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Should We Pay Farmers Not to Farm?
A Case of the Conservation Reserve Program

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Introduction

In 2008, congress reauthorized the Conservation Reserve Program but reduced the acreage cap from the 39.2 million acres to 32 million acres. The CRP currently enrolls 31.1 million acres(U.S. Department of Agriculture 2011c). CRP was initially authorized to help control soil erosion, stabilize land prices, and control excessive agricultural production. Since then, the program has been expanded to include environmental goals (Cowan 2010). Today, the primary objectives of the CRP include: reducing sedimentation, improving water quality, fostering wildlife habitat, providing income support for farmers, and protecting the nation's long term capacity to produce food and fiber (U.S. Department of Agriculture 2011a).

CRP is the largest private land retirement program operated by the federal government (Cowan 2010), retiring over 11% of farmland in the United States (U.S. Department of Agriculture 2010a). Between 2009 and 2014, more than 62% of CRP acres will expire, of which 71% reside in the plains states (Dicks 2008). CRP currently pays out 1,697,343,000 dollars per year in rental payments (U.S. Department of Agriculture 2012). In Oklahoma, the CRP currently provides \$27,858,000 in revenue to farmers in the form of rental payments, with an average payment of \$33.83 per acre (U.S. Department of Agriculture 2012). Oklahoma has 823,488 acres of land in CRP (U.S. Department of Agriculture 2012) which represents roughly 11% of the total farmland in the state (U.S. Department of Agriculture 2010a).

With the large number of expiring acres and the resulting losses of revenue, producers will be forced to find alternative uses for their land to avoid acquiring idle assets. Skaggs, Kirksey, and Harper (1994); Bangsund, Hodur, and Larry Leistriz

(2004); Johnson, Misra, and Ervin (1997) all suggest that producers will opt to return the CRP lands to row crop production, however little research has been done to assess the economic potential of returning these lands to row crop production.

Problem Statement

Since 2005, corn prices have risen significantly and other commodities have closely followed. Prices are at all-time highs for some crops. This has led to a call for CRP lands to be placed back into production by certain producer groups (Grabanski 2011; Love 2011; Cowan 2010). When the CRP was initially created, it enrolled economically marginal and highly erodible land (Bangsund, Hodur, and Larry Leistritz 2004) mostly located in the Great Plains. Thus, the question as to whether these CRP lands can be profitably returned row crop production in the Great Plains is important.

A key issue is whether or not the land can produce at a profitable level before the operation faces diminishing marginal returns. Research suggests that there is a point in which the addition of farm resources (i.e. fertilizer) will no longer be profitable because the resources ability to be utilized has been maximized in the soil profile (Hoag 1998).

It is because of these concerns that the main objective of this research was to determine if bringing CRP land back into production would be profitable for Oklahoma contract holders. Using field level data, nutrient status was determined on current CRP lands, and the remaining nutrient requirements for optimal plant growth were assessed. This assessment in conjunction with the costs of a wheat-sorghum-fallow rotation was used to answer the primary research question for this study.

Supporting Literature

Producer Choice

The producer's choice alternative to CRP has been extensively reported. A study by Johnson, Misra, and Ervin (1997) in the Texas High Plains region used a qualitative choice model based on utility maximization of different producer alternatives. Using a survey of CRP contract holders, the model was built using ten independent variables that would determine the amount of CRP returned to cropland post-contract. It was revealed that 69% of CRP would be returned to crop production in the absence of a CRP extension. The results of their model suggested that the decision to return the land to cropland is heavily dependent on the financial value of the commodity base; while in retrospect, the presence of a livestock enterprise in the contract holders' operation would increase the probability that the land would remain in cover.

Similar results were found by Bangsund, Hodur, and Larry Leistritz (2004). Using a survey distributed in 16 North Dakota counties to CRP land holders, questions were asked about previous uses, relative yields, and use if the land were to come out of contract. Depending on the geographic region of North Dakota, the amount that would have returned to cropland post-contract varied from 63%-82% with an average of 72%. Skaggs, Kirksey, and Harper (1994) cited various estimates that used similar methods from other studies in their literature review ranging from 42%-80% of CRP land that would be returned to cropland.

CRP Land Productivity

The production capability of CRP land has been examined by a few researchers from various perspectives. A study by Unger (1999) centered in the Texas Panhandle explored the conversion of CRP grassland to the dryland crops, grain sorghum and wheat, using field experimentation. The study was conducted from 1995-1997 when the first wave of CRP contracts were set to expire. CRP land in the Texas Panhandle is predominantly grama-buffalo grass and bunch grasses (Skaggs, Kirksey, and Harper 1994) and there was no research on converting these types of grasses to cropland. Converting CRP lands and destroying these warm-season, bunch-type grasses proved to be more difficult in the Great Plains states, than the sub-humid and semiarid climates (Dao et al. 2000).

Imposing climatic conditions occurred during the research period. Nitrogen was applied at various rates and mixed results were found. In 1995, the Sorghum plot produced 11.4 bu/acre while the Texas High Plains Agricultural District average was 51 bu/acre (U.S. Department of Agriculture 2011d). In 1996, Sorghum was not planted due to drought, although the district averaged 68.2 bu/acre (U.S. Department of Agriculture 2011d). In 1997, the study averaged 55.44 bu/acre for sorghum, and the district averaged 61.1 bu/acre (U.S. Department of Agriculture 2011d). In 1995-1996, both wheat crops failed, and in 1997, the experimental wheat plots averaged 26.25 bu/acre. The average wheat yield for the district in 1997 was 31.5 bu/acre (U.S. Department of Agriculture 2011d). The primary reason for the high variance in yields or the crop failures was said to be attributed to low soil water content at planting and during the study.

Another study conducted by Dao et al. (2000) measured the relative efficacy of systems of transition from the CRP. These systems were the production of old world

bluestem (OWB), dryland wheat, and cotton. Their experiment sites were in Northwestern Oklahoma near Forgan and Southwestern Oklahoma near Duke. Dao et al. (2000) stated that; in the transition to CRP, OWB was used extensively as permanent soil cover in the Panhandles of Oklahoma and Texas and before the CRP, much of the land in Oklahoma was cropped annually to wheat; however cotton remained important in Southwestern Oklahoma.

Their study was conducted over the period of 1994-1997, and various applications of nitrogen and phosphorus were made at the two sites. In Northwestern OK, OWB plots were not fertilized in the first year; but nitrogen applications were made in 1995-1997. Crude protein on OWB plots increased with fertilizer application, however the most significant increases occurred when improved management was incorporated with fertilizer.

No-Till (NT) plots had the highest returns in both the Northwestern and Southwestern parts of the state. Wheat yields for NT in the northwest were: 15.79, 2.85, and 15.91 bu/acre in 1994-1997 respectively. The 1995-1996 crop experienced a drought and resulted in lower yields for the no till plots in the northwest. In the southwest, wheat yields were 24.68, 11.73, and 9.63 for NT during the 1994-1997 time periods. Cotton in the southwest faced adverse conditions and performed poorly averaging 0.17 bales/acre in 1994-1995, and resulted in crop failure in 1996-1997.

Climatic factors were said to have affected the production capacity of the soils at these sites during the study, however in the southwest, growth responses to fertilizer application was consistently positive and at least 2 of the 3 years in the northwest. It was suggested that to convert CRP to “successful” annual crop production, fertilizer should be

applied to improve the nutrient status of the soil and the timing and suppression of grass cover is critical to conserving soil water for optimal plant growth.

A study focused in Greenley County Kansas by Williams, Llewelyn, et al. (2010) examined the economic potential of producing a wheat and grain sorghum rotation with three different tillage strategies compared with the Conservation Reserve Program. Yields, input data, field operations were obtained from an experimental field from 1991-2001 in Western Kansas, and a standard conversion process for CRP was used for all three practices. They used enterprise budgeting and stochastic efficiency with respect to a function to evaluate returns and the associated risk. A price series from 2006-2008 for both crops were used for the enterprise budget analysis and evaluation of risk. Costs were determined for each field operation from previous research. Input costs were based on experimental application rates and Spring 2008 material costs were used.

Using the average price from January 2006 to December 2008 and 2008 costs; Williams, Llewelyn, et al. (2010) found that net returns were the highest when a reduced till operation was implemented, the no-till operation had the next best returns. The returns to these systems however, did not exceed the average CRP rental payment in the area. Under average prices from January 2007 to December 2008, that the returns to reduced-till and no-till systems were determined to exceed even the highest CRP rental payment in the area. From these results, it was suggested that care should be given when making the decision to return land back to crop production.

