingness to bear risk. In a Target MOTAD model, risk is measured as mean deviations from a target income. For the model, acreage was arbitrarily set at 1,000 acres. The target income was first set at 85% and then 75% of the maximum average income. The returns above variable costs from the enterprise budgets were used in the model for yearly incomes. The model was run for both the irrigated and dryland conditions, with and without crop insurance.

Under irrigated conditions with no participation in a crop insurance program, continuous cotton had the highest average returns above variable costs, and therefore, the greatest economic value. The rotation with the next highest economic value was the cotton-peanut rotation. Dryland conditions with no crop insurance participation yielded continuous peanuts as having the greatest economic value. However, the cotton-peanut rotation had nearly the same value as continuous peanuts for average returns above variable costs, so their economic values are almost identical.

For the irrigated condition when the producer does participate in crop insurance, the cotton-peanut rotation had the greatest economic value, followed closely by continuous cotton. Under the dryland condition with crop insurance participation, a cotton-peanut rotation had the greatest economic value, followed by continuous peanuts.

The returns above variable costs obtained from the enterprise budgets were used in the Target MOTAD model to determine optimal cropping patterns. The first analysis performed assumed no participation in crop insurance. Under the irrigated condition when risk is not a concern, the most profitable strategy is to maintain a continuous cotton monoculture. As the risk aversion is increased, the optimal strategy included maintaining some acreage in a cotton-peanut rotation. For the dryland condition when risk is not an issue, the most profitable strategy is to plant all acreage in continuous peanuts. However, as the assumed risk aversion level increased, the optimal strategy included increasing acreage in a cotton-peanut rotation.

The second analysis performed assumed participation in a crop insurance program. Under the irrigated condition, the addition of crop insurance made the cotton-peanut rotation the most profitable strategy when risk is not a concern. When the risk level increased, the optimal strategy included planting some acreage in continuous cotton. For the dryland condition, the addition of the crop insurance made the cotton-peanut rotation more profitable than continuous peanuts, and the optimal strategy called for planting all acres in a cotton-peanut rotation. As the risk aversion increased, continuous peanuts entered the optimal solution. However, while this is the most profitable strategy based on the experimental data, a peanut monoculture will greatly increase disease and nematode pressure. In this instance, moving to continuous peanuts may not be the most ideal way to mitigate risk.

Results of this study indicate that under irrigation, continuous cotton may be the most profitable choice without crop insurance, but that a risk-averse farmer using crop insurance to protect against income loss may prefer a cotton rotation with peanuts. For dryland, continuous peanuts were the most profitable choice without crop insurance, but with crop insurance, a cotton-peanut rotation would be preferred. Corn, or corn in rotation with peanuts, was not economically significant based on the assumptions and scenarios of this study; however, it did have an important effect on increasing peanut yields. Of careful note is the fact that the results of this study are limited to the experimental data compiled. Therefore, extrapolation of these results is problematic.

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Table 1. Crop Rotation Patterns by Year, Dryland, GCREC

Rotation #	Base Rotation	Cropping Sequence 2003	2004	2005	2006	2007	2008	2009	2010
1	C-C-C	corn	corn	corn	corn	corn	corn	corn	corn
2	C-P-C	corn	peanut	corn	peanut	corn	peanut	corn	peanut
3	C-C-P	corn	corn	peanut	corn	corn	peanut	corn	corn
4	C-C-C-P	corn	corn	corn	peanut	corn	corn	corn	peanut
5	P-P-P	peanut	peanut	peanut	peanut	peanut	peanut	peanut	peanut
6	P-C-P	peanut	corn	peanut	corn	peanut	corn	peanut	corn
7	P-P-C	peanut	peanut	corn	peanut	peanut	corn	peanut	peanut
8	CT-CT-CT	cotton	cotton	cotton	cotton	cotton	cotton	cotton	cotton
9	P-P-CT	peanut	peanut	cotton	peanut	peanut	cotton	peanut	peanut
10	CT-P-CT	cotton	peanut	cotton	peanut	cotton	peanut	cotton	peanut
11	P-CT-P	peanut	cotton	peanut	cotton	peanut	cotton	peanut	cotton
12	P-CT-CT	peanut	cotton	cotton	peanut	cotton	cotton	peanut	cotton
13	CT-CT-P	cotton	cotton	peanut	cotton	cotton	peanut	cotton	cotton
14	CT-CT-CT-P	cotton	cotton	cotton	peanut	cotton	cotton	cotton	peanut
15	CT-C-CT	cotton	corn	cotton	corn	cotton	corn	cotton	corn
16	CT-C-C	cotton	corn	corn	cotton	corn	corn	cotton	corn
17	CT-C-C-C	cotton	corn	corn	corn	cotton	corn	corn	corn
18	CT-CT-C	cotton	cotton	corn	cotton	cotton	corn	cotton	cotton
19	CT-CT-CT-C	cotton	cotton	cotton	corn	cotton	cotton	cotton	corn

Note: C = Corn, P = Peanut and CT = Cotton

[a]Base rotations indicate the rotation pattern when the experiment was installed. Yearly cropping sequence picks up the rotation pattern beginning in 2003.

Table 2. Crop Rotation Patterns by Year, Irrigated Cotton and Peanut, WREC

Rotation #	Base Rotation[a]	Cropping Sequence 2004	2005	2006	2007	2008	2009	2010	2011
1	P-P-P	peanut	peanut	peanut	peanut	peanut	peanut	peanut	peanut
2	P-C-P	peanut	corn	peanut	corn	peanut	corn	peanut	corn
3	C-P-C	corn	peanut	corn	peanut	corn	peanut	corn	peanut
13	C-C-P	corn	corn	peanut	corn	corn	peanut	corn	corn
14	CT-CT-P	cotton	cotton	peanut	cotton	cotton	peanut	cotton	cotton
16	P-CT-CT	peanut	cotton	cotton	peanut	cotton	cotton	peanut	cotton
18	P-C-C	peanut	corn	corn	peanut	corn	corn	peanut	corn
19	C-C-C	corn	corn	corn	corn	corn	corn	corn	corn
20	P-P-P	peanut	peanut	peanut	peanut	peanut	peanut	peanut	peanut
21	P-C-P	peanut	corn	peanut	corn	peanut	corn	peanut	corn
22	CT-P-C	cotton	peanut	corn	cotton	peanut	corn	cotton	peanut
23	P-P-CT-CT	peanut	peanut	cotton	cotton	peanut	peanut	cotton	cotton
26	CT-CT-CT	cotton	cotton	cotton	cotton	cotton	cotton	cotton	cotton
27	C-C-C-P-P	corn	corn	corn	peanut	peanut	corn	corn	corn
30	CT-CT-P	cotton	peanut	cotton	cotton	peanut	cotton	cotton	peanut
31	CT-CT-CT-P	cotton	peanut	cotton	cotton	cotton	peanut	cotton	cotton
33	CT-C-P	corn	peanut	cotton	corn	peanut	cotton	corn	peanut
34	P-C-P	peanut	cotton	peanut	cotton	peanut	cotton	peanut	cotton
35	CT-CT-CT-P-P	cotton	cotton	cotton	peanut	peanut	cotton	cotton	cotton
36	C-C-C-P	corn	peanut	corn	corn	corn	peanut	corn	corn
37	C-C-P	corn	peanut	corn	corn	peanut	corn	corn	peanut
38	CT-P-P	peanut	peanut	cotton	peanut	peanut	cotton	peanut	peanut

Note: C = Corn, P = Peanut and CT = Cotton.

[a]Base rotations indicate the rotation pattern when the experiment was installed. Yearly cropping sequence picks up the rotation pattern beginning in 2004.

