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A Comparison of the Economic Profitability of Specified Risk Management Alternatives for Intermountain West Farmers

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A COMPARISON OF THE ECONOMIC PROFITABILITY OF SPECIFIED RISK

MANAGEMENT ALTERNATIVES FOR INTERMOUNTAIN WEST FARMERS

by

Cody Dean Bingham

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Alternatives for Intermountain West Farmers

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The purpose of this research is to provide quantitative and limited qualitative analysis for the United States Intermountain West on the economic effectiveness of risk management alternatives in an agricultural operation. This research is not meant to be an exhaustive comparison of every potential combination of alternatives and risk scenarios. Instead, specific parameters such as farm size, crops grown, risk attitudes and risk management strategies are set to guide the research and offer a basis of comparison.

This research evaluates several levels of coverage using Multiple Peril Crop Insurance, Crop Revenue Coverage Insurance, Adjusted Gross Revenue – Lite Insurance and a limited interaction of the futures market. Microsoft Excel and the add-in Simetar was used to perform the quantitative analysis. A set of spreadsheets were created to allow a variety of data to be easily input and manipulated. The values used in this research were based on the 2002 Census of Agriculture to create a "typical" farm considered in Box Elder County, Utah.

The results generated were sorted and ranked according to four decision criteria in relation to the net income observed in each simulated scenario. These include: the probability that net income will exceed $0; a maxi-min; a maxi-max; and the maximum positive net income at a probability of occurrence of 0.5, resembling a Safety-First criterion. The later three decision criterion used correspond to risk attitudes that may be possessed by a producer: risk adverse, risk preferring or seeking, and risk neutral respectively.

The quantitatively "best" observed results were then qualitatively compared to the next "best" result. In general the conclusion is made that some strategy is better than no strategy and the "best" risk management strategy is one compatible with the risk attitude of the producer and the parameters of the farm in consideration. There is no single strategy for all decision criterions that consistently outperforms all other strategies considered in this research.

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I declare that the dissertation represents the results of my own research or advanced studies and that it has been compiled by me. Where appropriate, I have made acknowledgement to the work of others.

Signed,

Cody Dean Bingham
April 14, 2008

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This dissertation has taken a lot of dedication to complete; on my part as well as several other individuals. I would never have completed all the work in the time frame I did without the help and motivation of my dear wife Elizabeth. In the midst of what seemed like a chaotic time in our lives, she kept me focused. The quality of the research completed would have been significantly lower without the help of my dissertation committee, in particular Dr. E. Bruce Godfrey. His patience and knowledge are qualities I admire in him and put to the test in working to complete this task.

I also need to publicly thank two individuals who graciously volunteered their time to edit this work. Marjorie May and Gayla Otto have limited backgrounds in risk management, agriculture and econometrics, but their literary expertise far exceeds my own and greatly enhanced the quality of writing. Many other individuals took time out of their normal schedules and added to my education, data collection, model identification, literature collection and reference, as well as editing, and I wish I could thank each one individually because this dissertation would not be what it is without everyone that has contributed to the final status.

Cody D. Bingham

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SUMMARY OF ABBREVIATIONS

AGR – Adjusted Gross Revenue
AGR-Lite – Adjusted Gross revenue – Lite
APH – Actual Production History
ARMS - Agricultural Resource Management Study
CBOT – Chicago Board of Trade
CDF – Cumulative Density Function
CRC- Crop Revenue Coverage
ERS – Economic Research Service
FCIC – Federal Crop Insurance Corporation
FLIPSIM – Firm Level Income Tax and Farm Policy Simulation Model
IRS – Internal Revenue Service
MPCI – Multiple Peril Crop Insurance
MVE – Multi-Variate Empirical Distribution
NASS – National Agricultural Statistics Service
NYMEX – New York Mercantile Exchange
P - Probability
PDF – Probability Density Function
RMA – Risk Management Agency
TAES – Texas Agricultural Experiment Station
U.S. – United States
USA – United States of America
USDA – United States Department of Agriculture
USU – Utah State University

CHAPTER I

INTRODUCTION

Topic

Agriculture producers are faced with a myriad of decisions on managing risks associated with their industry. Producers had few choices early in history to help manage risks. They could either choose to produce or choose not to produce and from several products. As the human population has progressed economically, socially and technologically, various types of agricultural risk have been defined. These risks generally fall into one or more of five categories: production, market or price, human, legal/institutional and financial.

Some or all of these risks can be ignored, but the organization that disregards any such risks increases the possibility of suffering devastating consequences in its operations. Many farmers and ranchers have become more aware of and have implemented the use of risk management strategies, such as diversification, but other strategies are not as commonly used. For example, Utah has been declared an “underserved state” by the United States Department of Agriculture (USDA) because farmers in the state use federally subsidized crop insurance less commonly than in other states such as Minnesota (RMA Strategic Plan 2007). There is also considerable variation between the use of risk management strategies by type of operation (e.g. dry land wheat versus irrigated wheat) and location. A number of risk management strategies such as futures and options markets, federal aide programs, various types of federally subsidized insurance (e.g., multiple–peril insurance, cash revenue insurance) might also be used. The use of any or all of these, as well as other alternatives has different impacts on the returns a producer might obtain. None are 'cost free' and may have differing impacts on the returns obtained.