Conceptual Framework

Location

Information from County-by-County Summary of the 41st Conservation Reserve Program Signup indicates that 50% of the CRP land in Oklahoma was located in the three counties of the Panhandle (U.S. Department of Agriculture 2011b). Of that 50%, 44% of the CRP land was in Texas County and 63% of that land was in the Western half of the county, West of Guymon to the Texas county border. The Western part of Texas County represents 14% of the total CRP land in all of Oklahoma, and 1.2% of the CRP land in Texas, Kansas, Colorado, Oklahoma, and New Mexico. Given the concentration and resource constraints faced for this study, this research focuses on the Western portion of Texas County. This resulted in a population of 122,995 CRP acres for this study.

Sampling

To determine an adequate number of CRP sample fields for this study, preliminary numbers on nutrient status of particular crop acreages were obtained for Texas County from Oklahoma State University Soil, Water and Forage Analytical Laboratory (SWAFL) and used in a sample size formula from Lusk and Shogren (2008). These data were taken from various locations and various crops in Texas County from 2003-2010. This was the largest set of electronic data available and since the sample size calculations are approximate (Kraemer and Thiemann 1987; Kupper and Hafner 1989), this data was assumed adequate.

A wheat-sorghum-fallow rotation had long been utilized and proven as a productive system in the Oklahoma Panhandle (*No-Till Wheat Sorghum Fallow Rotation*

2012), therefore this study focused on the conversion of CRP land to such a system. Because of this, the preliminary data on wheat, grain sorghum, and sorghum sudan hay were used segregated and used in the calculation. Sample sizes were calculated for phosphorus on wheat ground, nitrogen on wheat ground, phosphorus on sorghum, nitrogen on sorghum, and organic matter as a whole. The largest of the calculations was assumed to be the most conservative estimation and was used for this research.

A sample of participants was obtained by randomly selecting farmers from a pool of CRP data obtained from the United States Department of Agriculture Farm Service Agency. Farmers selected in this process were contacted individually to request permission to take soil samples on their land. When enough farmers agreed to participate, soil samples were taken on April 7th, 2012.

Samples were analyzed at Oklahoma State University's SWAFL under a routine soil test. The lab used the Mehlich 3 (M3) processes to obtain: NO₃ (N) and soil test P (STP). For this study, potassium was not measured since Zhang and McCray (2009) reported that most of Oklahoma is high in potassium. Further, the majority of the soils in Texas County have a high pH (Zhang and McCray 2009). Therefore, potassium and pH were not considered limiting factors if CRP land was to return to production. As a result, these nutrients were not used in the budgeting process.

At the Oklahoma State University Soil, Water and Forage Analytical Laboratory, phosphorus is measured and reported on a soil test P index, or STP. This test measures the amount of available phosphorus for the whole growing season (Zhang and McCray 2009). The STP index is primarily used because P exists in many different forms in the soil, some of which are not readily available for use by the crop. The STP "has been

calibrated with crop yield response in different parts of the state of Oklahoma to identify the degree of sufficiency and the amount of fertilizer P needed to correct any deficiency” (Zhang, Johnson, and Raun 1998). Soils with a STP of 65 or above are considered to be 100% sufficient for growth of both wheat and sorghum, and are said to be adequately supplied to meet 100% of the crops growth potential (Zhang and McCray 2009).

Budgeting

Total revenue and costs for a traditional Wheat-Sorghum-Fallow rotation on CRP land was calculated to determine if a profit or loss would occur. The theory behind the revenue calculation is as follows:

$$TR_{ik} = P_i * Q_k \quad (1)$$

Where: TR = Total Revenue
P = Price
Q = Yield
i = Price used in the calculation (EP, Min, Max)
k = Yield Level (Avg., Min, Max)

It is assumed that the producers objective is to maximize profit, thus revenue would have to be optimized subject to the cost constraint. These costs are associated with the field operations that the producer undertakes in the wheat- sorghum-fallow rotation. Field ops and the costs associated are discussed in greater detail in the data and methods section.

Using these costs the following model was developed:

$$C_{jt} = S_j * N_j + \left(\sum FT + \sum CH \right)_{tl} + CI_{tl} + AOC_{tl} + \sum MO_{tl} + OC \quad (2)$$

Where: S = Seed Cost
N = Amount of seed planted
FT = Fertilizer applied

CH = Chemical applied
MO = Machine Operation
CI = Crop Insurance
OC = Opportunity Cost

This study is concerned with the long term, thus all costs become variable. Therefore if total revenue drops below the total cost, the producers operation will shut down or incur debt. To evaluate this, profit is calculated as:

$$\pi_{ikjt} = TR_{ik} - C_{jt} \quad (3)$$

Where: π = Profit

Data and Methods

To determine if CRP land would be profitable if it were transitioned to a wheat-sorghum-fallow rotation, enterprise budgets were developed for a dryland wheat operation, sorghum operation, and fallow operation. Each of these budgets was duplicated for a no-till, conservation-reduced till, and conventional till system. In each budget, average costs, minimum costs, and maximum costs were compared with the expected price, ten year high harvest price, and ten year low harvest price. This process is similar to the one undertaken by Williams, Llewelyn, et al. (2010), however this study differs by location, data collection procedure, field operations, prices, and costs. Williams, Llewelyn, et al. (2010) also used a standard breakout procedure for CRP land regardless of the tillage practice. All CRP acreage was initially broke out by disking. This method is not consistant with some of the tilliage practices in which the rest of the crop underwent. Therefore in this study, break procedures consistant with each tillage practice were used.

Field Operations

A previous extension report by the University of Nebraska was written to advise producers on the costs associated with converting CRP to millet and wheat cropland in the Nebraska Panhandle (Lyon and Holman 1997). Lyon and Holman (1997) determined the operations and costs associated with converting CRP to millet and wheat cropland in the Nebraska Panhandle. These operations were used as the basis for this study. However adjustments were made due to the amount of time since the list was compiled, location of the study, and crop differences. These field operations are found in the appendix 1.

Yield

Using the latitude and longitude of each sample taken, average yield, minimum yield, and maximum yield were determined from the NRCS web soil survey. The web soil survey provides average, median, minimum, and maximum yield estimates by the state soil scientist that mapped the area. Williams, Llewelyn, et al. (2010) used actual yields from 1991-2001, however these yields were in a time period where yield improved drastically (Calderini, Dreccer, and Slafer 1995) as a result of farm technology. This fact, in addition to being subjected to the perils of the environment make their research very realistic for the 1991-2001 time period, however less realistic for today. The Web Soil Survey is updated periodically, and provides a current source for our data.

Fertilizer Requirements

To determine the proper application of fertilizer to get the maximum yields for each crop, a regression was built using the numbers from Zhang et al. (2009). The Zhang

et al. (2009) report presents tables for major crops in Oklahoma that are most commonly deficient for plant nutrients. It was stated in the report that the relationships between yield and the amount of nutrients presented in the tables of the report are valid for interpreting soil test values from the Oklahoma State University Soil, Water, and Forage Analytical Laboratory. The Nitrogen requirements in the table are based on a yield goal while the other nutrients are based on soil test values and their corresponding sufficiency level.

When the regression for wheat was run for phosphorus, an adjusted R^2 of .94 resulted. Using an average STP of 46.57 was found in the samples taken from Western Texas County with the coefficients generated in the regression, the model determined that 16.64 lbs/acre of phosphorus was needed for wheat production in the coming crop year. The same process was conducted for sorghum, and the model resulted in an adj. R^2 of .99. When the average STP was placed in this model, it was found that 15.82 lbs/acre of phosphorus needed to be applied for grain sorghum to be 100% sufficient.

A regression was run on the nitrogen requirement in terms of maximum yield for both crops. The models resulted in an adj. R^2 of .99 and .98 for wheat and sorghum, respectively. The web soil survey reported that maximum yields of 25 bu/acre for wheat and 44 bu/acre for sorghum were capable of being produced on the sampled lands in Western Texas County. Using this information in the regression, it was found that 47.31 lbs/acre of nitrogen needed to be applied to obtain these yields in wheat production. The regression for sorghum did not return realistic values for nitrogen application, so a visual estimation was made on the basis of the scale provided in the Zhang et al. (2009) report.

It was estimated that roughly 40 lbs/acre was needed for maximum yields in grain sorghum.

The list of field operations called for an application of 11-52-0 to be put down at time of planting. The phosphorus requirement was to be met with 11-52-0 and the remaining nitrogen requirement was filled with an application of urea ammonium nitrate (32-0-0) shortly after planting. The application of 11-52-0 was combined with planting in order to reduce the cost per acre. Since 16.64 lbs/acre of phosphorus was needed for proper wheat production, a total of 31.995 lbs/acre of 11-52-0 was called for at planting. This application of fertilizer added 3.52 lbs/acre of nitrogen to the soil, and in turn resulted in dropping the required subsequent nitrogen application for wheat to 43.79 lbs/acre. This remaining nitrogen requirement translated into 136.84 lbs/acre of 32-0-0, and was filled shortly after planting.