Table 3. Yields for Cotton, Corn and Peanuts by Rotation and Year, Dryland, GCREC

	Yield			
Rotation Pattern	Corn (bu./acre)	Peanuts (lbs/acre)	Cotton Lint (lbs/acre)	Cottonseed (tons/acre)
Continuous				
2003	135.75	2534.25	486.50	0.36
2004	135.55	4297.81	0.00	0.00
2005	84.74	3383.65	867.13	0.65
2006	89.00	4138.87	1449.81	1.09
2007	103.63	3392.50	1007.40	0.76
2008	106.03	4526.16	1057.24	0.79
2009	111.86	3900.19	1238.74	0.93
2010	114.63	3657.34	1137.33	0.85
Average	110.15	3728.84	905.52	0.68
Corn-Peanut				
2003	138.00	2797.50		
2004	131.63	5058.27		
2005	79.01	3888.33		
2006	89.60	3840.78		
2007	109.48	4404.50		
2008	115.14	4991.25		
2009	123.50	4860.94		
2010	139.44	4517.21		
Average	115.72	4294.85		
Cotton-Peanut				
2003		3072.75	450.40	0.34
2004		4782.99	0.00	0.00
2005		4347.13	839.60	0.63
2006		4494.28	1449.81	1.09
2007		4703.50	1016.60	0.76
2008		4276.59	975.56	0.73
2009		5175.47	1057.24	0.79
2010		4219.12	1149.94	0.86
Average		4383.98	867.39	0.65

Table 4. Yields for Cotton, Corn and Peanuts by Rotation and Year, Irrigated[a], WREC

	Yield			
Rotation Pattern	Corn (bu./acre)	Peanuts (lbs/acre)	Cotton Lint (lbs/acre)	Cottonseed (tons/acre)
Continuous				
2004	176.00	3426.72	837.90	0.63
2005	94.25	2444.00	1601.30	1.20
2006	126.75	4087.38	1594.40	1.20
2007	76.78	4263.44	1457.80	1.09
2008	126.00	3627.88	1463.40	1.10
2009	63.75	2855.75	1196.40	0.90
2010	118.50	2904.00	1225.49	0.92
2011	16.50	3806.96	1662.54	1.25
Average	99.82	3427.01	1379.90	1.03
Corn-Peanut				
2004	149.30	4345.11		
2005	89.30	3490.00		
2006	120.00	3543.00		
2007	85.80	5383.29		
2008	117.00	4896.50		
2009	96.00	4314.00		
2010	117.50	4051.08		
2011	7.90	4882.35		
Average	97.85	4363.17		
Cotton-Peanut				
2004		3659.04	997.10	0.75
2005		2971.01	1449.10	1.09
2006		4871.50	1897.34	1.42
2007		5247.89	1809.30	1.36
2008		4911.00	1741.44	1.31
2009		3611.20	1106.40	0.83
2010		3608.22	1715.37	1.29
2011		4572.54	1339.47	1.00
Average		4181.55	1506.94	1.13

[a]Due to irrigation timing, corn was dryland

Table 5. Annual Crop Prices, Nominal and Inflation-Adjusted

		Nominal				Inflation-Adjusted			
		Corn	Peanuts	Cotton Lint	Cottonseed	Corn	Peanuts	Cotton Lint	Cottonseed
Year	PPI[a]	($/bu.)	($/lb)	($/lb)	($/ton)	($/bu.)	($/lb)	($/lb)	($/ton)
2003	111.5	2.36	0.183	0.60	98.50	3.95	0.306	1.00	164.93
2004	123.3	2.48	0.178	0.41	91.00	3.76	0.270	0.61	137.79
2005	118.5	2.50	0.165	0.49	81.50	3.94	0.260	0.77	128.41
2006	117	2.91	0.168	0.45	90.50	4.64	0.268	0.71	144.41
2007	143.4	4.54	0.191	0.60	135.00	5.91	0.249	0.78	175.76
2008	161.3	5.26	0.225	0.45	196.00	6.09	0.260	0.52	226.86
2009	134.6	3.89	0.210	0.66	129.00	5.40	0.291	0.91	178.93
2010	151	5.07	0.203	0.87	132.00	6.27	0.251	1.07	163.21
2011	186.7	6.25	0.263	0.90	204.00	6.25	0.263	0.90	204.00

[a]PPI = Producer's Price Index. PPI values used are for farm products. Inflated prices are adjusted to 2011 value.

Table 6. Base Enterprise Budget for a Continuous Corn Crop Rotation, Dryland, WREC

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Corn	bu.	99.82	5.28	**527.03**
2. VARIABLE COSTS				
Seed	1000k	24.00	2.40	57.60
Seed Treatment	acre	0.00	10.50	0.00
Tech Fee	acre	1.00	0.00	0.00
Fertilizer				
Nitrogen	units	160.00	0.68	108.80
Phosphate	units	60.00	0.50	30.00
Potash	units	60.00	0.58	34.80
Micronutrients	acre	1.00	8.00	8.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides	acre	1.00	30.00	30.00
Insecticides	acre	0.00	7.00	0.00
Fungicides	acre	1.00	0.00	0.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	5.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying	bu.	99.82	0.28	27.95
Hauling	bu.	99.82	0.25	24.95
Crop Insurance	acre	0.00	26.00	0.00
Aerial Application	acre	0.00	9.00	0.00
Labor (Wages & Fringe)	hour	1.60	11.25	18.00
Tractor/Machinery	acre	1.00	19.00	19.00
Interest on Operating Capital	dol.	185.33	0.07	12.05
TOTAL VARIABLE COST				**382.70**
RETURNS ABOVE VARIABLE COST				**144.33**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	26.00	26.00
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	382.70	0.08	30.62
TOTAL FIXED COSTS				**256.62**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**639.31**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**-112.29**

Table 7. Base Enterprise Budget for a Continuous Peanut Crop Rotation, Irrigated, WREC

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Peanut	lbs	3427	0.26	**891.02**
2. VARIABLE COSTS				
Seed	lbs	100.00	1.40	140.00
Innoculant	acre	1.00	0.00	0.00
Fertilizer				
Phosphate	units	40.00	0.50	20.00
Potash	units	40.00	0.58	23.20
Boron /Micronutrients	acre	1.00	10.00	10.00
Lime (Prorated)	tons	0.50	35.00	17.50
Herbicides	acre	1.00	35.00	35.00
Insecticides	acre	1.00	12.00	12.00
Fungicides	acre	1.00	80.00	80.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	8.00	12.00	96.00
Drying	tons	1.71	30.00	51.41
Cleaning	tons	1.71	12.00	20.56
Hauling	tons	1.71	17.50	29.99
Crop Insurance	acre	0.00	20.00	0.00
Check Off	tons	1.71	2.50	4.28
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	58.00	58.00
Interest on Operating Capital	dol.	314.44	0.07	20.43
TOTAL VARIABLE COST				**649.30**
RETURNS ABOVE VARIABLE COST				**241.72**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	60.00	60.00
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	649.30	0.08	51.94
TOTAL FIXED COSTS				**311.94**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**961.25**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**-70.23**

Table 8. Base Enterprise Budget for a Continuous Cotton Crop Rotation, Irrigated, WREC

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Cotton Lint	lbs	1379.90	0.78	1076.32
Cottonseed	tons	1.03	169.92	175.02
Total Revenue				**1251.34**
2. VARIABLE COSTS				
Seed	bag	0.13	567.00	73.71
Seed Treatment	bag	0.00	17.00	0.00
Tech Fee (RF/BG2)	bag	0.00	0.00	0.00
Fertilizer				
Nitrogen	units	120.00	0.68	81.60
Phosphate	units	80.00	0.50	40.00
Potash	units	80.00	0.58	46.40
Micronutrients		0.00	0.00	0.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides				
Burndown/Planting	acre	1.00	24.32	24.32
Post	acre	1.00	25.63	25.63
Lay-By	acre	1.00	8.19	8.19
Insecticides				
Planting	acre	1.00	0.00	0.00
Early Season	acre	1.00	10.00	10.00
Mid Season	acre	1.00	7.00	7.00
Late Season	acre	1.00	10.00	10.00
Systemic Fungicides	acre	0.00	2.00	0.00
Growth Regulator	oz.	13.33	0.75	10.00
Defol/Harvest Aid	acre	1.00	13.00	13.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	8.00	12.00	96.00
Crop Insurance	acre	0.00	28.00	0.00
Aerial Application	acre	0.00	9.00	0.00
Boll Weevil Eradication	acre	1.00	0.65	0.65
Cover Crop Establishment.	acre	1.00	25.00	25.00
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	70.00	70.00
Interest on Operating Capital	dol.	291.99	0.065	18.98
Ginning/whs	lbs	0.00	0.10	0.00
Classing/Promotion Fee	bale	0.00	1.56	0.00
TOTAL VARIABLE COST				**602.96**
RETURNS ABOVE VARIABLE COST				**648.38**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	98.43	98.43
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	602.96	0.08	48.24
TOTAL FIXED COSTS				**346.67**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**949.63**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**301.71**

Table 9. Base Enterprise Budget for a Corn-Peanut Crop Rotation, Irrigated Peanut, WREC

Corn

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Corn	bu.	97.90	5.28	**518.87**
2. VARIABLE COSTS				
Seed	1000k	24.00	2.40	57.60
Seed Treatment	acre	0.00	10.50	0.00
Tech Fee	acre	1.00	0.00	0.00
Fertilizer				
Nitrogen	units	160.00	0.68	108.80
Phosphate	units	60.00	0.50	30.00
Potash	units	60.00	0.58	34.80
Micronutrients	acre	1.00	8.00	8.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides	acre	1.00	30.00	30.00
Insecticides	acre	0.00	7.00	0.00
Fungicides	acre	1.00	0.00	0.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	5.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying	bu.	97.90	0.28	27.41
Hauling	bu.	97.90	0.25	24.48
Crop Insurance	acre	0.00	26.00	0.00
Aerial Application	acre	0.00	9.00	0.00
Labor (Wages & Fringe)	hour	1.60	11.25	18.00
Tractor/Machinery	acre	1.00	19.00	19.00
Interest on Operating Capital	dol.	184.82	0.07	12.01
TOTAL VARIABLE COST				**381.65**
RETURNS ABOVE VARIABLE COST				**137.22**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	26.00	26.00
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	381.65	0.08	30.53
TOTAL FIXED COSTS				**256.53**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**638.18**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**-119.31**