Research has not been performed quantitatively for the Intermountain West area to show how different risk management alternatives affect an operation. Many producers understand there is risk involved in production but are unable or unfamiliar with how to quantitatively define or evaluate risk management alternatives. This research is not meant to be an exhaustive comparison of every potential combination of alternatives and risk scenarios due to the enormity of such a task. Instead, specific parameters such as farm size, crops grown, risk attitudes and risk management strategies are established to guide the analysis and offer a basis of comparison. Establishing such a basis will, if used, help agricultural producers further understand the potential economic benefits of adopting particular risk management strategies. This research will also serve as an example of how comparisons can be made with regard to similar topics.

Methods

In order to accomplish the desired results of this dissertation, a broad to narrow approach has been taken, typically in chronological order where it applies. The literature review encompasses broad research by examining established research and summarizing important topics, of which a basic comprehension is necessary to fully utilize the information contained within this research.

The narrow approach takes many of the established topics found in the literature review and applies them to a “typical” Intermountain West farm proposed to be located in Box Elder County, Utah. Focus is given to the effects of risk management tools available to farmers in the proposed area while holding constant many other variables (e.g. changes in agricultural policy or changes to farm size or structure). The tools being analyzed are Multi-Peril Crop Insurance (MPCI), Crop Revenue Coverage (CRC), Adjusted Gross Revenue – Lite Insurance (AGR-Lite), and a limited influence of participation in the futures market.

Econometric tools are the main source of validation for the scenarios considered. To complete this research, Microsoft Excel© with its spreadsheet capabilities as well as an add-in known as Simetar© are used. These programs offer a user friendly interface to complete complex function computations and analysis. These programs simplified and reduced the time required to complete associated mathematical, statistical and economic analysis.

Objectives and Scope

Many studies have been previously completed in regards to the benefits of risk management and agricultural risks. For example, more than 2,300 publications have been written and posted on the national risk management web site (http://www.agrisk.umn.edu/Library/Topics.aspx?LIB=AR) (Regents 2007).

The general concepts outlined in these publications have been summarized in the literature review compromising the next chapter. However, none of these publications directly quantify and compare risk management alternatives for the Intermountain West. The purpose of this study is to directly quantify and compare several specified risk management tools for the designated area. The specific objective of this study is to:

- Determine which risk management alternatives offer the “best” economic results based upon the simulation results.

In order to accomplish this objective the following tasks where followed:

- To review the literature available to become familiar with topics related to risk management and economic analysis.
- To develop sufficient data to depict a “typical” farm found in the Box Elder County region of the state of Utah in the Intermountain West.
- To develop historical financial information for this “typical” farm.
- To integrate the ability to manipulate the risk management economic effects in the financial information.
- To develop probability distributions for crop yields, harvest cash prices and basis values for the specified region.
- To simulate the selected risk management strategies for multiple scenarios for the established “typical” farm in the Intermountain West.

This dissertation includes seven chapters. Chapter two will review relevant topics previously published. Chapter three contains a description of the data used in this study. Chapter four discusses the methodology used in collecting data, data manipulation, data validation, and data interpretation. Chapter five presents the findings of the research conducted. Chapter six gives the summary, conclusion, and recommendations for application and future research. Chapter seven is a self reflection of the author in relation to completing this dissertation.

CHAPTER II

LITERATURE REVIEW

Today's agricultural producers are faced with a multitude of pressures, many of which originate outside of the producer's business organization. In spite of aspects that may be out of a producer's control, the producer's actions and reactions are major keys to determine the profitability of a firm. Education or knowledge of outcomes pertaining to influences on an organization can help the producer select the correct actions and reactions (Boehlje & Eidman 1984). This is one of the stated goals of this dissertation: to offer an educational resource pertaining to several risk management alternatives available. To fully understand the results of this research, there are several subjects that, when better understood help clarify the findings.

Risk

The first concept to be understood is risk, particularly risks related to agriculture. Risk as a noun is generally defined as, "the chance of something going wrong" (Encarta 2007). This definition alone does not offer any benefit to a producer, therefore further clarification is needed to explain an important difference between "risk" and "uncertainty." While the words can and are used interchangeably there is a fundamental difference. Risk is an event whose outcome is unknown, but the mathematical odds of those outcomes can be quantified (Knight 1921). Uncertainty, however, includes those events that occur in which the outcome is unknown, and the associated odds cannot be ascertained (Knight 1921). Examples to further help clarify this point could be that risk is similar to the odds associated with playing a hand of poker, whereas uncertainty is more like placing a friendly bet about the weather several years in the future (Goodwin & Ker 2002).