It is assumed that the phosphorus applied in the wheat season was entirely utilized, so in the phosphorus calculation for the grain sorghum crop, the average STP was used as well. Therefore, since 15.82 lbs/acre of phosphorus was required for the grain sorghum crop, 30.43 lbs/acre of 11-52-0 needed to be applied. This application of 11-52-0 added 3.35 lbs/acre of nitrogen to the soil, leaving 36.65 lbs/acre of nitrogen left to fill for a grain sorghum yield of 44 bu/acre. Thus this resulted in an application of 114.54 lbs/acre of UAN (32-0-0) to fill the remaining requirement.

Calculations for the two fertilizer applications on wheat and grain sorghum were used for every scenario in the sensitivity analysis because it was assumed that although the producer may not have maximum yields at harvest, the operation will be set up so that the potential exists to do so.

Prices

The price received was also estimated. Assuming that some of these lands could come out of the program as early as 2013, an expected price received for harvest next year was desired. The original plan was to use the historical basis and the Hooker, OK spot price to calculate the 2013 expected harvest price. However recent findings by Hatchett, Brorsen, and Anderson (2010) found that due to recent structural changes in the market, use of the previous year's basis would provide a more accurate estimate of harvest price. Therefore, the following equation was used to estimate the expected harvest price:

$$EP_j = FP_{w/c} + Basis_{2012} \quad (4)$$

Where: EP = Expected Harvest Price for 2013
FP = Futures Price
w/c = wheat or corn
j = Wheat or Sorghum
Basis₂₀₁₂ = 2012 Basis for wheat or corn

The futures price for corn was used to estimate the basis for grain sorghum because grain sorghum futures do not exist. The average ten year high and low harvest price received were taken from the National Agricultural Statistics Service quick stats database for the months of July and September for wheat and sorghum respectively (U.S. Department of Agriculture 2011e).

Costs

The costs associated with the field operations were taken from the Oklahoma farm and ranch custom rates report for 2011-2012 by Doye and Sahs (2012). This report summarized data that was collected from Oklahoma farmers, ranchers, and custom

operators during the summer of 2011. Because the custom rates do not include the cost of the materials, these costs were collected from three separate cooperatives that serve the area: Perryton Equity, Hooker Equity, and Elkhart Equity. From these cooperatives a high, low and average price was determined for each one of the products. A complete list of costs for the locations on June 7th 2012 are shown in table 1.

Table 1: Product Prices from Local Cooperatives

Product Prices from local Coop					
Chemical	Units N.	Equity 1	Equity 2	Equity 3	Avg. Price
11-52-0	Lb	\$0.30	\$0.33	\$0.32	\$0.31
32-0-0 (UAN)	Lb	\$0.26	\$0.25	\$0.26	\$0.26
Glyphosate	Oz	\$0.10	\$0.14	\$0.11	\$0.11
2-4-D Amine 4	Pint	\$1.99	\$1.94		\$1.97
Dupont Ally XP	Oz	\$13.86	\$12.52	\$13.00	\$13.13
Atrazine 4L	Pint	\$1.65	\$1.61	\$1.66	\$1.64
Class Act	Oz	\$0.08	\$0.07	\$0.08	\$0.08
Interlock	Oz	\$0.43	\$0.41		\$0.42
Superb HC	Pint	\$2.60	\$2.60	\$1.38	\$2.19

The Doye and Sahs (2012) report is broken into three regions, West, Central, and East Oklahoma. When a sufficient amount of data was present, specific estimates for those regions were reported as well as state average, high, and low costs of the operation. Under normal budgeting practices, machinery depreciation, fuel, lube, etc., are all included in the budget, however it is assumed that that custom rates implicitly incorporate these costs so no budgetary action on these items were required for this study.

An opportunity cost of the land was necessary to include as well. If this land is returned back to production while there is an opportunity to reenroll the land into the

CRP, the opportunity cost assumed in this process is the cost of giving up the CRP rental payment.

Revenue Protection crop insurance was included and calculated using the median yield supplied by the NRCS estimates at 100% of the projected harvest price. Crop insurance is partially subsidized by the government. The producer pays a premium in order to enroll in the program. This premium varies with the percent of revenue he or she wishes to insure. Average yields estimated by the web soil survey were assumed to be sufficient for the calculation of revenue this research. For 2012 wheat and grain sorghum, approximately 34% and 40% of producers were enrolled in the 65% coverage level in Oklahoma for wheat and sorghum respectively. Roughly 24% and 20% were enrolled in 70% coverage for wheat and sorghum. The remaining producers were enrolled in various other coverage levels, however these were the largest percentages (Federal Crop Insurance Corporation 2012).

The cost of annual operating capital is essential to include as well. Operating capital is cash that is used for the daily operation of the business. The cost associated with operating capital is the interest that could have been collected if those resources were not tied into the operation. Therefore the cost was calculated as follows:

$$AOC_{tlr} = \left(C_{jt} * \frac{M}{12} \right) * IR \quad (5)$$

Where: AOC = Annual Operating Capital
C = Total Cost
S = Seed Cost
M = Months of capital use
IR = Interest rate
t = Tillage practice
l = Cost Level (Avg., Low, High)

Interest rates are the average effective interest rate on non-real estate bank loans made to farmers. In 2011, the interest rate for other current operating expenses was 5% and in the first quarter of 2012, the interest rate was 5%. “These data are estimates from the Federal Reserve System’s Survey of the Terms of Bank Lending to Farmers. Effective interest rates are calculated from the stated rate and other terms of the loan and weighted by loan size. Quarterly estimates are based on loans made during the first full week of the second month of the quarter. Other Current Operating Expenses are loans used primarily to finance such items as current crop production expenses and care and feeding of livestock” (Federal Reserve Bank of Kansas City 2012). Since 2008, the rate has been consistent around 5%, thus 5% was used in this study (See Appendix 2).

Base Budgets

To begin, a base budget with average costs and expected price was created for the three enterprises in a no-till, conservation-reduced till, and conventional till system (See Appendix 3 for details). As mentioned above, all costs for the machine operations in these budgets were taken from custom rates published by Doye and Sahs (2012), and material costs were gathered from local cooperatives. Crop insurance was estimated at the average rate of coverage in the area of 65% of revenue (Federal Reserve Bank of Kansas City 2012).

The resulting profit or loss for the three enterprises in each system was summed to give a total profit or loss over the three year rotation. This number was then divided by three to give the average profit or loss per year. The systems were then cross compared with one another (See appendix 3 table 1).

Break-Even Analysis

In addition to this, to further determine the potential of the land to sustain production, a break-even yield and a break-even price were calculated for each enterprise as well. The calculations for these estimates follow.

$$BEQ_{ijt} = \frac{PR_{ij}}{TC_{tj}} \quad (1)$$

$$BEP_{kjt} = \frac{Q_{kj}}{TC_{tj}} \quad (2)$$

Where: BEQ = Break-Even Yield
 BEP = Break-Even Price
 i = Price used in calculation
 j = Wheat or Sorghum
 t = Tillage practice
 k = Yield Level

Sensitivity Analysis

The low, average, and high estimates for each parameter in the enterprise budget were used to develop a sensitivity analysis for price, yield, cost, and tillage operation to determine potential points of profitability if the transition were to occur. To do this, in addition to the average level, crop insurance was estimated at the high levels of enrollment of 75% for wheat and 70% for sorghum. High and low machinery costs were taken from the custom rates, and material cost was determined in the process above. Once these numbers were gathered, costs and profits were determined in the same fashion as the base budgets. Each estimate of profit and loss for the budgets was then summed with their equivalent counterparts. This process resulted in a sensitivity analysis with a

full range of scenarios subject to the numbers in the estimate. This analysis resulted in eighty-one estimates and each scenario was considered equally likely.

Upon completion of the analysis, the number of positive estimates under each tillage system was divided by the total number of estimates in the system. This gave the percentage of time in the analysis that the operation was profitable.

Results

Profitability results were obtained for a wheat-sorghum-fallow rotation under the three tillage systems for the lands sampled in the Western part of Texas County. Using the base budgets using average costs, average yield, and expected price, the no-till system resulted in a \$31.67 loss per acre, while conservation-till and conventional till systems resulted in \$11.02 and \$16.65 losses respectively. The costs associated with these operations are found in table 2. These results were found with an expected price and average yield for wheat of \$7.01 bu and 23.48 bu/acre, and \$5.88 bu and 29.56 bu/acre for grain sorghum.

Using these costs and the field operations in appendix 1, the following per acre costs resulted for each crop under the specified tillage practice (table 2). These costs do not account for the opportunity cost of giving up the average annual CRP rental payment of \$32.34 per acre in Texas County (U.S. Department of Agriculture 2010b).