Peanut

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Peanut	lbs	4363.2	0.26	**1308.96**
2. VARIABLE COSTS				
Seed	lbs	100.00	1.40	140.00
Innoculant	acre	1.00	0.00	0.00
Fertilizer				
Phosphate	units	40.00	0.50	20.00
Potash	units	40.00	0.58	23.20
Boron /Micronutrients	acre	1.00	10.00	10.00
Lime (Prorated)	tons	0.50	35.00	17.50
Herbicides	acre	1.00	35.00	35.00
Insecticides	acre	1.00	12.00	12.00
Fungicides	acre	1.00	80.00	80.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	8.00	12.00	96.00
Drying	tons	2.18	30.00	65.45
Cleaning	tons	2.18	12.00	26.18
Hauling	tons	2.18	17.50	38.18
Crop Insurance	acre	0.00	20.00	0.00
Check Off	tons	2.18	2.50	5.45
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	58.00	58.00
Interest on Operating Capital	dol.	328.95	0.07	20.43
TOTAL VARIABLE COST				**678.33**
RETURNS ABOVE VARIABLE COST				**630.63**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	60.00	60.00
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	678.33	0.08	54.27
TOTAL FIXED COSTS				**314.27**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**992.59**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**316.37**

Table 10. Base Enterprise Budget for a Cotton-Peanut Crop Rotation, Irrigated, WREC

Cotton

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Cotton Lint	lbs	1379.90	0.78	1076.32
Cottonseed	tons	1	169.92	169.92
Total Revenue				**1246.24**
2. VARIABLE COSTS				
Seed	bag	0.13	567.00	73.71
Seed Treatment	bag	0.00	17.00	0.00
Tech Fee (RF/BG2)	bag	0.00	0.00	0.00
Fertilizer				
Nitrogen	units	120.00	0.68	81.60
Phosphate	units	80.00	0.50	40.00
Potash	units	80.00	0.58	46.40
Micronutrients				0.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides				0.00
Burndown/Planting	acre	1.00	24.32	24.32
Post	acre	1.00	25.63	25.63
Lay-By	acre	1.00	8.19	8.19
Insecticides				0.00
Planting	acre	1.00	0.00	0.00
Early Season	acre	1.00	10.00	10.00
Mid Season	acre	1.00	7.00	7.00
Late Season	acre	1.00	10.00	10.00
Systemic Fungicides	acre	0.00	2.00	0.00
Growth Regulator	oz.	13.33	0.75	10.00
Defol/Harvest Aid	acre	1.00	13.00	13.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	8.00	12.00	96.00
Crop Insurance	acre	0.00	28.00	0.00
Aerial Application	acre	0.00	9.00	0.00
Boll Weevil Eradication	acre	1.00	0.65	0.65
Cover Crop Establishment.	acre	1.00	25.00	25.00
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	70.00	70.00
Interest on Operating Capital	dol.	291.99	0.065	18.98
Ginning/whs	lbs	1379.90	0.10	137.99
Classing/Promotion Fee	bale	2.87	1.56	4.48
TOTAL VARIABLE COST				**745.44**
RETURNS ABOVE VARIABLE COST				**500.80**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	98.43	98.43
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	745.44	0.08	59.64
TOTAL FIXED COSTS				**358.07**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**1103.50**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**142.74**

Peanut

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Peanut	lbs	4181.5	0.26	**1087.19**
2. VARIABLE COSTS				
Seed	lbs	100.00	1.40	140.00
Innoculant	acre	1.00	0.00	0.00
Fertilizer				
Phosphate	units	40.00	0.50	20.00
Potash	units	40.00	0.58	23.20
Boron /Micronutrients	acre	1.00	10.00	10.00
Lime (Prorated)	tons	0.50	35.00	17.50
Herbicides	acre	1.00	35.00	35.00
Insecticides	acre	1.00	12.00	12.00
Fungicides	acre	1.00	80.00	80.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	8.00	12.00	96.00
Drying	tons	2.09	30.00	62.72
Cleaning	tons	2.09	12.00	25.09
Hauling	tons	2.09	17.50	36.59
Crop Insurance	acre	0.00	20.00	0.00
Check Off	tons	2.09	2.50	5.23
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	58.00	58.00
Interest on Operating Capital	dol.	326.13	0.07	20.43
TOTAL VARIABLE COST				**672.69**
RETURNS ABOVE VARIABLE COST				**414.50**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	60.00	60.00
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	672.69	0.08	53.82
TOTAL FIXED COSTS				**313.82**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**986.51**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**100.68**

Table 11. Base Enterprise Budget for a Continuous Corn Crop Rotation, Dryland, GCREC

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Corn	bu.	110.00	5.00	**549.45**
2. VARIABLE COSTS				
Seed	1000k	24.00	2.40	57.60
Seed Treatment	acre	0.00	10.50	0.00
Tech Fee	acre	1.00	0.00	0.00
Fertilizer				
Nitrogen	units	160.00	0.68	108.80
Phosphate	units	60.00	0.50	30.00
Potash	units	60.00	0.58	34.80
Micronutrients	acre	1.00	8.00	8.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides	acre	1.00	30.00	30.00
Insecticides	acre	0.00	7.00	0.00
Fungicides	acre	1.00	0.00	0.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	5.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying	bu.	110.00	0.28	30.80
Hauling	bu.	110.00	0.25	27.50
Crop Insurance	acre	0.00	26.00	0.00
Aerial Application	acre	0.00	9.00	0.00
Labor (Wages & Fringe)	hour	1.60	11.25	18.00
Tractor/Machinery	acre	1.00	19.00	19.00
Interest on Operating Capital	dol.	188.03	0.07	12.22
TOTAL VARIABLE COST				**388.27**
RETURNS ABOVE VARIABLE COST				**161.18**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	26.00	26.00
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	388.27	0.08	31.06
TOTAL FIXED COSTS				**257.06**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**645.33**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**-95.88**

Table 12. Base Enterprise Budget for a Continuous Peanut Crop Rotation, Dryland, GCREC

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Peanut	lbs	3729	0.269375	**1004.50**
2. VARIABLE COSTS				
Seed	lbs	100.00	1.40	140.00
Innoculant	acre	1.00	0.00	0.00
Fertilizer				
Phosphate	units	40.00	0.55	22.00
Potash	units	40.00	0.55	22.00
Boron /Micronutrients	acre	1.00	10.00	10.00
Lime (Prorated)	tons	0.50	35.00	17.50
Herbicides	acre	1.00	35.00	35.00
Insecticides	acre	1.00	40.00	40.00
Fungicides	acre	7.00	7.50	52.50
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying &cleaning	tons	1.86	45.00	83.90
Hauling	tons	1.86	17.50	32.63
Crop Insurance	acre	0.00	20.00	0.00
Check Off	tons	1.86	2.50	4.66
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	58.00	58.00
Interest on Operating Capital	dol.	274.57	0.07	20.43
TOTAL VARIABLE COST				**569.56**
RETURNS ABOVE VARIABLE COST				**434.94**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	70.00	60.00
Irrigation	acre	0.00	125.00	0.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	569.56	0.08	45.56
TOTAL FIXED COSTS				**180.56**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**750.12**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**254.37**

Table 13. Base Enterprise Budget for a Continuous Cotton Crop Rotation, Dryland, GCREC