Uncertainty as previously defined is more dominant in agriculture (Mapp et. al 1979). A good example to substantiate this is the “uncertainty” of the weather or the condition of the economy at some future moment. While historical records exist establishing previous weather and economic patterns, no one knows quantitatively what will occur in the future. This requires such “risks” to be estimated (Goodwin & Ker 2002). Throughout the past several decades, risk has come to be quantified or represented using statistical tools, such as the variance and probability density functions (PDF) (Goodwin & Ker 2002). Using such information, an individual can quantitatively compare potentially risky outcomes of a decision.

Risk is also subject to the individual or firm involved. The “risk attitude” of the entity will determine which option(s) will be pursued. Risk attitudes are generally broken into three categories as described by Darren Hudson (2007) and Michael Boehlje & Vernon Eidman (1984):

- Risk Neutral are individuals that show indifference towards the level of risk associated with making decisions. This tends to be the “traditional profit maximization model” of individual decision making.

- Risk Averse characterizes individuals that will forego some level of higher return to avoid assuming the risk associated with the specified choice.
- Risk Preferring individuals are often times termed “adventure seekers” and bear more risk in order to achieve higher returns.

Risk attitudes are also connected to the financial capabilities of the individual considered. If an individual has a higher net worth of $200,000 they are less affected by a $30,000 loss than an individual with a net worth of only $50,000 (Boehlje & Eidman 1984). In this dissertation, risk attitudes are an underlying principle in considering the “best” scenario determination.

Risk in agriculture is typically considered unique, as previously described (Mapp et. al 1979). Several variables of production are not dependent upon the actions of a producer. The aforementioned example of weather illustrates this concept. A producer cannot change long term weather patterns or the weather during a particular production season. Instead, the producer must react to the present environmental conditions.

In 1996, the United States Department of Agriculture’s Agricultural Resource Management Study (ARMS), formerly known as the *“Farm Costs and Returns Survey,”* asked producers to express their concern about the factors that affect their operations (ERS 1999). Concerns cited in the survey included: decreases in production, uncertainty of commodity prices, ability to adopt new technology, lawsuits, changes in consumer preference, and changes in government policy. The mean scores where estimated with 1.00 being not concerned and 4.00 being very concerned about the issues surveyed. Table 1 shows the results of this USDA survey. To highlight those pertaining to this dissertation, other cash grains, wheat, and corn producers expressed an increased concern about yield and price variability. Yield and price variability are the two sources of agricultural risk considered in this dissertation (ERS 1999).

Table 1—Farmers' degree of concern about factors affecting the continued operation of their farm

How concerned are you about each factor's effect on the continued operation of your farm?	Other cash grains	Wheat	Corn	Soybeans	Tobacco	Cotton	Other field crops	Fruit/nuts	Vegetables	Nursery/greenhouse	Beef	Hogs	Poultry	Dairy	Other livestock	All farms
Decrease in crop yields or livestock production	3.35	3.51	3.20	2.98	3.16	3.68	2.53	3.05	2.85	2.78	3.09	3.53	3.20	3.40	2.41	2.95
Uncertainty in commodity prices	3.41	3.83	3.40	2.93	3.15	3.75	2.48	2.88	2.82	2.63	2.96	3.31	3.09	3.54	2.47	2.91
Ability to adopt new technology	2.52	2.38	2.39	2.33	2.21	2.77	1.92	2.34	2.09	2.24	2.25	2.63	2.60	2.45	2.12	2.23
Lawsuits	2.43	2.47	2.03	2.46	1.89	2.78	2.07	2.39	2.66	2.06	2.36	2.70	2.32	2.36	2.00	2.26
Changes in consumer preferences for agricultural products	2.65	2.55	2.39	2.40	2.40	2.86	2.13	2.44	2.59	2.69	2.58	3.01	2.79	2.76	2.30	2.47
Changes in Government laws and regulations	3.31	3.36	3.15	2.79	2.77	3.54	2.88	2.97	2.75	3.09	3.03	3.23	3.34	3.31	2.88	3.02

*1 = Not concerned, 2 = Slightly concerned, 3 = Somewhat concerned, 4 = Very concerned.

Source: Perry, Janet, editor, "Adaptive Management Decisions--Responding to the Risks of Farming," unpublished working paper, USDA, ERS, December 1997

Production or yield risk stems from uncontrollable events, which in many cases are related to weather. Technology is also an important factor in production risks associated with agriculture. The development of new technologies may enhance producers' methods of mitigating risk (e.g. drought resistant plants). However, obsolescence of technology also affects producers (e.g. "using machinery for which parts are no longer available") (ERS 1999).

Price or market risk results from the changes in the prices of outputs and inputs that change after production has begun. Production in agriculture is generally a long process; whereas today's global economies change for the better or worse very quickly due to events that may occur domestically or in distant countries (ERS 1999). For example, increased demand for petroleum products by China adds market pressure and therefore increases prices for petroleum based inputs to producers in the Intermountain West of the United States of America (USA).

Other sources of risk that occurs in agriculture are institutional (changes in government policy and regulation), human or personal (changes that occur as a result of human behavior, like divorce, or a change in the objectives of the principal operator), and financial (the effect of the manner in which and the amount the firm obtains financing) (ERS 1999). These three categories of risk, although important, are not extensively considered in this research and in many cases the associated variables are held constant.