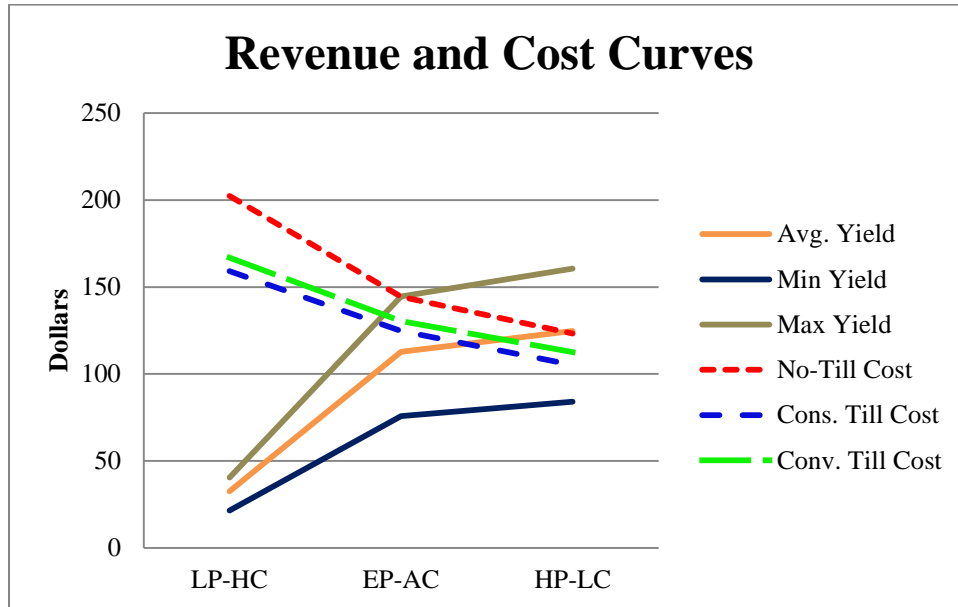
Table 2: Per Acre Costs Associated with Field Operations

Costs Per Acre Associated with Field Operations			
	Low Cost	Avg. Cost	High. Cost
No-Till Wheat	\$181.03	\$207.73	\$283.27
No-Till Sorghum	\$147.65	\$173.62	\$241.51
No-Till Fallow	\$41.29	\$52.04	\$82.19
Conservation Wheat	\$159.95	\$184.40	\$230.37
Conservation Sorghum	\$128.23	\$152.71	\$197.90
Conservation Fallow	\$27.30	\$36.83	\$49.35
Conventional Wheat	\$175.82	\$199.11	\$251.01
Conventional Sorghum	\$131.29	\$153.90	\$198.92
Conventional Fallow	\$30.45	\$38.05	\$50.40

The low prices used for wheat and sorghum were \$2.37 bu and \$1.41 bu, while high prices were \$7.54 bu and \$6.66 bu respectively. These prices are the high and low prices over the last ten years during the harvest months for each crop. The sensitivity analysis using these prices and the costs listed can be found in table 1 of appendix 3.

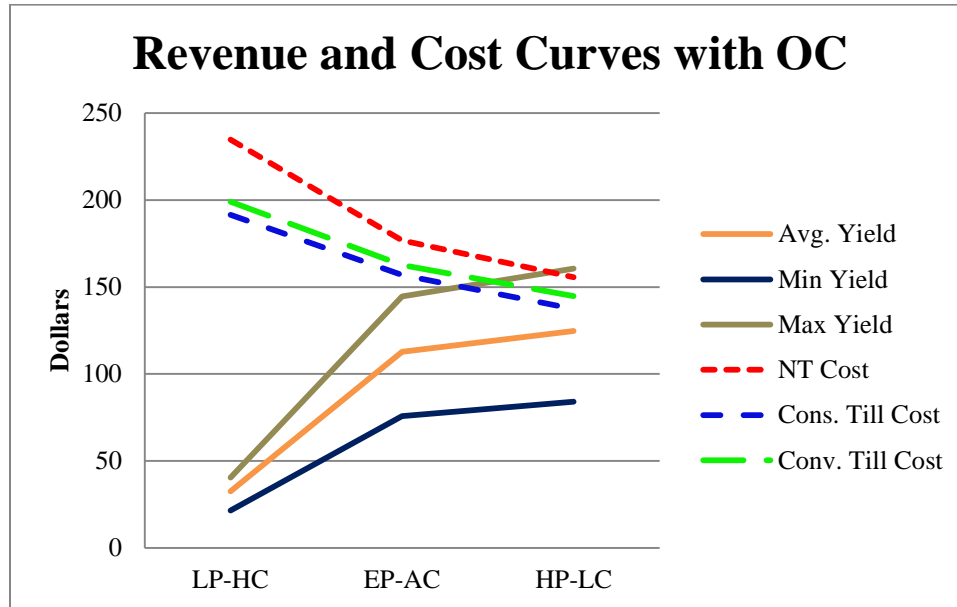
Assuming that each one of the scenarios are equally likely, it was found that the producer would be profitable in a no-till operation 14.81% of the time, while under conservation and conventional till systems they would be profitable 25.93% and 22.22% of the time (appendix 5, table 3). This is better depicted by in figure 1.

Figure 1: Revenue and Cost Curves Not Accounting for CRP Opportunity Cost



When the opportunity cost is taken into account, profitability of the no-till operation drops to 3.7% of the time, while conservation and conventional till were found to be profitable 11.11% and 3.7% of the time respectively (appendix 3, table 3). The results of this sensitivity analysis can be found in appendix 4, table 2. Figure 2 helps to summarize this.

Figure 2: Revenue and Cost Curves Accounting for CRP Opportunity Cost



Following closely with the results of the sensitivity analysis are the results of the break even analysis. Analysis on yield was conducted for the expected price, average price, and high price with average costs, low costs, and high costs. This resulted in nine analyses for each crop in each tillage system. Therefore, a total of fifty-four analyses were conducted. These analyses are shown in Table 3.

Table 3: Break-Even Analysis on Yield

Break-Even Yield									
	Avg. Cost			Low Cost			High Cost		
	EP	low P	high P	EP	low P	high P	EP	low P	high P
NT Wheat	29.63	87.65	27.55	25.83	76.39	24.01	40.41	119.52	37.57
NT Sorghum	29.53	123.03	26.05	25.11	104.63	22.16	41.08	171.14	36.24
CR Wheat	26.30	77.80	24.46	22.82	67.49	21.21	32.86	97.20	30.55
CR Sorghum	25.97	108.22	22.92	21.81	90.86	19.24	33.66	140.24	29.70
CV Wheat	28.40	84.01	26.41	25.08	74.19	23.32	35.81	105.91	33.29
CV Sorghum	26.18	109.05	23.09	22.33	93.03	19.70	33.83	140.96	29.85

With yields ranging from 14 bu/acre to 25 bu/acre for wheat, and 22 bu/acre to 44 bu/acre for grain sorghum, the percentage of time that these yields were above the break-even points in the analysis above were low. Under all three tillage systems, maximum yields for wheat and grain sorghum surpassed the numbers in the analysis 42.59% of the time, while the low yields were above these numbers only 5.56% of the time.

The break-even analysis on price was conducted in the same fashion. Analysis was generated for the average yields, low yields, and high yields with average costs, low costs, and high costs. This again resulted in nine analyses for each crop in each tillage system, for a total of fifty-four estimates. These results are shown in table 4.

Table 4: Break-Even Analysis on Price

Break-Even Price									
	Avg. Cost			Low Cost			High Cost		
	AY	LY	HY	AY	LY	HY	AY	LY	HY
NT Wheat	\$8.85	\$14.84	\$8.31	\$7.71	\$12.93	\$7.24	\$12.06	\$20.23	\$11.33
NT Sorghum	\$5.87	\$7.89	\$3.95	\$4.99	\$6.71	\$3.36	\$8.17	\$10.98	\$5.49
CR Wheat	\$7.85	\$13.17	\$7.38	\$6.81	\$11.42	\$6.40	\$9.81	\$16.46	\$9.21
CR Sorghum	\$5.17	\$6.94	\$3.47	\$4.34	\$5.83	\$2.91	\$6.69	\$9.00	\$4.50
CV Wheat	\$8.48	\$14.22	\$7.96	\$7.49	\$12.56	\$7.03	\$10.69	\$17.93	\$10.04
CV Sorghum	\$5.21	\$7.00	\$3.50	\$4.44	\$5.97	\$2.98	\$6.73	\$9.04	\$4.52

Prices ranged from \$2.37 bu to \$7.54 bu for wheat, and \$1.41 bu to \$6.66 bu for grain sorghum. Under the tillage systems examined, the top-end prices for wheat and grain sorghum surpassed the numbers in the analysis 42.59% of the time, while the low-end prices never broke the break-even point on either crop.