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Cotton Lint	lbs	906.00	0.79625	721.40
Cottonseed	tons	0.7248	165.0375	119.62
Total Revenue				**841.02**
2. VARIABLE COSTS				
Seed	bag	0.13	567.00	73.71
Seed Treatment	bag	0.00	17.00	0.00
Tech Fee (RF/BG2)	bag	0.00	0.00	0.00
Fertilizer				
Nitrogen	units	90.00	0.68	61.20
Phosphate	units	60.00	0.50	30.00
Potash	units	60.00	0.58	34.80
Micronutrients				0.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides				0.00
Burndown/Planting	acre	1.00	24.32	24.32
Post	acre	1.00	25.63	25.63
Lay-By	acre	1.00	8.19	8.19
Insecticides				0.00
Planting	acre	1.00	0.00	0.00
Early Season	acre	0.50	10.00	5.00
Mid Season	acre	1.00	7.00	7.00
Late Season	acre	1.00	10.00	10.00
Systemic Fungicides	acre	0.00	2.00	0.00
Growth Regulator	oz.	13.33	0.75	10.00
Defol/Harvest Aid	acre	1.00	13.00	13.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Crop Insurance	acre	0.00	28.00	0.00
Aerial Application	acre	0.00	9.00	0.00
Boll Weevil Eradication	acre	1.00	3.00	3.00
Cover Crop Establishment.	acre	1.00	25.00	25.00
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	70.00	70.00
Interest on Operating Capital	dol.	221.67	0.065	14.41
Ginning/Whs	lbs	906.00	0.10	90.60
Classing/Promotion Fee	bale	1.89	1.56	2.94
TOTAL VARIABLE COST				**551.29**
RETURNS ABOVE VARIABLE COST				**289.73**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	98.43	98.43
Irrigation	acre	1.00	0.00	0.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	551.29	0.08	44.10
TOTAL FIXED COSTS				**217.53**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**768.82**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**72.20**

Table 14. Base Enterprise Budget for a Corn-Peanut Crop Rotation, Dryland, GCREC

Corn

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Corn	bu.	115.72	5.00	**578.04**
2. VARIABLE COSTS				
Seed	1000k	24.00	2.40	57.60
Seed Treatment	acre	0.00	10.50	0.00
Tech Fee	acre	1.00	0.00	0.00
Fertilizer				
Nitrogen	units	160.00	0.68	108.80
Phosphate	units	60.00	0.50	30.00
Potash	units	60.00	0.58	34.80
Micronutrients	acre	1.00	8.00	8.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides	acre	1.00	30.00	30.00
Insecticides	acre	0.00	7.00	0.00
Fungicides	acre	1.00	0.00	0.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	5.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying	bu.	115.72	0.28	32.40
Hauling	bu.	115.72	0.25	28.93
Crop Insurance	acre	0.00	26.00	0.00
Aerial Application	acre	0.00	9.00	0.00
Labor (Wages & Fringe)	hour	1.60	11.25	18.00
Tractor/Machinery	acre	1.00	19.00	19.00
Interest on Operating Capital	dol.	189.54	0.07	12.32
TOTAL VARIABLE COST				**391.40**
RETURNS ABOVE VARIABLE COST				**186.64**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	26.00	26.00
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	391.40	0.08	31.31
TOTAL FIXED COSTS				**257.31**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**648.72**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**-70.67**

Peanut

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Peanut	lbs	4294.846563	0.269	**1155.31**
2. VARIABLE COSTS				
Seed	lbs	100.00	1.40	140.00
Innoculant	acre	1.00	0.00	0.00
Fertilizer				
Phosphate	units	40.00	0.55	22.00
Potash	units	40.00	0.55	22.00
Boron /Micronutrients	acre	1.00	10.00	10.00
Lime (Prorated)	tons	0.50	35.00	17.50
Herbicides	acre	1.00	35.00	35.00
Insecticides	acre	1.00	40.00	40.00
Fungicides	acre	7.00	7.50	52.50
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying &cleaning	tons	2.15	45.00	96.63
Hauling	tons	2.15	17.50	37.58
Crop Insurance	acre	0.00	20.00	0.00
Check Off	tons	2.15	2.50	5.37
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	58.00	58.00
Interest on Operating Capital	dol.	283.76	0.07	20.43
TOTAL VARIABLE COST				**587.95**
RETURNS ABOVE VARIABLE COST				**567.36**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	70.00	60.00
Irrigation	acre	0.00	125.00	0.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	587.95	0.08	47.04
TOTAL FIXED COSTS				**182.04**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**769.99**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**385.33**

Table 15. Base Enterprise Budget for a Cotton-Peanut Crop Rotation, Dryland, GCREC

Cotton

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Cotton Lint	lbs	867.39	0.80	693.92
Cottonseed	tons	0.69391515	165.04	114.52
Total Revenue				**808.44**
2. VARIABLE COSTS				
Seed	bag	0.13	567.00	73.71
Seed Treatment	bag	0.00	17.00	0.00
Tech Fee (RF/BG2)	bag	0.00	0.00	0.00
Fertilizer				
Nitrogen	units	90.00	0.68	61.20
Phosphate	units	60.00	0.50	30.00
Potash	units	60.00	0.58	34.80
Micronutrients				0.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides				0.00
Burndown/Planting	acre	1.00	24.32	24.32
Post	acre	1.00	25.63	25.63
Lay-By	acre	1.00	8.19	8.19
Insecticides				0.00
Planting	acre	1.00	0.00	0.00
Early Season	acre	0.50	10.00	5.00
Mid Season	acre	1.00	7.00	7.00
Late Season	acre	1.00	10.00	10.00
Systemic Fungicides	acre	0.00	2.00	0.00
Growth Regulator	oz.	13.33	0.75	10.00
Defol/Harvest Aid	acre	1.00	13.00	13.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Crop Insurance	acre	0.00	28.00	0.00
Aerial Application	acre	0.00	9.00	0.00
Boll Weevil Eradication	acre	1.00	3.00	3.00
Cover Crop Establishment.	acre	1.00	25.00	25.00
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	70.00	70.00
Interest on Operating Capital	dol.	221.67	0.065	14.41
Ginning/Whs	lbs	867.39	0.10	86.74
Classing/Promotion Fee	bale	1.81	1.56	2.82
TOTAL VARIABLE COST				**547.30**
RETURNS ABOVE VARIABLE COST				**261.14**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	98.43	98.43
Irrigation	acre	1.00	0.00	0.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	547.30	0.08	43.78
TOTAL FIXED COSTS				**217.21**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**764.52**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**43.92**

Peanut

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Peanut	lbs	4383.979063	0.269	**1179.29**
2. VARIABLE COSTS				
Seed	lbs	100.00	1.40	140.00
Innoculant	acre	1.00	0.00	0.00
Fertilizer				
Phosphate	units	40.00	0.55	22.00
Potash	units	40.00	0.55	22.00
Boron /Micronutrients	acre	1.00	10.00	10.00
Lime (Prorated)	tons	0.50	35.00	17.50
Herbicides	acre	1.00	35.00	35.00
Insecticides	acre	1.00	40.00	40.00
Fungicides	acre	7.00	7.50	52.50
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying &cleaning	tons	2.19	45.00	98.64
Hauling	tons	2.19	17.50	38.36
Crop Insurance	acre	0.00	20.00	0.00
Check Off	tons	2.19	2.50	5.48
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	58.00	58.00
Interest on Operating Capital	dol.	285.21	0.07	20.43
TOTAL VARIABLE COST				**590.85**
RETURNS ABOVE VARIABLE COST				**588.44**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	70.00	60.00
Irrigation	acre	0.00	125.00	0.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	590.85	0.08	47.27
TOTAL FIXED COSTS				**182.27**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**773.11**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**406.18**

Table 16. Crop Insurance Premiums by Rotation and Year, WREC

	Premium (2011 US Dollars)		
Rotation Pattern	Corn	Peanuts	Cotton
Continuous			
2004	12.46	10.84	46.62
2005	10.94	12.31	42.08
2006	12.05	12.69	60.22
2007	13.94	24.74	51.39
2008	18.52	25.46	58.11
2009	25.04	31.90	53.43
2010	18.17	28.44	58.03
2011	14.70	23.00	76.26
Average	15.73	21.17	55.77
Corn-Peanut			
2004	12.97	13.79	
2005	11.22	15.79	
2006	12.22	16.53	
2007	14.11	23.81	
2008	18.86	26.28	
2009	25.70	33.22	
2010	18.76	31.23	
2011	15.17	30.98	
Average	16.13	23.95	
Cotton-Peanut			
2004		13.21	46.62
2005		14.69	42.08
2006		15.17	60.22
2007		23.38	51.39
2008		25.78	58.11
2009		32.69	53.43
2010		30.23	58.03
2011		29.77	76.26
Average		23.12	55.77

Table 17. Crop Insurance Premiums by Rotation and Year, GCREC

Rotation Pattern	Premium (2011 US Dollars)		
	Corn	Peanuts	Cotton
Continuous			
2003	12.44	17.03	30.07
2004	12.46	14.47	25.83
2005	10.94	16.24	22.52
2006	12.05	16.88	30.08
2007	13.94	16.08	28.77
2008	18.52	16.55	33.42
2009	25.04	20.74	31.56
2010	18.17	18.48	35.82
Average	15.45	17.06	29.76
Corn-Peanut			
2003	13.08	18.54	
2004	12.97	15.79	
2005	11.22	17.98	
2006	12.22	18.79	
2007	14.11	17.49	
2008	18.86	18.35	
2009	25.70	22.97	
2010	18.76	21.47	
Average	15.87	18.92	
Cotton-Peanut			
2003		19.18	28.79
2004		16.29	24.62
2005		18.24	21.45
2006		19.32	28.78
2007		18.28	27.82
2008		19.22	32.54
2009		23.55	30.52
2010		22.11	34.07
Average		19.52	28.57