Risk Management

The previous discussion of risk, particularly risk in agriculture, sets the stage for consideration of the alternatives currently used by producers to manage the several sources of risk. Throughout recent history many efforts have been made to create viable tools to help reduce assumed risks. Many of the tools available shift the risk to another party outside of the producing firm's operations. While there are many risk management tools available, this study considers four: Multi-Peril Crop Insurance (MPCI), Crop Revenue Coverage (CRC), Adjusted Gross Revenue – Lite (AGR-Lite), and a limited approach to the futures market.

The first three of the four are government premium subsidized insurance products available to producers via local insurance companies.

Current crop insurance programs are the result of nearly one hundred years of experimentation. The very first form of crop insurance was introduced by a private company in Minneapolis, Minnesota, in 1899 (Edwards & Barnaby 2000). For several years, attempts were made to create a viable crop insurance program by private companies, but none were realized. Due to severe drought conditions in the mid 1930’s, several pieces of legislation were passed establishing the necessary organizations to create a nationally viable crop insurance program. In 1939, the newly established Federal Crop Insurance Corporation (FCIC), launched its first program to offer coverage from a large range of naturally caused losses that affected wheat (Edwards & Barnaby 2000). The current version of this program has now become known as Multi-Peril Crop Insurance and has expanded coverage to several crops affected by a variety of circumstances.

MPCI uses actual production history (APH) yields and a Risk Management Agency (RMA) forecast market price in combination to calculate the amount of insurance coverage producers may purchase. The producer can select coverage levels of their APH from 55 to 75 percent and also elect to receive between 60 and 100 percent of the RMA established price. As a producer selects higher levels of coverage, the premium required also increases. The United States (U.S.) government subsidizes the premium paid by the producer. This subsidy ranges from 23 to 100 percent of the total, depending upon the level of coverage selected (Edwards & Barnaby 2000).

Innovations of insurance programs based upon production performance during the last decade and a half include catastrophic policies as well as a group risk plan (Edwards & Barnaby 2000). These policies are not considered within this dissertation due to limited availability to the geographical region and a higher level of interest in those policies considered.

Another set of recent innovations is the concept of insurance coverage based upon guaranteeing a minimum level of gross income per acre. Several proposals have been made over the past fifteen years. Two of these programs are considered within this research: Crop Revenue Coverage and Adjusted Gross Revenue – Lite.

CRC protects producers from reductions in price and yield rather than just yield as does MPCI. However, the crops eligible for CRC coverage are limited to corn, soybeans, wheat, cotton and grain sorghum in the major producing areas of the U.S. This coverage is partly based upon a producer's APH, but also uses a RMA forecast price to establish a minimum level of gross income as a guarantee (Edwards & Barnaby 2000).

AGR-Lite is one of the most recent developments put into practice. Based upon the pilot Adjusted Gross Revenue (AGR) program, AGR-Lite is a whole farm revenue protection plan (RMA AGR-Lite 2007). AGR-Lite could be termed a glorified CRC policy as it is a similar concept protecting a producer from losses due to adverse prices and yields. AGR-Lite differs from CRC in that it uses a producer's five-year historical farm average revenue reported to the Internal Revenue Service (IRS) on the firm's tax return and an annual farm report which provides a base to establish the guaranteed revenue (RMA AGR-Lite 2007). AGR-Lite covers a wide variety of crops and livestock in 34 states across the country.

The final risk management alternative this dissertation considers is the effect of using the futures market. The futures market is the "stock market" for agricultural and other commodities. Several exchanges have been established in the U.S. and include entities such as the Chicago Board of Trade (CBOT) and the New York Mercantile Exchange (NYMEX) (Hudson 2007). These U.S. future markets had their beginnings in 1848 when the CBOT was established. Future markets are organized exchanges of contractual agreements for the delivery of a commodity (Hudson 2007). A wide variety (e.g. coffee, orange juice, soybeans, etc...) of commodities can be exchanged on these markets.

Futures markets serve three primary roles in agriculture. First, the markets serve as a forum for "price discovery" (Hudson 2007). These markets are the primary source of price information used around the globe and by the RMA in establishing the prices that pertain to the insurance products being reviewed. The second, and most important to this dissertation, is the role of "risk shifting" (Hudson 2007). The futures market allows producers to sell contracts for crops in current or future production at a guaranteed price to be delivered at an arranged future delivery date. When a producer sells a quantity of their crop in this manner, he has “shifted” the price risk to the buyer of the future contract. Often delivery of the actual commodity will not occur and the producer will buy an offsetting amount of contracts to fill the requested amounts previously purchased. The gain or loss from this transaction is then added / subtracted from the local cash price received by the producer. This participation in the futures market, know as hedging, smoothes the variance of price for the producer (Hudson 2007).