Conclusions

Profit will be slightly higher in the years after the initial breakout, *ceteris paribus*, however the things that will contribute to this increase are few. After the first year, there will be no need to mow the land before the herbicide applications or tillage occurs. This will drop the costs down \$10-\$20 per acre over the three year rotation. Additionally: a 48 oz application of herbicide under the no-till operation, a sweep till in the conservation system, and the chisel plow in the conventional system, will not be necessary. This will drop the cost \$10-\$19, \$8-\$13.50, and \$10-\$16 for the no-till, conservation-till, and conventional till systems over a three year rotation. The impact that these costs will make on the operation will be marginal, \$6-\$12, and will not make up for potential losses occurred under high costs or low prices. At best, this will change the percentage that the operation is profitable in the sensitivity analysis under a no-till operation from 14.81% to 18.52%, and from 25.93% to 29.63% for conservation till. Conventional-till will see no increase in the amount of time that it is expected to be profitable.

Williams, Schlegel, et al. (2010) found that (1) risk-neutral and risk-adverse decision makers would prefer CRP to crop production under January 2006 prices and December 2008 costs, and (2) that moderately to strongly risk adverse individuals would prefer CRP to any tillage system using January 2007 prices and December 2008 costs. These assessments were made when the probability of returning a profit above the CRP rental payment was 38% for conservation-reduced till and 36% for no-till for the first analysis. In the second analysis the probability for a profit above the CRP payment was 55% and 54% for conservation-reduced till and no-till respectively.

In this study; the potential for profit in the first three year rotation, accounting for the CRP opportunity cost was, 3.7%, 11.11%, and 3.7% for no-till, conservation-till, and

conventional-till systems respectively. In the years after, the potential for profit above the CRP payment is, 7.41%, 11.11%, and 11.11% under these assumptions for no-till, conservation-till, and conventional till systems respectively.

In short, if the producer chooses to return their CRP land to production, they could face returns as high as \$54.48 per acre profit to as low as a \$180.92 per acre loss depending on the costs, price received, yield, and tillage system. This assessment is not accounting for the opportunity cost of forgoing the CRP payment. When this cost is accounted for, the producer could return a profit as high as \$22.14 per acre or lose as much as \$213.26 per acre. These results pertain to Western Texas County specifically, however given its geographic similarity to many other areas of the Prairie Gateway they could be extended to other areas. However, the ultimate conclusion that can be made from these results and similar research is that the worst mistake that any researcher or government official can make in terms of the CRP is to stereotype the program. In order to gain a full understanding of the potential that these lands have outside of this region, a full range and multi-state project should be conducted.

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Appendix 1: Field Operations for No-Till, Conservation, and Conventional Tillage Practice

Table 1: No Till Field Operations for a Wheat-Sorghum-Fallow Rotation

Year	Month	Operation	Machine Op	Amount	Unit	
1	April	Mow	Mower			Fallow
1	May	Glyphosate (Roundup) w/ Adjuvant & Surfactant (Class Act)	Spray	48	oz/acre	
1		w/		0.48	oz/acre	
1		Drift Control (Interlock)		5	oz/acre	
1	June	Glyphosate (Roundup)	Spray	24	oz/acre	
1		Adjuvant & Surfactant (Class Act)		0.24	oz/acre	
1		Drift Control (Interlock)		5	oz/acre	
1	June	Broadleaf Control (2-4-D Amine 4)	Spray	4	pint/acre	
		w/				
		Adjuvant & Surfactant (Superb HC)		1	pint/acre	
		w/				
		Drift Control (Interlock)		5	oz/acre	
1	Sept	Glyphosate (Roundup) w/	Spray	24	oz/acre	
1		Adjuvant & Surfactant (Class Act)		0.24	oz/acre	
1		Drift Control (Interlock)		5	oz/acre	
1	Sept	Plant Wheat & apply	Air Seeder	60	lb/acre	Wheat
		Fertilize (18-46-0)		P Rec.	lb/acre	
2	Feb	Fertilize (32-0-0) (UAN)	Apply	Rem. N.	oz/acre	
2	March	Broadleaf Control (Dupont Ally XP) w/	Spray	0.1	oz/acre	
		Drift Control (Interlock)		5	oz/acre	
2	March	Broadleaf Control (2-4-D Amine 4)	Spray	1	pint/acre	
		w/				
		Adjuvant & Surfactant (Superb HC)		1	pint/acre	
		w/				
		Drift Control (Interlock)		5	oz/acre	
2	June	Harvest	Combine			
2	July	Glyphosate (Roundup) w/	Spray	24	oz/acre	Fallow
		Adjuvant & Surfactant (Class Act)		0.24	oz/acre	
		w/				

		Drift Control (Interlock)		5	oz/acre	
2	July	Broadleaf and Grass Control (Atrazine 4L) w/	Spray	4	pints/acre	
		Drift Control (Interlock)		5	oz/acre	

3	March	Glyphosate (Roundup) w/	Spray	24	oz/acre	Sorghum
		Adjuvant & Surfactant (Class Act) w/		0.24	oz/acre	
		Drift Control (Interlock)		5	oz/acre	
3	April	Glyphosate (Roundup) w/	Spray	24	oz/acre	
		Adjuvant & Surfactant (Class Act) w/		0.24	oz/acre	
		Drift Control (Interlock)		5	oz/acre	
3	April	Plant Sorghum & apply	Air Seeder	3	lb/acre	
		Fertilize (18-46-0)		P Rec.	lb/acre	
3	June	Fertilize (32-0-0) (UAN)	Apply	Rem. N.	oz/acre	
3	June	Broadleaf Control (2-4-D Amine 4) w/	Spray	1	pints/acre	
		Adjuvant & Surfactant (Superb HC) w/		1	pint/acre	
		Drift Control (Interlock)		5	oz/acre	
3	Sept	Harvest	Combine			

Table 2: Conservation Till Field Operations for a Wheat-Sorghum-Fallow Rotation

Year	Month	Operation	Machine Op	Amount	Unit	
1	April	Mow	Mower			Fallow
1	May	Sweep Till 1	Sweep			
1	June	Sweep Till 2	Sweep			
1	Sept	Sweep Till 3	Sweep			

1	Sept	Plant Wheat & apply	Air Seeder	60	lb/acre	Wheat
		Fertilize (18-46-0)		P Rec.	lb/acre	
1	Sept	Fertilize (32-0-0) (UAN)	Apply	Rem. N.	oz/acre	
2	March	Broadleaf Control (Dupont Ally XP) w/	Spray	0.1	oz/acre	
		Drift Control (Interlock)		5	oz/acre	
2	June	Harvest	Combine			

2	July	Sweep Till 1	Sweep			Fallow
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3	April	Sweep Till 2	Sweep			
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3	April	Plant Sorghum & apply	Air Seeder	3	lb/acre	Sorghum
		Fertilize (18-46-0)		P Rec.	lb/acre	
3	May	Fertilize (32-0-0) (UAN)	Apply	Rem. N.	oz/acre	
3	July	Broadleaf Control (2-4-D Amine 4) w/	Spray	1	pints/acre	
		Adjuvant & Surfactant (Superb HC) w/		1	pint/acre	
		Drift Control (Interlock)		5	oz/acre	
3	Sept	Harvest	Combine			

Table 2: Conservation Till Field Operations for a Wheat-Sorghum-Fallow Rotation

Year	Month	Operation	Machine Op	Amount	Unit	
1	April	Mow	Mower			Fallow
1	May	Chisel Plow	Chisel			
1	June	Tandem Disk	Tandem Disk			

1	Aug	Tandem Disk	Tandem Disk			Wheat
1	Aug	Chisel w/9 inch sweeps and harrow	Chisel			
1	Sept	Plant Wheat & apply	Air Seeder	60	lb/acre	
		Fertilize (18-46-0)		P Rec.	lb/acre	
1	Sept	Fertilize (32-0-0) (UAN)	Apply	Rem. N.	oz/acre	
2	March	Broadleaf Control (Dupont Ally XP) w/	Spray	0.1	oz/acre	
2		Drift Control (Interlock)		5	oz/acre	
2	June	Harvest	Combine			