Table 18. Base Enterprise Budget for a Continuous Corn Crop Rotation with Crop Insurance, Dryland, WREC

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Corn	bu.	99.82	5.28	527.03
CI Pmt				63.73
				590.76
2. VARIABLE COSTS				
Seed	1000k	24.00	2.40	57.60
Seed Treatment	acre	0.00	10.50	0.00
Tech Fee	acre	1.00	0.00	0.00
Fertilizer				
Nitrogen	units	160.00	0.68	108.80
Phosphate	units	60.00	0.50	30.00
Potash	units	60.00	0.58	34.80
Micronutrients	acre	1.00	8.00	8.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides	acre	1.00	30.00	30.00
Insecticides	acre	0.00	7.00	0.00
Fungicides	acre	1.00	0.00	0.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	5.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying	bu.	99.82	0.28	27.95
Hauling	bu.	99.82	0.25	24.95
Crop Insurance	acre	1.00	15.73	15.73
Aerial Application	acre	0.00	9.00	0.00
Labor (Wages & Fringe)	hour	1.60	11.25	18.00
Tractor/Machinery	acre	1.00	19.00	19.00
Interest on Operating Capital	dol.	193.19	0.07	12.56
TOTAL VARIABLE COST				**398.94**
RETURNS ABOVE VARIABLE COST				**191.82**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	26.00	26.00
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	398.94	0.08	31.91
TOTAL FIXED COSTS				**257.91**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**656.85**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**-129.83**

Table 19. Base Enterprise Budget for a Continuous Peanut Crop Rotation with Crop Insurance, Irrigated, WREC

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Peanut	lbs	3427	0.26	**891.02**
2. VARIABLE COSTS				
Seed	lbs	100.00	1.40	140.00
Innoculant	acre	1.00	0.00	0.00
Fertilizer				
Phosphate	units	40.00	0.50	20.00
Potash	units	40.00	0.58	23.20
Boron /Micronutrients	acre	1.00	10.00	10.00
Lime (Prorated)	tons	0.50	35.00	17.50
Herbicides	acre	1.00	35.00	35.00
Insecticides	acre	1.00	12.00	12.00
Fungicides	acre	1.00	80.00	80.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	8.00	12.00	96.00
Drying	tons	1.71	30.00	51.41
Cleaning	tons	1.71	12.00	20.56
Hauling	tons	1.71	17.50	29.99
Crop Insurance	acre	1.00	21.17	21.17
Check Off	tons	1.71	2.50	4.28
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	58.00	58.00
Interest on Operating Capital	dol.	325.02	0.07	20.43
TOTAL VARIABLE COST				**670.48**
RETURNS ABOVE VARIABLE COST				**220.54**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	60.00	60.00
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	670.48	0.08	53.64
TOTAL FIXED COSTS				**313.64**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**984.12**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**-93.10**

Table 20. Base Enterprise Budget for a Continuous Cotton Crop Rotation with Crop Insurance, Irrigated, WREC

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Cotton Lint	lbs	1379.90	0.78	1076.32
Cottonseed	tons	1.03	169.922	175.02
Total Revenue				**1251.34**
2. VARIABLE COSTS				
Seed	bag	0.13	567.00	73.71
Seed Treatment	bag	0.00	17.00	0.00
Tech Fee (RF/BG2)	bag	0.00	0.00	0.00
Fertilizer				
Nitrogen	units	120.00	0.68	81.60
Phosphate	units	80.00	0.50	40.00
Potash	units	80.00	0.58	46.40
Micronutrients				0.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides				0.00
Burndown/Planting	acre	1.00	24.32	24.32
Post	acre	1.00	25.63	25.63
Lay-By	acre	1.00	8.19	8.19
Insecticides				0.00
Planting	acre	1.00	0.00	0.00
Early Season	acre	1.00	10.00	10.00
Mid Season	acre	1.00	7.00	7.00
Late Season	acre	1.00	10.00	10.00
Systemic Fungicides	acre	0.00	2.00	0.00
Growth Regulator	oz.	13.33	0.75	10.00
Defol/Harvest Aid	acre	1.00	13.00	13.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	8.00	12.00	96.00
Crop Insurance	acre	1.00	55.77	55.77
Aerial Application	acre	0.00	9.00	0.00
Boll Weevil Eradication	acre	1.00	0.65	0.65
Cover Crop Establishment.	acre	1.00	25.00	25.00
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	70.00	70.00
Interest on Operating Capital	dol.	319.88	0.065	20.79
Ginning/whs	lbs	1379.90	0.10	137.99
Classing/Promotion Fee	bale	2.87	1.56	4.48
TOTAL VARIABLE COST				**803.02**
RETURNS ABOVE VARIABLE COST				**448.32**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	98.43	98.43
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	803.02	0.08	64.24
TOTAL FIXED COSTS				**362.67**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**1165.69**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**85.65**

Table 21. Base Enterprise Budget for a Corn-Peanut Crop Rotation with Crop Insurance, Irrigated Peanut, WREC

Corn

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Corn	bu.	97.90	5.28	516.91
CI pmt				55.04
				571.96
2. VARIABLE COSTS				
Seed	1000k	24.00	2.40	57.60
Seed Treatment	acre	0.00	10.50	0.00
Tech Fee	acre	1.00	0.00	0.00
Fertilizer				
Nitrogen	units	160.00	0.68	108.80
Phosphate	units	60.00	0.50	30.00
Potash	units	60.00	0.58	34.80
Micronutrients	acre	1.00	8.00	8.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides	acre	1.00	30.00	30.00
Insecticides	acre	0.00	7.00	0.00
Fungicides	acre	1.00	0.00	0.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	5.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying	bu.	97.90	0.28	27.41
Hauling	bu.	97.90	0.25	24.48
Crop Insurance	acre	1.00	16.13	16.13
Aerial Application	acre	0.00	9.00	0.00
Labor (Wages & Fringe)	hour	1.60	11.25	18.00
Tractor/Machinery	acre	1.00	19.00	19.00
Interest on Operating Capital	dol.	192.88	0.07	12.54
TOTAL VARIABLE COST				**398.30**
RETURNS ABOVE VARIABLE COST				**173.66**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	26.00	26.00
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	398.30	0.08	31.86
TOTAL FIXED COSTS				**257.86**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**656.16**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**-139.25**

Peanut

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Peanut	lbs	4363.2	0.26	**1134.43**
2. VARIABLE COSTS				
Seed	lbs	100.00	1.40	140.00
Innoculant	acre	1.00	0.00	0.00
Fertilizer				
Phosphate	units	40.00	0.50	20.00
Potash	units	40.00	0.58	23.20
Boron /Micronutrients	acre	1.00	10.00	10.00
Lime (Prorated)	tons	0.50	35.00	17.50
Herbicides	acre	1.00	35.00	35.00
Insecticides	acre	1.00	12.00	12.00
Fungicides	acre	1.00	80.00	80.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	8.00	12.00	96.00
Drying	tons	2.18	30.00	65.45
Cleaning	tons	2.18	12.00	26.18
Hauling	tons	2.18	17.50	38.18
Crop Insurance	acre	1.00	23.95	23.95
Check Off	tons	2.18	2.50	5.45
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	58.00	58.00
Interest on Operating Capital	dol.	340.93	0.07	20.43
TOTAL VARIABLE COST				**702.28**
RETURNS ABOVE VARIABLE COST				**432.15**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	60.00	60.00
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	702.28	0.08	56.18
TOTAL FIXED COSTS				**316.18**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**1018.46**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**115.97**

Table 22. Base Enterprise Budget for a Cotton-Peanut Crop Rotation with Crop Insurance, Irrigated, WREC