The final role of the futures market, which is connected to the second role, is that of facilitating financing (Hudson 2007). A producer may be more likely to receive out of firm financing if they have sold a futures contract which is expected to stabilize the price received. This gives a lender increased confidence that the producer will be able to repay the owed debt (Hudson 2007). In this dissertation, the futures market will only be considered in regards to wheat and corn produced on the “typical” farm, as they are the only two of the four crops considered that are traded on the futures market in the United States and in Box Elder County.

Econometric Analysis

Capturing the effects of risk management strategies employed within an operation presents specialized issues when using econometric analytical tools. To comprehend these specialized issues it is necessary to have knowledge of basic econometric tools.

One of the necessary steps of this dissertation is to generate a relationship between yields achieved and prices received by the “typical” farm in order to generate financial values to determine the economic effects of pursuing risk management strategies. Using a simple linear regression function for example, could be done, but there are issues that arise when this is done. Simple linear regression assumes that there is no overwhelming correlation between the independent variables (Gujarati 2003). Agricultural yields and prices at a global and national level in most circumstances affect or are correlated with each other. If there are decreased yields realized for a commodity, the price of that commodity generally increases.

Throughout the past half century, numerous studies have been completed to identify the best way to capture the relationship of agricultural yields and prices. Leading researchers and authors such as Harry P. Mapp and James W. Richardson have dedicated their careers to studying this relationship. In the past various forms of regression, simultaneous equations and several forms of simulation have been used to attempt to best approach the real interaction between yield and price. Many of which have proven inefficient.

Simulation

In this dissertation a basic simulation technique is used to generate a form of data that can be analyzed. Simulation can be defined as the building of, “an artificial model of a real system to study and understand the system” (Barreto & Howland 2006). A common style of simulation is called Monte Carlo simulation.

The “Monte Carlo” name in itself offers some insight into the nature of the simulation techniques. (Barreto & Howland 2006) Nikos Drakos (1995) offered a good explanation of the origin of the name as well as the reason it defines this style of simulation:

> “The name ‘Monte Carlo’ was coined by [physicist Nicholas] Metropolis… during the Manhattan Project of World War II, because of the similarity of statistical simulation to the game of chance, and because the capital on Monaco was a center for gambling and similar pursuits. Monte Carlo is now used routinely in many fields, from the simulation of complex physical phenomenon such as radiant transport in the earth’s atmosphere… to the mundane, such as the simulation of… Monty Hall’s vexing offer to the contestant in ‘Let’s make a Deal.’”

In summary, “Monte Carlo simulation is a method of analysis based on artificially recreating a chance process (usually with a computer), running it many times, and directly observing the results” (Barreto & Howland 2006). This dissertation uses Monte Carlo simulation in connection with a stochastic yield and price generation function, and the “typical” farm’s financial data to determine which risk management strategies are the most economical.

Simulation in agriculture, as aforementioned, has gone through years of research and analysis. In this literature review, I will consider three topics with regards to this subject. They are: the Firm Level Income Tax and Farm Policy Simulation Model (FLIPSIM) (TAES 1981); an article titled, *“An Applied Procedure for Estimating and Simulating Multivariate Empirical (MVE) Probability Distributions in Farm-Level Risk Assessment and Policy Analysis”* by Richardson, Klose and Gray (2000); and Simetar© 2006 (Richardson et al 2006).

In March of 1981 Richardson and Nixon released the simulation model Farm Level Income and Policy Simulation Model (FLIPSIM). "FLIPSIM is a farm growth simulator capable of simulating the growth of different types of farms" (TAES 1981). Since its inception, the program has been used in a variety of ways, several of which were in conjunction with government policy research being conducted at that time (Bailey 1983).

In August of 2000 Richardson, Klose and Gray published *"An Applied Procedure for Estimating and Simulating Multivariate Empirical (MVE) Probability Distributions in Farm-Level Risk Assessment and Policy Analysis."* This article was another approach to estimating stochastic yield and price variables in econometric models. The review begins by pointing out that econometric simulation is not unique to agriculture, but that agriculture does present unique conditions to consider when undertaking simulation problems. A majority of techniques outlined in simulation literature apply to business in general, which is also part of agricultural production (e.g. Law & Kelton 1991, Savage 1998, and Winston 1996). Richardson, Klose and Gray identify several "special problems" of simulation at the firm level in agriculture, which are:

- "Non-normally distributed random yields and prices,
- Intra-temporal correlation of production across enterprises and fields,
- Intra- and inter-temporal correlation of output prices,

- Heteroscedasticity, [or unequal variance] of random variables over time due to policy changes,
- Numerous enterprises that are affected by weather and carried out over a lengthy growing season,
- Government policies that affect the shape of the price distributions, and
- Strategic risks associated with technology adoption, competitor responses, and contract negotiations."

These "special problems" violate several of the assumptions of such models such as ordinary lest squares regression. This, once again, is the justification for further research into more efficient models of variable estimation. This dissertation is primarily focused on obtaining results pertaining to how several risk management tools perform as part of an operation. The aforementioned issues are very important to be conscious of during analysis, in order to obtain accurate results.