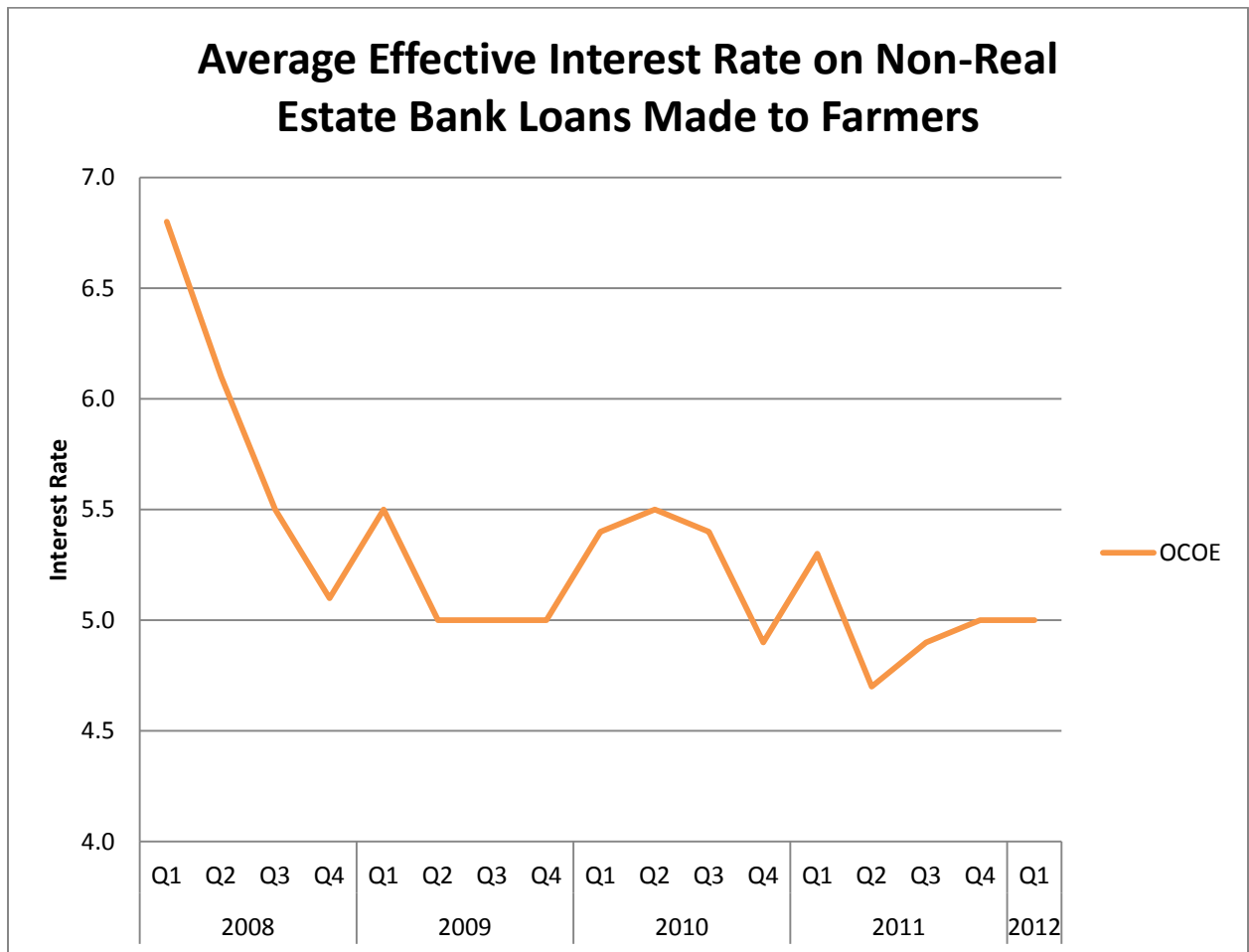
2	July	Tandem Disk	Tandem Disk			Fallow
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3	April	Tandem Disk	Tandem Disk			Sorghum
3	April	Plant Sorghum & apply	Air Seeder	3	lb/acre	
		Fertilize (18-46-0)		P Rec.	lb/acre	
3	May	Fertilize (32-0-0) (UAN)	Apply	Rem. N.	oz/acre	

3	July	Broadleaf Control (2-4-D Amine 4) w/	Spray	1	pints/acre	
		Adjuvant & Surfactant (Superb HC) w/		1	pint/acre	
		Drift Control (Interlock)		5	oz/acre	
3	Sept	Harvest	Combine			

Appendix 2: Average Effective Interest Rate on Non-Real Estate Bank Loans Made to Farmers

Table 1: Other Current Operating Expenses



Appendix 3: Enterprise Budgets for No-Till, Conservation-Reduced Till, Conventional Till Systems under Average Costs and Expected prices

Budget 1: No-Till Wheat

Dryland No-Till Wheat Enterprise Budget - Grain Only					
2012 Harvest Price Projection Wheat-Sorghum-Fallow Rotation					
ITEM	Units	E Price (\$)	Qt.	Excess	\$/Acre
Returns to Wheat	Bu.	\$7.01	23.48		\$164.59
Total Revenue					\$164.59
COST					
Seed	lb	\$0.25	60		\$15.00
Fertilizer					
11-52-0	lb	\$0.31	32		\$10.03
UAN (32-0-0)	lb	\$0.26	136.84		\$35.24
Herbicide					
Glyphosate (Roundup)	oz	\$0.11	96		\$10.92
Broadleaf Control (2-4-D Amine 4)	pint	\$1.97	5		\$9.83
Broadleaf Control (Dupont Ally XP)	oz	\$13.13	0.1		\$1.31
Other Chemical					
Adjuvant & Surfactant (Superb HC)	pint	\$2.19	1		\$2.19
Adjuvant & Surfactant (Class Act)	oz	\$0.08	0.96		\$0.07
Drift Control (Interlock)	oz	\$0.42	24		\$10.01
Crop Insurance (65%) 2012	acre	\$15.00	1		\$15.00
Annual Operating Capital	%	0.05000	\$144.80		\$7.24
Machine Operation					
Mow	acre	\$13.80	1		\$13.80
Air Seeder with Fertilizer	acre	\$15.58	1		\$15.58
Fert. Liq. App	acre	\$4.37	1		\$4.37
Herb App	acre	\$5.07	6		\$30.42
Combine	acre	\$21.06	1		\$21.06
Extra charge for bu/acre > 30	bu	\$0.21	3.48	\$0.73	\$0.73
Hauling Small Grains	bu	\$0.21	23.48		\$4.93
Total Cost					\$207.73
Net Return to Land, Overhead, and Mgmt.					(\$43.13)
Net Return for 1/3 acre					(\$14.38)

Budget 2: No-Till Sorghum

Dryland No-Till Sorghum Enterprise Budget - Grain Only					
2012 Harvest Price Projection Wheat-Sorghum-Fallow Rotation					
ITEM	Units	Price (\$)	Qt.	>30	\$/Acre
Returns to Sorghum	bu	\$5.88	29.5616		\$173.80
Total Revenue					\$173.80
COST					
Seed	lb	\$1.40	3.00		\$4.20
Fertilizer					
11-52-0	lb	\$0.31	30.43		\$9.53
UAN (32-0-0)	lb	\$0.26	114.54		\$29.49
Herbicide					
Glyphosate (Roundup)	oz	\$0.11	72.00		\$8.19
Broadleaf Control (2-4-D Amine 4)	pint	\$1.97	1.00		\$1.97
Broadleaf and Grass Control (Atrazine 4L)	pint	\$1.64	4.00		\$6.56
Other Chemical					
Adjuvant & Surfactant (Superb HC)	pint	\$2.19	1.00		\$2.19
Adjuvant & Surfactant (Class Act)	oz	\$0.08	0.72		\$0.06
Drift Control (Interlock)	oz	\$0.42	20.00		\$8.34
Crop Insurance (65%) 2012	acre	\$11.00	1.00		\$11.00
Annual Operating Capital	%	0.05000	\$58.60		\$2.93
Machine Operation					
Mow	acre	\$13.80	1.00		\$13.80
Air Seeder with Fertilizer	acre	\$15.58	1.00		\$15.58
Fert. Liq. App	acre	\$4.37	1.00		\$4.37
Herb App	acre	\$5.07	5.00		\$25.35
Combine	acre	\$22.67	1.00		\$22.67
Extra charge for bu/acre > 30	bu	\$0.23	-0.44	\$0.10	\$0.00
Hauling Small Grains	bu	\$0.25	29.56		\$7.39
Total Cost					\$173.62
Net Return to Land, Overhead, and Mgmt.					\$0.18
Net Return for 1/3 acre					\$0.06