Cotton

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Cotton Lint	lbs	1506.90	0.78	1175.38
Cottonseed	tons	1.1	169.922	186.91
Total Revenue				**1362.30**
2. VARIABLE COSTS				
Seed	bag	0.13	567.00	73.71
Seed Treatment	bag	0.00	17.00	0.00
Tech Fee (RF/BG2)	bag	0.00	0.00	0.00
Fertilizer				
Nitrogen	units	120.00	0.68	81.60
Phosphate	units	80.00	0.50	40.00
Potash	units	80.00	0.58	46.40
Micronutrients				0.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides				0.00
Burndown/Planting	acre	1.00	24.32	24.32
Post	acre	1.00	25.63	25.63
Lay-By	acre	1.00	8.19	8.19
Insecticides				0.00
Planting	acre	1.00	0.00	0.00
Early Season	acre	1.00	10.00	10.00
Mid Season	acre	1.00	7.00	7.00
Late Season	acre	1.00	10.00	10.00
Systemic Fungicides	acre	0.00	2.00	0.00
Growth Regulator	oz.	13.33	0.75	10.00
Defol/Harvest Aid	acre	1.00	13.00	13.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	8.00	12.00	96.00
Crop Insurance	acre	1.00	55.77	55.77
Aerial Application	acre	0.00	9.00	0.00
Boll Weevil Eradication	acre	1.00	0.65	0.65
Cover Crop Establishment.	acre	1.00	25.00	25.00
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	70.00	70.00
Interest on Operating Capital	dol.	319.88	0.065	20.79
Ginning/whs	lbs	1506.90	0.10	150.69
Classing/Promotion Fee	bale	3.14	1.56	4.90
TOTAL VARIABLE COST				**816.13**
RETURNS ABOVE VARIABLE COST				**546.16**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	98.43	98.43
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	816.13	0.08	65.29
TOTAL FIXED COSTS				**363.72**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**1179.85**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**182.44**

Peanut

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Peanut	lbs	4181.5	0.26	**1087.19**
2. VARIABLE COSTS				
Seed	lbs	100.00	1.40	140.00
Innoculant	acre	1.00	0.00	0.00
Fertilizer				
Phosphate	units	40.00	0.50	20.00
Potash	units	40.00	0.58	23.20
Boron /Micronutrients	acre	1.00	10.00	10.00
Lime (Prorated)	tons	0.50	35.00	17.50
Herbicides	acre	1.00	35.00	35.00
Insecticides	acre	1.00	12.00	12.00
Fungicides	acre	1.00	80.00	80.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	8.00	12.00	96.00
Drying	tons	2.09	30.00	62.72
Cleaning	tons	2.09	12.00	25.09
Hauling	tons	2.09	17.50	36.59
Crop Insurance	acre	1.00	23.12	23.12
Check Off	tons	2.09	2.50	5.23
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	58.00	58.00
Interest on Operating Capital	dol.	337.69	0.07	20.43
TOTAL VARIABLE COST				**695.81**
RETURNS ABOVE VARIABLE COST				**391.38**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	60.00	60.00
Irrigation	acre	1.00	125.00	125.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	695.81	0.08	55.66
TOTAL FIXED COSTS				**315.66**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**1011.47**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**75.72**

Table 23. Base Enterprise Budget for a Continuous Corn Crop Rotation with Crop Insurance, Dryland, GCREC

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Corn	bu.	110.00	5.00	**549.45**
2. VARIABLE COSTS				
Seed	1000k	24.00	2.40	57.60
Seed Treatment	acre	0.00	10.50	0.00
Tech Fee	acre	1.00	0.00	0.00
Fertilizer				
Nitrogen	units	160.00	0.68	108.80
Phosphate	units	60.00	0.50	30.00
Potash	units	60.00	0.58	34.80
Micronutrients	acre	1.00	8.00	8.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides	acre	1.00	30.00	30.00
Insecticides	acre	0.00	7.00	0.00
Fungicides	acre	1.00	0.00	0.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	5.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying	bu.	110.00	0.28	30.80
Hauling	bu.	110.00	0.25	27.50
Crop Insurance	acre	1.00	15.45	15.45
Aerial Application	acre	0.00	9.00	0.00
Labor (Wages & Fringe)	hour	1.60	11.25	18.00
Tractor/Machinery	acre	1.00	19.00	19.00
Interest on Operating Capital	dol.	195.75	0.07	12.72
TOTAL VARIABLE COST				**404.22**
RETURNS ABOVE VARIABLE COST				**145.23**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	26.00	26.00
Irrigation	acre	0.00	125.00	0.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	404.22	0.08	32.34
TOTAL FIXED COSTS				**133.34**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**537.56**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**11.89**

Table 24. Base Enterprise Budget for a Continuous Peanut Crop Rotation with Crop Insurance, Dryland, GCREC

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Peanut	lbs	3729	0.269375	**1004.50**
2. VARIABLE COSTS				
Seed	lbs	100.00	1.40	140.00
Innoculant	acre	1.00	0.00	0.00
Fertilizer				
Phosphate	units	40.00	0.55	22.00
Potash	units	40.00	0.55	22.00
Boron /Micronutrients	acre	1.00	10.00	10.00
Lime (Prorated)	tons	0.50	35.00	17.50
Herbicides	acre	1.00	35.00	35.00
Insecticides	acre	1.00	40.00	40.00
Fungicides	acre	7.00	7.50	52.50
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying &cleaning	tons	1.86	45.00	83.90
Hauling	tons	1.86	17.50	32.63
Crop Insurance	acre	1.00	17.06	17.06
Check Off	tons	1.86	2.50	4.66
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	58.00	58.00
Interest on Operating Capital	dol.	283.10	0.07	20.43
TOTAL VARIABLE COST				**586.62**
RETURNS ABOVE VARIABLE COST				**417.88**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	70.00	70.00
Irrigation	acre	0.00	125.00	0.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	586.62	0.08	46.93
TOTAL FIXED COSTS				**191.93**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**778.55**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**225.95**

Table 25. Base Enterprise Budget for a Continuous Cotton Crop Rotation with Crop Insurance, Dryland, GCREC

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Cotton Lint	lbs	905.52	0.79625	721.02
Cottonseed	tons	0.7244143	165.0375	119.56
Total Revenue				**840.57**
2. VARIABLE COSTS				
Seed	bag	0.13	567.00	73.71
Seed Treatment	bag	0.00	17.00	0.00
Tech Fee (RF/BG2)	bag	0.00	0.00	0.00
Fertilizer				
Nitrogen	units	90.00	0.68	61.20
Phosphate	units	60.00	0.50	30.00
Potash	units	60.00	0.58	34.80
Micronutrients				0.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides				0.00
Burndown/Planting	acre	1.00	24.32	24.32
Post	acre	1.00	25.63	25.63
Lay-By	acre	1.00	8.19	8.19
Insecticides				0.00
Planting	acre	1.00	0.00	0.00
Early Season	acre	0.50	10.00	5.00
Mid Season	acre	1.00	7.00	7.00
Late Season	acre	1.00	10.00	10.00
Systemic Fungicides	acre	0.00	2.00	0.00
Growth Regulator	oz.	13.33	0.75	10.00
Defol/Harvest Aid	acre	1.00	13.00	13.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Crop Insurance	acre	1.00	29.76	29.76
Aerial Application	acre	0.00	9.00	0.00
Boll Weevil Eradication	acre	1.00	3.00	3.00
Cover Crop Establishment.	acre	1.00	25.00	25.00
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	70.00	70.00
Interest on Operating Capital	dol.	236.55	0.065	15.38
Ginning/Whs	lbs	905.52	0.10	90.55
Classing/Promotion Fee	bale	1.89	1.56	2.94
TOTAL VARIABLE COST				**581.97**
RETURNS ABOVE VARIABLE COST				**258.61**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	92.00	92.00
Irrigation	acre	1.00	0.00	0.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	581.97	0.08	46.56
TOTAL FIXED COSTS				**213.56**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**795.52**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**45.05**

Table 26. Base Enterprise Budget for a Corn-Peanut Crop Rotation with Crop Insurance, Dryland, GCREC

Corn

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Corn	bu.	115.72	5.00	**578.04**
2. VARIABLE COSTS				
Seed	1000k	24.00	2.40	57.60
Seed Treatment	acre	0.00	10.50	0.00
Tech Fee	acre	1.00	0.00	0.00
Fertilizer				
Nitrogen	units	160.00	0.68	108.80
Phosphate	units	60.00	0.50	30.00
Potash	units	60.00	0.58	34.80
Micronutrients	acre	1.00	8.00	8.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides	acre	1.00	30.00	30.00
Insecticides	acre	0.00	7.00	0.00
Fungicides	acre	1.00	0.00	0.00
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	5.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying	bu.	115.72	0.28	32.40
Hauling	bu.	115.72	0.25	28.93
Crop Insurance	acre	1.00	12.44	12.44
Aerial Application	acre	0.00	9.00	0.00
Labor (Wages & Fringe)	hour	1.60	11.25	18.00
Tractor/Machinery	acre	1.00	19.00	19.00
Interest on Operating Capital	dol.	195.76	0.07	12.72
TOTAL VARIABLE COST				**404.25**
RETURNS ABOVE VARIABLE COST				**173.80**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	26.00	26.00
Irrigation	acre	0.00	125.00	0.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	404.25	0.08	32.34
TOTAL FIXED COSTS				**133.34**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**537.59**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**40.46**