The rest of the article by Richardson, Klose and Gray outlines the procedures for simulating a multivariate empirical probability distribution. The results of their studies are promising as a way to efficiently estimate yield and price variables (Richardson, Klose & Gray 2000). However, the model is very complex and considers these variables on a larger scale than this study. This dissertation is concerned with a single "typical" farm in Box Elder County, Utah which has limited if any effect on national prices and yields realized. Nor is yield achieved or price received correlated for the individual farm of the size considered in this research. Due to the minute portion of the national market the "typical" Box Elder farm plays, the low level of price and yield correlation, and the desired straightforward results of the research, simple mathematical computations are used in the creation of distributions needed for simulation.

One of the most recent developments in simulation occurred with the release of Simetar© 2006. The instruction manual, *"Simetar©: Simulation & Econometrics to Analyze Risk"* by James W. Richardson et al states, "Simetar© 2006 is a simulation language written for risk analysis to provide a transparent method for analyzing data, simulating the effects of risk, and presenting results in the user friendly environment of Microsoft® Excel" (Richardson et al 2006).

This definition of the program explains how the program applies to this research through analyzing the effects of risk and the outlined management strategies. Simetar© 2006 further develops the already powerful Microsoft® Excel program into an excellent econometric tool. In this dissertation, the historical yield, price and financial data are built into Excel spreadsheets and easily manipulated and simulated with the Simetar© add-in. The Simetar© manual, while not specifically dealing with the topic of research proved most helpful in understanding and constructing the empirical analysis.

To fully appreciate all that has been done with regards to agricultural simulation modeling further research beyond what is presented in this section of review is suggested.

Financial Analysis

In conducting the literature review, a set of Microsoft© Excel spreadsheets entitled, "*RDFinancial*" that was compiled by Duane Griffith at Montana State University (2008). These spreadsheets "take a quick and dirty look" at an operation that evaluates the financial feasibility of an operation (Griffith 2008). The author clearly states that the spreadsheets are not meant to analyze in detail the financial status of a firm but are instead an educational group of spreadsheets that show the "interaction of financial statements" (Griffith 2008).

The included spreadsheet on insurance allows the user to enter farm values necessary to calculate the contribution and cost of Multi-Peril Crop Insurance as a risk management strategy. The concept of how a risk management strategy contributes to the overall operation is one of the goals of the research done in this dissertation. One downside is that Griffith only allows for a basic review of MPCI and how it affects the financial statements (2008). Therefore, it does not give consideration to Crop Revenue Coverage, AGR-Lite insurance or futures market risk management strategies.

These spreadsheets are not directly focused on the same research issue but are used as the basis of a financial program due to the consideration already given to insurance within the spreadsheets. The existing setup of the spreadsheets allowed time to be saved by having a base model to further develop in order to manipulate the financial data and achieve the desired output during simulation.

Decision Criteria

Most research requires the establishment of decision criteria, or creating mechanisms to choose from the results the desired outcome. Any type of established pattern or system can be classified as decision criteria. Chapter eleven of "*Farm Management*," by M. D. Boehlje and V. R. Eidman (1984) discusses decision criteria, out of which were chosen rules to be used in this study. Boehlje & Eidman (1984) point out that the decision-maker must align his goals, associated probabilities of gains or losses, and the current financial ability to bear risk.

Decision criteria can be broken into three groups. First, those that do not require probability estimation, this set of rules is useful when estimating the probabilities of alternative outcomes is difficult. The second grouping of criteria requires probability estimates. The third group may be termed as efficiency criteria or a group that sorts the alternatives by whether the results should be considered by the producer or not (Boehlje & Eidman 1984).

This study considers suggested decision criteria that are part of group one, or those criteria that do not require probability estimation of the alternatives and group two, those that do require probability estimation. The first of these is known as the Maxi-min criteria. This rule is to select the alternative that returns the largest minimum outcome (Boehlje & Eidman 1984). This criterion is a pessimistic approach, or one that a risk adverse individual may adopt to avoid any kind of financial loss.

The second criterion is known as the Maxi-max. It is the opposite of the maxi-min criteria and the most desirable, or profitable alternative will be selected (Boehlje & Eidman 1984). This study will use this criterion to define what a risk preferring individual might select. The risk preferring individual wants to achieve the highest net income regardless of any associated risk.

The third, and final, decision criterion used in this study resembles that of a Safety-First criterion. This approach maximizes the expected results subject to a set probability that a minimum level of net income will be achieved (Boehlje & Eidman 1984).

Similar Research

At the time of this literature review no comparable published research could be found. Several studies have been completed in relation to risk management topics, many of which are available through the national risk management web site (http://www.agrisk.umn.edu/Library/Topics.aspx?LIB=AR) (Regents 2007). However, none of these studies were found to quantitatively and qualitatively compare the economic effects of employing risk management strategies in an individual firm as this dissertation does.

CHAPTER III

DESCRIPTION OF THE DATA

This dissertation has required the collection of a variety of data. The first data set collected was used to derive a "typical" farm used in Box Elder County. To determine the scope of the farm the USDA's 2002 Census of Agriculture was used. The timing of this dissertation occurred as the 2007 Census of Agriculture was being completed. This directly correlates to the first assumption made in regards to the "typical" farm data used, that is whether or not the 2002 census information used still describes agriculture in Box Elder County Utah accurately.