Budget 3: No-Till Fallow

Dryland No-Till Fallow Enterprise Budget - Grain Only					
Wheat-Sorghum-Fallow Rotation					
ITEM	Units	Price (\$)	Qt.	>20	\$/acre
Returns	bu	\$0.00	0.00		\$0.00
Total Revenue					\$0.00
COST					
Herbicide					
Glyphosate (Roundup)	oz	\$0.11	48.00		\$5.46
Broadleaf Control (2-4-D Amine 4)	pint	\$1.97	4.00		\$7.87
Other Chemical					
Adjuvant & Surfactant (Superb HC)	pint	\$2.19	1.00		\$2.19
Adjuvant & Surfactant (Class Act)	oz	\$0.08	0.48		\$0.04
Drift Control (Interlock)	oz	\$0.42	12.00		\$5.01
Crop Insurance (65%) 2012	acre	\$15.00	0.00		\$0.00
Annual Operating Capital	%	0.05000	\$49.56		\$2.48
Machine Operation					
Mow	acre	\$13.80	1		\$13.80
Air Seeder with Fertilizer	acre	\$15.58	0		\$0.00
Fert. Liq. App	acre	\$4.37	0		\$0.00
Herb App	acre	\$5.07	3		\$15.21
Combine	acre	\$21.06	0		\$0.00
Extra charge for bu/acre > 30	bu	\$0.21	-20.00	\$4.20	\$0.00
Fieldwork through Harvesting	acre	\$86.67	0		\$0.00
Hauling Small Grains	bu	\$0.21	0.00		\$0.00
Total Cost					\$52.04
Net Return to Land, Overhead, and Mgmt.					(\$52.04)
Net Return for 1/3 acre					(\$17.35)

Budget 4: Conservation-Reduced Till Wheat

Dryland Conservation-Reduced Wheat Enterprise Budget - Grain Only					
2012 Harvest Price Projection Wheat-Sorghum-Fallow Rotation					
ITEM	Units	Price (\$)	Qt.	>20	\$/Acre
Returns to Wheat	Bu.	\$7.01	23.48		\$164.59
Total Revenue					\$164.59
COST					
Seed	lb	\$0.25	60		\$15.00
Fertilizer					
11-52-0	lb	\$0.31	32		\$10.03
UAN (32-0-0)	lb	\$0.26	136.84		\$35.24
Herbicide					
Broadleaf Control (Dupont Ally XP)	oz	\$13.13	0.1		\$1.31
Other Chemical					
Drift Control (Interlock)	oz	\$0.42	4		\$1.67
Crop Insurance (65%) 2012	acre	\$15.00	1		\$15.00
Annual Operating Capital	%	0.05000	\$124.15		\$6.21
Machine Operation					
Mow	acre	\$13.80	1		\$13.80
Sweep Till	acre	\$10.64	3		\$31.92
Air Seeder with Fertilizer	acre	\$15.58	1		\$15.58
Fert. Liq. App	acre	\$4.37	1		\$4.37
Herb App	acre	\$5.07	1		\$5.07
Combine	acre	\$21.06	1		\$21.06
Extra charge for bu/acre > 30	bu	\$0.21	3.48	\$0.73	\$0.73
Hauling Small Grains	bu	\$0.21	23.48		\$4.93
Total Cost					\$181.91
Net Return to Land, Overhead, and Mgmt.					(\$17.32)
Net Return for 1/3 acre					(\$5.77)

Budget 5: Conservation-Reduced Till Sorghum

Dryland Conservation-Reduced Till Sorghum Enterprise Budget - Grain Only					
2012 Harvest Price Projection Wheat-Sorghum-Fallow Rotation					
ITEM	Units	Price (\$)	Qt.	>30	\$/Acre
Returns to Sorghum	bu	\$5.88	29.56		\$173.80
Total Revenue					\$173.80
COST					
Seed	lb	\$1.40	3.00		\$4.20
Fertilizer					
11-52-0	lb	\$0.31	30.43		\$9.53
UAN (32-0-0)	lb	\$0.26	114.54		\$29.49
Herbicide					
Broadleaf Control (2-4-D Amine 4)	pint	\$1.97	1.00		\$1.97
Other Chemical					
Adjuvant & Surfactant (Superb HC)	pint	\$2.19	1.00		\$2.19
Drift Control (Interlock)	oz	\$0.42	4.00		\$1.67
Crop Insurance (65%) 2012	acre	\$11.00	1.00		\$11.00
Annual Operating Capital	%	0.05000	\$50.06		\$2.50
Machine Operation					
Mow	acre	\$13.80	1.00		\$13.80
Sweep Till	acre	\$10.64	2.00		\$21.28
Air Seeder with Fertilizer	acre	\$15.58	1.00		\$15.58
Fert. Liq. App	acre	\$4.37	1.00		\$4.37
Herb App	acre	\$5.07	1.00		\$5.07
Combine	acre	\$22.67	1.00		\$22.67
Extra charge for bu/acre > 30	bu	\$0.23	-0.44	\$0.10	\$0.00
Hauling Small Grains	bu	\$0.25	29.56		\$7.39
Total Cost					\$152.71
Net Return to Land, Overhead, and Mgmt.					\$21.09
Net Return for 1/3 acre					\$7.03

Budget 6: Conservation-Reduced Till Fallow

Dryland Conservation-Reduced Till Fallow Enterprise Budget - Grain Only					
Wheat-Sorghum-Fallow Rotation					
ITEM	Units	Price	Qt.	>20	\$/acre
Returns	bu	\$0.00	0.00		\$0.00
Total Revenue					\$0.00
COST					
Herbicide					
Glyphosate (Roundup)	oz	\$0.11	0.00		\$0.00
Broadleaf Control (2-4-D Amine 4)	pint	\$1.97	0.00		\$0.00
Other Chemical					
Adjuvant & Surfactant (Superb HC)	pint	\$2.19	0.00		\$0.00
Adjuvant & Surfactant (Class Act)	oz	\$0.08	0.00		\$0.00
Drift Control (Interlock)	oz	\$0.42	0.00		\$0.00
Crop Insurance (65%) 2012	acre	\$15.00	0.00		\$0.00
Annual Operating Capital	%	0.05000	\$35.08		\$1.75
Machine Operation					
Mow	acre	\$13.80	1		\$13.80
Sweep Till	acre	\$10.64	2		\$21.28
Air Seeder with Fertilizer	acre	\$15.58	0		\$0.00
Fert. Liq. App	acre	\$4.37	0		\$0.00
Herb App	acre	\$5.07	0		\$0.00
Combine	acre	\$21.06	0		\$0.00
Extra charge for bu/acre > 30	bu	\$0.21	-20.00	\$4.20	\$0.00
Hauling Small Grains	bu	\$0.21	0.00		\$0.00
Total Cost					\$36.83
Net Return to Land, Overhead, and Mgmt.					(\$36.83)
Net Return for 1/3 acre					(\$12.28)

Budget 7: Conventional Till Wheat

Dryland Conventional Wheat Enterprise Budget - Grain Only					
2012 Harvest Price Projection Wheat-Sorghum-Fallow Rotation					
ITEM	Units	Price (\$)	Qt.	> 20	\$/Acre
Returns to Wheat	Bu.	\$7.01	23.48		\$164.59
Total Revenue					\$164.59
COST					
Seed	lb	\$0.25	60.00		\$15.00
Fertilizer					
11-52-0	lb	\$0.31	32.00		\$10.03
UAN (32-0-0)	lb	\$0.26	136.84		\$35.24
Herbicide					
Broadleaf Control (Dupont Ally XP)	oz	\$13.13	0.10		\$1.31
Other Chemical					
Drift Control (Interlock)	oz	\$0.42	4.00		\$1.67
Crop Insurance (65%) 2012	acre	\$15.00	1.00		\$15.00
Annual Operating Capital	%	0.05000	\$135.74		\$6.79
Machine Operation					
Mow	acre	\$13.80	1.00		\$13.80
Chisel Plowing	acre	\$11.69	2.00		\$23.38
Tandum Disk	acre	\$11.22	2.00		\$22.44
Air Seeder with Fertilizer	acre	\$15.58	1.00		\$15.58
Fert. Liq. App	acre	\$4.37	1.00		\$4.37
Herb App	acre	\$5.07	1.00		\$5.07
Combine	acre	\$21.06	1.00		\$21.06
Extra charge for bu/acre > 30	bu	\$0.21	3.48	\$0.73	\$0.73
Hauling Small Grains	bu	\$0.21	23.48		\$4.93
Total Cost					\$196.39
Net Return to Land, Overhead, and Mgmt.					(\$31.80)
Net Return for 1/3 acre					(\$10.60)