Peanut

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Peanut	lbs	4294.846563	0.269	**1155.31**
2. VARIABLE COSTS				
Seed	lbs	100.00	1.40	140.00
Innoculant	acre	1.00	0.00	0.00
Fertilizer				
Phosphate	units	40.00	0.55	22.00
Potash	units	40.00	0.55	22.00
Boron /Micronutrients	acre	1.00	10.00	10.00
Lime (Prorated)	tons	0.50	35.00	17.50
Herbicides	acre	1.00	35.00	35.00
Insecticides	acre	1.00	40.00	40.00
Fungicides	acre	7.00	7.50	52.50
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying &cleaning	tons	2.15	45.00	96.63
Hauling	tons	2.15	17.50	37.58
Crop Insurance	acre	0.00	20.00	0.00
Check Off	tons	2.15	2.50	5.37
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	58.00	58.00
Interest on Operating Capital	dol.	283.76	0.07	20.43
TOTAL VARIABLE COST				**587.95**
RETURNS ABOVE VARIABLE COST				**567.36**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	70.00	70.00
Irrigation	acre	0.00	125.00	0.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	587.95	0.08	47.04
TOTAL FIXED COSTS				**192.04**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**779.99**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**375.33**

Table 27. Base Enterprise Budget for a Cotton-Peanut Crop Rotation with Crop Insurance, Dryland, GCREC

Cotton

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Cotton Lint	lbs	867.39	0.80	693.92
Cottonseed	tons	0.69391515	165.04	114.52
Total Revenue				**808.44**
2. VARIABLE COSTS				
Seed	bag	0.13	567.00	73.71
Seed Treatment	bag	0.00	17.00	0.00
Tech Fee (RF/BG2)	bag	0.00	0.00	0.00
Fertilizer				
Nitrogen	units	90.00	0.68	61.20
Phosphate	units	60.00	0.50	30.00
Potash	units	60.00	0.58	34.80
Micronutrients				0.00
Lime (Prorated)	tons	0.33	35.00	11.55
Herbicides				0.00
Burndown/Planting	acre	1.00	24.32	24.32
Post	acre	1.00	25.63	25.63
Lay-By	acre	1.00	8.19	8.19
Insecticides				0.00
Planting	acre	1.00	0.00	0.00
Early Season	acre	0.50	10.00	5.00
Mid Season	acre	1.00	7.00	7.00
Late Season	acre	1.00	10.00	10.00
Systemic Fungicides	acre	0.00	2.00	0.00
Growth Regulator	oz.	13.33	0.75	10.00
Defol/Harvest Aid	acre	1.00	13.00	13.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Crop Insurance	acre	1.00	28.57	28.57
Aerial Application	acre	0.00	9.00	0.00
Boll Weevil Eradication	acre	1.00	3.00	3.00
Cover Crop Establishment.	acre	1.00	25.00	25.00
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	70.00	70.00
Interest on Operating Capital	dol.	235.95	0.065	15.34
Ginning/Whs	lbs	867.39	0.10	86.74
Classing/Promotion Fee	bale	1.81	1.56	2.82
TOTAL VARIABLE COST				**576.80**
RETURNS ABOVE VARIABLE COST				**231.64**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	92.00	92.00
Irrigation	acre	1.00	0.00	0.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	576.80	0.08	46.14
TOTAL FIXED COSTS				**213.14**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**789.94**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**18.49**

Peanut

	UNIT	QUANTITY	PRICE OR COST/UNIT	TOTAL PER ACRE
1. INCOME				
Peanut	lbs	4383.979063	0.269	**1179.29**
2. VARIABLE COSTS				
Seed	lbs	100.00	1.40	140.00
Innoculant	acre	1.00	0.00	0.00
Fertilizer				
Phosphate	units	40.00	0.55	22.00
Potash	units	40.00	0.55	22.00
Boron /Micronutrients	acre	1.00	10.00	10.00
Lime (Prorated)	tons	0.50	35.00	17.50
Herbicides	acre	1.00	35.00	35.00
Insecticides	acre	1.00	40.00	40.00
Fungicides	acre	7.00	7.50	52.50
Nematicide	acre	1.00	0.00	0.00
Consultant/Scouting Fee	acre	0.00	6.00	0.00
Irrigation	ac/in	0.00	12.00	0.00
Drying &cleaning	tons	2.19	45.00	98.64
Hauling	tons	2.19	17.50	38.36
Crop Insurance	acre	1.00	19.52	19.52
Check Off	tons	2.19	2.50	5.48
Labor (Wages & Fringe)	hour	2.75	11.25	30.94
Tractor/Machinery	acre	1.00	58.00	58.00
Interest on Operating Capital	dol.	294.97	0.07	20.43
TOTAL VARIABLE COST				**610.37**
RETURNS ABOVE VARIABLE COST				**568.92**
3. FIXED COSTS				
Tractor/Machinery	acre	1.00	70.00	70.00
Irrigation	acre	0.00	125.00	0.00
Land Ownership Cost	acre	1.00	75.00	75.00
General Overhead	dol.	610.37	0.08	48.83
TOTAL FIXED COSTS				**193.83**
4. TOTAL COST OF ALL SPECIFIED EXPENSES				**804.20**
RETURNS ABOVE ALL SPECIFIED EXPENSES				**375.09**

Table 28. Expected Returns Above Variable Cost by Rotation in 2011 US Dollars, No Crop Insurance

	Expected Return (2011 US Dollars)				
Study Site	Continuous Corn	Continuous Peanut	Continuous Cotton	Corn-Peanut	Cotton-Peanut
WREC	$121.39	$253.45	$516.44	$294.65	$472.41
GCREC	$158.35	$430.36	$306.02	$376.66	$428.94

Table 29. Expected Returns Above Variable Cost by Rotation in 2011 US Dollars, with Crop Insurance

	Expected Return (2011 US Dollars)				
Study Site	Continuous Corn	Continuous Peanut	Continuous Cotton	Corn-Peanut	Cotton-Peanut
WREC	$168.88	$232.28	$458.86	$301.87	$481.20
GCREC	$142.41	$413.30	$334.82	$359.05	$433.95

Table 30. Returns Above Variable Cost in 2011 US Dollars, WREC

	Rotation Pattern				
	Continuous Corn	Continuous Peanut	Continuous Cotton	Corn-Peanut	Cotton-Peanut
No Crop Insurance					
2004	237.37	275.92	-91.77	323.50	119.84
2005	-8.31	16.61	618.91	115.52	378.10
2006	190.68	425.64	537.13	229.84	574.30
2007	83.65	386.36	575.77	381.27	588.37
2008	370.31	287.72	255.90	449.33	418.73
2009	-18.71	199.43	522.79	358.18	459.32
2010	350.07	95.81	731.78	346.26	491.26
2011	-233.98	340.15	981.02	153.31	749.39
Average	121.39	253.45	516.44	294.65	472.41
Base	144.33	241.72	505.90	296.66	457.65
With Crop Insurance					
2004	224.51	265.08	-139.90	309.91	137.73
2005	-19.60	4.30	575.47	101.83	290.97
2006	178.24	412.95	474.95	215.27	643.94
2007	69.26	361.62	522.71	362.08	692.26
2008	351.19	262.26	195.90	426.45	457.43
2009	79.37	167.53	467.62	328.30	373.04
2010	331.31	67.37	671.87	320.96	712.97
2011	136.79	317.15	902.28	350.16	541.23
Average	168.88	232.28	458.86	301.87	481.20
Base	191.82	220.54	448.32	302.90	483.84

Table 31. Returns Above Variable Cost in 2011 US Dollars, GCREC

	Rotation Pattern				
	Continuous Corn	Continuous Peanut	Continuous Cotton	Corn-Peanut	Cotton-Peanut
No Crop Insurance					
2003	133.85	244.75	42.72	229.13	198.81
2004	107.43	572.36	-457.74	423.89	114.92
2005	-40.56	321.41	209.50	188.11	364.46
2006	36.16	526.34	589.42	247.39	599.73
2007	227.64	286.11	365.66	382.11	471.56
2008	259.65	581.33	174.74	498.64	325.22
2009	214.75	559.83	718.93	539.71	718.01
2010	327.91	350.76	804.98	504.27	638.81
Average	158.35	430.36	306.02	376.66	428.94
Base	161.18	434.94	289.73	377.00	424.79
With Crop Insurance					
2003	121.01	227.72	17.66	213.44	186.70
2004	94.56	557.89	-14.59	409.30	317.94
2005	-51.85	305.17	186.24	173.33	344.27
2006	23.72	509.46	558.36	231.68	575.21
2007	213.25	270.03	335.93	366.08	448.06
2008	240.53	564.78	140.35	479.73	298.81
2009	188.90	539.09	686.40	514.96	690.47
2010	309.15	332.28	768.19	483.85	610.16
Average	142.41	413.30	334.82	359.05	433.95
Base	145.23	417.88	258.61	370.58	400.28