From the 2002 Census of Agriculture, the County Summary Highlights for Utah were used to determine the size or acres that were applied to the "typical" farm. The number of farms in Box Elder County totaled 1,113 and the total land in farms equaled 1,400,759 total acres of which 113,251 are irrigated on 827 farms. The average size of farm reported in 2002 was 1,259 acres for all farms and acreage reported. If the irrigated acres are divided by the number of farms the result is nearly 137 acres per farm. In this dissertation the "typical" farm acreage used is 1,260 acres, as it is the rounded overall average farm size reported in the 2002 USDA Census for Box Elder County, Utah. The overall average farm size also allows enough farmable acreage to substantiate financial aspects of machinery, equipment and buildings associated with the farm, even though the overall average in the census includes all types of farming (e.g. dry-land, irrigated, etc.).

Next the crops considered used the same 2002 County Summary Highlights from the census data as used for farm size. Four crops are considered in this study: alfalfa hay, corn for grain, barley, and irrigated wheat as these are generally the most commonly produced in Box Elder County, Utah. By using the selected crop's census data the number of reported harvested acres was divided by the reported number of farms that grew the crop. This resulted in an average number of acres per farm for each crop as shown below:

Alfalfa Hay (Forage) = 98.24 acres

Corn for Grain = 69.58 acres

Barley = 56 acres

Wheat = 184.87 acres

Total Acres = 408.69

Using this information, a percentage of the total acres was calculated for each crop and that percentage was multiplied by 1260 acres to arrive at the acreage each crop constituted. The values were then rounded to the nearest ten to simplify later calculations. The results were as follows:

Alfalfa Hay (Forage) = 24% x 1260 = 302.4 = 300 acres

Corn for Grain = 17% x 1260 = 214.2 = 210 acres

Barley = 14% x 1260 = 176.4 = 180 acres

Wheat = 45% x 1260 = 567 = 570 acres

Total Acres = 1260 acres

Financial information used the 2002 Census of Agriculture, specifically the County Summary Highlights. In the highlights is a line titled, “estimated market value of land and buildings,” and a line titled, “estimated market value of all machinery and equipment.” Using this information, adjusted by average inflation since 2002, (InflationData.com 2007) the following values were calculated for each of the line categories: $751,944.29 in estimated market value of land and buildings per farm and $150,248.10 in estimated market value of all machinery and equipment. These two numbers served as a guide in establishing the listed assets of the “typical” farm.

Current land, building, machinery, and equipment costs were gathered and placed in their respective categories in the financial portions of the spreadsheets used which were slightly different from the Census data but a close approximation. Once established, these values remained constant in all simulated scenarios. This was done to eliminate or hold constant any potential risk from changes in the financial structure of the “typical” farm.

The crop expense data used in the research came from the Utah State University Extension Agribusiness website (2007a). This website posts enterprise budgets from late 2006 for each crop in each county of the state. The appropriate budgets were selected and added to the Excel workbook to be able to calculate the various costs associated with each crop (See Appendix C for spreadsheet layout).

The enterprise budgets calculate cost on a per acre basis. It was necessary to incorporate functions that allowed the costs to be calculated on per unit of yield because the RDFinancial program adds crop expenses based upon yields produced (Griffith 2008). It should also be noted that from these budgets, only the operating costs minus interest on operating capital was used. Ownership costs (i.e. assets and liabilities) are incorporated into the RDFinancial program separately based upon collected current information.

A summary of the assumptions made in connection to the typical farm that help keep several variables as constant as possible are as follows:

- Data accurately portrays the current “typical” farm in Box Elder County Utah.
- The farm has good financial ratings.
- Crop acreages remain constant in all scenarios considered.
- Equipment is well maintained and relatively new minimizing parts and repair costs.
- Land is partially owned and the remainder cash leased with a long-term commitment.
- All ground is irrigated.

Historical yield data was retrieved from Robert Smith at the Davis Regional Office of the USDA Risk Management Agency. This data consisted of historical producer reported yields used in calculating APH yields for RMA insurance purposes from Box Elder County, Utah.

All of the four crops data contained several variations of APH data. For example, wheat contained information for dry-land, irrigated, winter, or spring, all decipherable by the USDA code associated with the data for ten years. By using the sort feature in Microsoft Excel and the USDA codes, the data was sorted by whether or not it was irrigated, spring or winter for barley and wheat, grain or silage for corn and alfalfa or alfalfa grass. The data was also sorted by the code for actual production yield data versus using the T-yields (i.e. producer or county average) or another form of reported yield.

For each producer the same classification of yields one year in some instances was not the same classification of yields in succeeding years. In several instances the data contained actual production yields and the others the T-yield was used. Therefore the summary statistics had to be based on each year as it was sorted; this removed the guarantee that the yield data always included the same producer from year to year. However, the resulting data was actual yearly production data for Box Elder County averaged over the producers who reported their APH to this database.