Budget 8: Conventional Till Sorghum

Dryland Conventional Till Sorghum Enterprise Budget - Grain Only					
2012 Harvest Price Projection Wheat-Sorghum-Fallow Rotation					
ITEM	Units	Price (\$)	Qt.	> 30	\$/Acre
Returns to Sorghum	bu	\$5.88	29.56		\$173.80
Total Revenue					\$173.80
COST					
Seed	lb	\$1.40	3.00		\$4.20
Fertilizer					
11-52-0	lb	\$0.31	30.43		\$9.53
UAN (32-0-0)	lb	\$0.26	114.54		\$29.49
Herbicide					
Broadleaf Control (2-4-D Amine 4)	pint	\$1.97	1.00		\$1.97
Other Chemical					
Adjuvant & Surfactant (Superb HC)	pint	\$2.19	1.00		\$2.19
Drift Control (Interlock)	oz	\$0.42	4.00		\$1.67
Crop Insurance (65%) 2012	acre	\$11.00	1.00		\$11.00
Annual Operating Capital	%	0.05000	\$50.55		\$2.53
Machine Operation					
Mow	acre	\$13.80	1.00		\$13.80
Tandum Disk	acre	\$11.22	2.00		\$22.44
Air Seeder with Fertilizer	acre	\$15.58	1.00		\$15.58
Fert. Liq. App	acre	\$4.37	1.00		\$4.37
Herb App	acre	\$5.07	1.00		\$5.07
Combine	acre	\$22.67	1.00		\$22.67
Extra charge for bu/acre > 30	bu	\$0.23	-0.44	\$0.10	\$0.00
Hauling Small Grains	bu	\$0.25	29.56		\$7.39
Total Cost					\$153.90
Net Return to Land, Overhead, and Mgmt.					\$19.90
Net Return for 1/3 acre					\$6.63

Budget 9: Conventional Till Fallow

Dryland Conventional Fallow Enterprise Budget - Grain Only					
Wheat-Sorghum-Fallow Rotation					
ITEM	Units	Price (\$)	Qt.	>20	\$/acre
Returns	bu	\$0.00	0.00		\$0.00
Total Revenue					\$0.00
COST					
Herbicide					
Glyphosate (Roundup)	oz	\$0.11	0.00		\$0.00
Broadleaf Control (2-4-D Amine 4)	pint	\$1.97	0.00		\$0.00
Other Chemical					
Adjuvant & Surfactant (Superb HC)	pint	\$2.19	0.00		\$0.00
Adjuvant & Surfactant (Class Act)	oz	\$0.08	0.00		\$0.00
Drift Control (Interlock)	oz	\$0.42	0.00		\$0.00
Crop Insurance (65%) 2012	acre	\$15.00	0.00		\$0.00
Annual Operating Capital	%	0.05000	\$36.24		\$1.81
Machine Operation					
Mow	acre	\$13.80	1		\$13.80
Tandum Disk	acre	\$11.22	2		\$22.44
Air Seeder with Fertilizer	acre	\$15.58	0		\$0.00
Fert. Liq. App	acre	\$4.37	0		\$0.00
Herb App	acre	\$5.07	0		\$0.00
Combine	acre	\$21.06	0		\$0.00
Extra charge for bu/acre > 30	bu	\$0.21	-20.00	\$4.20	\$0.00
Hauling Small Grains	bu	\$0.21	0.00		\$0.00
Total Cost					\$38.05
Net Return to Land, Overhead, and Mgmt.					(\$38.05)
Net Return for 1/3 acre					(\$12.68)

Appendix 4: Sensitivity Analysis on Cost, Price, and Yield

Table 1: Without Accounting for Opportunity Cost

No-Till Sensitivity Analysis			
	10 Year Low Price		
	HC	AC	LC
Max. Yield	(\$163.41)	(\$105.19)	(\$83.81)
Avg. Yield	(\$169.87)	(\$112.01)	(\$90.87)
Min Yield	(\$180.92)	(\$123.05)	(\$101.92)
	Expected 2013 Price		
	HC	AC	LC
Max. Yield	(\$59.21)	(\$1.00)	\$20.39
Avg. Yield	(\$89.53)	(\$31.67)	(\$10.53)
Min Yield	(\$126.50)	(\$68.63)	(\$47.50)
	10 Year High Price		
	HC	AC	LC
Max. Yield	(\$43.28)	\$14.93	\$36.32
Avg. Yield	(\$77.65)	(\$19.78)	\$1.35
Min Yield	(\$118.27)	(\$60.41)	(\$39.27)
Conservation-Reduced Till Sensitivity Analysis			
	10 Year Low Price		
	HC	AC	LC
Max. Yield	(\$120.29)	(\$85.38)	(\$65.64)
Avg. Yield	(\$126.75)	(\$92.19)	(\$72.70)
Min Yield	(\$137.80)	(\$103.24)	(\$83.75)
	Expected 2013 Price		
	HC	AC	LC
Max. Yield	(\$16.09)	\$18.82	\$38.56
Avg. Yield	(\$46.41)	(\$11.85)	\$7.64
Min Yield	(\$83.38)	(\$48.82)	(\$29.33)

	10 Year High Price		
	HC	AC	LC
Max. Yield	(\$0.16)	\$34.74	\$54.48
Avg. Yield	(\$34.53)	\$0.03	\$19.52
Min Yield	(\$75.15)	(\$40.59)	(\$21.10)

Conventional-Till Sensitivity Analysis

	10 Year Low Price		
	HC	AC	LC
Max. Yield	(\$127.86)	(\$91.08)	(\$73.00)
Avg. Yield	(\$134.32)	(\$97.90)	(\$80.07)
Min Yield	(\$145.37)	(\$108.94)	(\$91.11)

	Expected 2013 Price		
	HC	AC	LC
Max. Yield	(\$23.66)	\$13.11	\$31.20
Avg. Yield	(\$53.98)	(\$17.55)	\$0.28
Min Yield	(\$86.83)	(\$54.52)	(\$36.69)

	10 Year High Price		
	HC	AC	LC
Max. Yield	(\$7.73)	\$29.04	\$47.12
Avg. Yield	(\$42.10)	(\$5.67)	\$12.16
Min Yield	(\$82.72)	(\$46.30)	(\$28.46)

Table 1: Accounting for Opportunity Cost

No-Till Sensitivity Analysis

	10 Year Low Price		
	HC	AC	LC
Max. Yield	(\$195.75)	(\$137.53)	(\$116.15)
Avg. Yield	(\$202.21)	(\$144.35)	(\$123.21)
Min Yield	(\$213.26)	(\$155.39)	(\$134.26)

	Expected 2013 Price		
	HC	AC	LC
Max. Yield	(\$91.55)	(\$33.34)	(\$11.95)
Avg. Yield	(\$121.87)	(\$64.01)	(\$42.87)
Min Yield	(\$158.84)	(\$100.97)	(\$79.84)

	10 Year High Price		
	HC	AC	LC
Max. Yield	(\$75.62)	(\$17.41)	\$3.98
Avg. Yield	(\$109.99)	(\$52.12)	(\$30.99)
Min Yield	(\$150.61)	(\$92.75)	(\$71.61)

Conservation-Reduced Till Sensitivity Analysis

	10 Year Low Price		
	HC	AC	LC
Max. Yield	(\$152.63)	(\$117.72)	(\$97.98)
Avg. Yield	(\$159.09)	(\$124.53)	(\$105.04)
Min Yield	(\$170.14)	(\$135.58)	(\$116.09)

	Expected 2013 Price		
	HC	AC	LC
Max. Yield	(\$48.43)	(\$13.52)	\$6.22
Avg. Yield	(\$78.75)	(\$44.19)	(\$24.70)
Min Yield	(\$115.72)	(\$81.16)	(\$61.67)

	10 Year High Price		
	HC	AC	LC
Max. Yield	(\$32.50)	\$2.40	\$22.14
Avg. Yield	(\$66.87)	(\$32.31)	(\$12.82)
Min Yield	(\$107.49)	(\$72.93)	(\$53.44)

Conventional-Till Sensitivity Analysis

	10 Year Low Price		
	HC	AC	LC
Max. Yield	(\$160.20)	(\$123.42)	(\$105.34)
Avg. Yield	(\$166.66)	(\$130.24)	(\$112.41)

Min Yield	(\$177.71)	(\$141.28)	(\$123.45)
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	Expected 2013 Price		
	HC	AC	LC
Max. Yield	(\$56.00)	(\$19.23)	(\$1.14)
Avg. Yield	(\$86.32)	(\$49.89)	(\$32.06)
Min Yield	(\$119.17)	(\$86.86)	(\$69.03)

	10 Year High Price		
	HC	AC	LC
Max. Yield	(\$40.07)	(\$3.30)	\$14.78
Avg. Yield	(\$74.44)	(\$38.01)	(\$20.18)
Min Yield	(\$115.06)	(\$78.64)	(\$60.80)

Table 3: Percentage of the Time Profitable

Percentage of Time Profitable			
Without Accounting for OC		Accounting for OC	
No-Till would be profitable	14.81%	No-Till would be profitable	3.70%
Cons. Till would be profitable	25.93%	Cons. Till would be profitable	11.11%
Conv. Till would be profitable	22.22%	Conv. Till would be profitable	3.70%