Table 32. Example Target MOTAD Model without Crop Insurance, WREC, 85% Target Income

	Cont. Peanut	Cont. Corn	Cont. Cotton	Corn-Peanut	Cotton-Peanut	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	type	rhs
objective	253.45	121.39	516.44	294.65	472.41									max	
land	1	1	1	1	1									le	1000
r2004	275.92	237.37	-91.77	323.50	119.84	1								ge	438976.03
r2005	16.61	-8.31	618.91	115.52	378.10		1							ge	438976.03
r2006	425.64	190.68	537.13	229.84	574.30			1						ge	438976.03
r2007	386.36	83.65	575.77	381.27	588.37				1					ge	438976.03
r2008	287.72	370.31	255.90	449.33	418.73					1				ge	438976.03
r2009	199.43	-18.71	522.79	358.18	459.32						1			ge	438976.03
r2010	95.81	350.07	731.78	346.26	491.26							1		ge	438976.03
r2011	340.15	-233.98	981.02	153.31	749.39								1	ge	438976.03
risk lim						0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	le	50500

Table 33. Example Target MOTAD Model without Crop Insurance, GCREC, 85% Target Income

	Cont. Peanut	Cont. Corn	Cont. Cotton	Corn-Peanut	Cotton-Peanut	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	type	rhs
objective	430.36	158.35	306.02	376.66	428.94									max	
land	1	1	1	1	1									le	1000
r2003	244.75	133.85	42.72	229.13	198.81	1								ge	365807.39
r2004	572.36	107.43	-457.74	423.89	114.92		1							ge	365807.39
r2005	321.41	-40.56	209.50	188.11	364.46			1						ge	365807.39
r2006	526.34	36.16	589.42	247.39	599.73				1					ge	365807.39
r2007	286.11	227.64	365.66	382.11	471.56					1				ge	365807.39
r2008	581.33	259.65	174.74	498.64	325.22						1			ge	365807.39
r2009	559.83	214.75	718.93	539.71	718.01							1		ge	365807.39
r2010	350.76	327.91	804.98	504.27	638.81								1	ge	365807.39
risk lim						0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	le	33000

Table 34. Example Target MOTAD Model with Crop Insurance, WREC, 85% Target Income

	Cont. Peanut	Cont. Corn	Cont. Cotton	Corn-Peanut	Cotton-Peanut	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	type	rhs
objective	232.28	168.88	458.86	301.87	481.20									max	
land	1	1	1	1	1									le	1000
r2004	265.08	224.51	-139.90	309.91	137.73	1								ge	409016.74
r2005	4.30	-19.60	575.47	101.83	290.97		1							ge	409016.74
r2006	412.95	178.24	474.95	215.27	643.94			1						ge	409016.74
r2007	361.62	69.26	522.71	362.08	692.26				1					ge	409016.74
r2008	262.26	351.19	195.90	426.45	457.43					1				ge	409016.74
r2009	167.53	79.37	467.62	328.30	373.04						1			ge	409016.74
r2010	67.37	331.31	671.87	320.96	712.97							1		ge	409016.74
r2011	317.15	136.79	902.28	350.16	541.23								1	ge	409016.74
risk lim						0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	le	50900

Table 35. Example Target MOTAD Model with Crop Insurance, GCREC, 85% Target Income

	Cont. Peanut	Cont. Corn	Cont. Cotton	Corn-Peanut	Cotton-Peanut	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	type	rhs
objective	413.30	142.41	334.82	359.05	433.95									max	
land	1	1	1	1	1									le	1000
r2003	227.72	121.01	17.66	213.44	186.70	1								ge	368860.57
r2004	557.89	94.56	-14.59	409.30	317.94		1							ge	368860.57
r2005	305.17	-51.85	186.24	173.33	344.27			1						ge	368860.57
r2006	509.46	23.72	558.36	231.68	575.21				1					ge	368860.57
r2007	270.03	213.25	335.93	366.08	448.06					1				ge	368860.57
r2008	564.78	240.53	140.35	479.73	298.81						1			ge	368860.57
r2009	539.09	188.90	686.40	514.96	690.47							1		ge	368860.57
r2010	332.28	309.15	768.19	483.85	610.16								1	ge	368860.57
risk lim						0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	le	10000

Table 36. Target MOTAD Solutions, WREC, No Crop Insurance

	Acres						
Target Income ($)	Continuous Peanut	Continuous Corn	Continuous Cotton	Corn-Peanut	Cotton-Peanut	Return ($)	Risk ($)
85% of Maximum Average Income							
438,976	0	0	1,000.00	0	0	516,442.39	90,000
438,976	0	0	909.68	0	90.32	512,465.95	85,000
438,976	0	0	696.03	0	303.97	503,058.92	75,000
438,976	0	0	482.37	0	517.63	493,651.88	65,000
438,976	0	0	268.71	0	731.29	484,244.85	55,000
438,976	0	0	27.99	0	972.01	473,646.31	50,500
75% of Maximum Average Income							
387,332	0	0	1,000.00	0	0	516,442.39	77,000
387,332	0	0	758.22	0	241.78	505,797.36	65,000
387,332	0	0	544.57	0	455.43	496,390.33	55,000
387,332	0	0	330.91	0	669.09	486,983.30	45,000
387,332	0	0	59.10	0	940.90	475,016.19	35,000
387,332	0	0	40.20	0	959.80	474,183.91	34,500

Table 37. Target MOTAD Solutions, WREC, Crop Insurance

	Acres						
Target Income ($)	Continuous Peanut	Continuous Corn	Continuous Cotton	Corn-Peanut	Cotton-Peanut	Return ($)	Risk ($)
85% of Maximum Average Income							
409,017	0	0	0	0	1,000.00	481,196.16	53,500
409,017	0	0	12.92	0	987.08	480,907.64	53,000
409,017	0	0	52.35	0	947.65	480,027.01	52,500
409,017	0	0	131.21	0	868.79	478,265.76	51,500
409,017	0	0	170.64	0	829.36	477,385.13	51,000
409,017	0	0	178.53	0	821.47	477,209.01	50,900
75% of Maximum Average Income							
360,897	0	0	0	0	1,000.00	481,196.16	34,500
360,897	0	0	34.72	0	965.28	480,420.81	34,300
360,897	0	0	67.18	0	932.82	479,695.74	34,200
360,897	0	0	99.65	0	900.35	478,970.68	34,100
360,897	0	0	132.11	0	867.89	478,245.61	34,000
360,897	0	0	197.04	0	802.96	476,795.48	33,800

Table 38. Target MOTAD Solutions, GCREC, No Crop Insurance

	Acres						
Target Income ($)	Continuous Peanut	Continuous Corn	Continuous Cotton	Corn-Peanut	Cotton-Peanut	Return ($)	Risk ($)
85% of Maximum Average Income							
365,807	1,000.00	0	0	0	0	430,361.63	33,000
365,807	957.08	0	0	0	42.92	430,300.56	30,000
365,807	752.67	0	0	0	247.33	430,009.67	25,000
365,807	621.20	0	0	0	378.80	429,822.58	22,000
365,807	577.38	0	0	0	422.62	429,760.22	21,000
365,807	573.00	0	0	0	427.00	429,753.98	20,900
75% of Maximum Average Income							
322,771	1,000.00	0	0	0	0	430,361.63	15,000
322,771	977.86	0	0	0	22.14	430,330.12	14,000
322,771	923.42	0	0	0	76.58	430,252.65	13,000
322,771	866.07	0	0	0	133.93	430,171.04	12,000
322,771	808.73	0	0	0	191.27	430,089.44	11,000
322,771	784.33	0	0	37.28	178.39	428,105.50	10,900

Table 39. Target MOTAD Solutions, GCREC, Crop Insurance

	Acres						
Target Income ($)	Continuous Peanut	Continuous Corn	Continuous Cotton	Corn-Peanut	Cotton-Peanut	Return ($)	Risk ($)
85% of Maximum Average Income							
368,861	0	0	0	0	1,000.00	433,953.61	41,000
368,861	93.97	0	0	0	906.03	432,013.06	35,000
368,861	172.73	0	0	0	827.27	430,386.53	30,000
368,861	226.97	0	0	0	773.03	429,266.43	27,000
368,861	256.84	0	0	0	743.16	428,649.76	26,000
368,861	262.81	0	0	0	737.19	428,526.43	25,800
75% of Maximum Average Income							
325,465	0	0	0	0	1,000.00	433,953.61	22,000
325,465	23.66	0	0	0	976.34	433,464.99	20,000
325,465	69.78	0	0	0	930.22	432,512.69	18,000
325,465	262.40	0	0	0	737.60	428,534.86	16,000
325,465	457.44	0	0	0	542.56	424,507.19	15,000
325,465	476.94	0	0	0	523.06	424,104.43	14,900