The average of the summary statistics for the APH yield data was calculated to result in a single value for each of the ten years of yield data, with the exception of alfalfa which only contained eight years of valid yield data. This resulted in an average Box Elder County yield based upon reported APH of producers found in the region. This form of data in some ways resembles yield data reported by the USDA National Agricultural Statistics Service (NASS) by being an averaged amount. It differs in the fact that the RMA data used are based upon APH of only those producers that were reported information for insurance purposes. NASS data is collected throughout the county and averaged on a county basis including a variety of yield information. Some of which is reported to the agency by producers and also the agency's estimated yields for non-reported acreage.

This method of calculation of producer yield data, as mentioned, results in an average of several producers over the time period considered. If the average of all summary statistics were used it could inaccurately represent the yield swings faced by a particular producer because the stochastic yield generation will be using an average of the producers' APH information. For example, in the alfalfa data the minimum reported actual yield was 0.4 tons per acre versus a maximum of 8.8 tons per acre. If the averaged eight year minimum was used then 2.7 tons per acre and a maximum of 7.3 tons per acre would be the values obtained. The alfalfa data illustrates that in some instances, a producer can face much lower yields than the average of a set of data. This issue will not allow a random number generator, which in this research uses the minimum and maximum in its calculations, to capture the true lowest and highest yield possible. The stochastic variable generation formulas used allow for only one minimum value to be entered. In this research the actual minimum and maximums data values for yield are used to more closely approximately potential yields achieved.

The following are the summary statistics calculated through the aforementioned processes for each crop's yield data over the period considered:

Table 2: RMA APH Yield Summary Statistics

	Barley	Corn	Forage (Alf)	Wheat
Mean	81.03	169.97	5.35	95.47
Std. Error	11.6753	8.4743	0.3385	3.2336
Median	80.45	176.25	5.35	101.40
Mode	84.00	192.00	5.09	108.60
Std. Dev.	38.7532	40.3384	1.3079	28.9220
Sam. Var.	1601.4915	1889.9151	2.0621	852.6447
Kurtosis	-0.0037	3.5923	0.1640	1.1380
Skewness	-0.1265	-1.0593	-0.3521	-0.9066
Range	121.00	180.90	4.60	140.80
Minimum	0.00	0.00	0.4	0.00
Maximum	180.00	285.00	8.8	185
Sum	914.60	4572.30	77.33	8808.00
Count	10	10	8	10

The means calculated for each crop became the base yield used in performing calculations when predicted yields were required. For example in calculating the AGR-Lite premium, it asks for projected revenue for the year insurance coverage is being purchased. In the case of the "typical" farm the mean values in Table 2 were used as part of the calculation of yield x price x acres = revenue for the specified crop.

The data for all the crops was slightly skewed to the left or negatively, corn and wheat having the most negatively skewed distribution. In spite of this slight skew compared to the mean for all crops, the data set provided good information to be used in generating stochastic yield variables for the simulated scenarios.

Price data is ten years of monthly values collected from two sources. Alfalfa and barley cash prices were collected from the USDA NASS online monthly Agricultural Prices Report (2007a). This report gathers prices received by farmers and the data is reported nationally and by state. Prices reported for the state of Utah were used for these two crops.

Corn and wheat cash prices were collected from the Utah State University Extension Agribusiness website (2007a). This data was offered as weekly data. All data entries were collected for ten years and then averaged into monthly values so the information for corn and wheat was on the same time scale as alfalfa and barley.

Agricultural producers sell a majority of their crops produced during a particular time frame given no other management strategy. The price information needed to be representative of this time frame, termed the “harvest time” price is an average of the months of July through October for each of the ten years for each crop. In this format, the price data exhibited the following summary statistics:

Table 3: Harvest Time (July – October) Averages of Price

	Alfalfa	Barley	Corn	Wheat
Mean	87.9500	2.1293	2.6691	3.1811
Std. Dev.	9.8290	0.2398	0.3240	0.5117
95 % LCI	79.7637	1.9295	2.3993	2.7549
95 % UCI	96.1363	2.3290	2.9389	3.6073
CV	11.1756	11.2611	12.1374	16.0865
Min	72.2500	1.8275	2.2171	2.3715
Median	86.5000	2.1163	2.6518	3.3341
Max	100.7500	2.5700	3.1478	3.7330
Skewness	-0.0178	0.3542	0.1942	-0.7699
Kurtosis	-1.3280	-0.4673	-0.9542	-0.9850
Sum	879.5000	21.2925	26.6908	31.8110
Count	10.0000	10.0000	10.0000	10.0000

During late 2006 and 2007, commodity prices received by farmers began to climb drastically, reaching levels that were previously unimaginable. This occurred largely because of crop failures both inside and outside of the U.S. and government mandated ethanol use, but commodity prices have remained high to the current date. The available 2007 price information was not included in this research due to the increase in prices that skewed the results.

From the summary statistics the necessary price information was used to generate stochastic prices for the simulated scenarios. The mean values were also used as predicted values were needed, for example as aforementioned, in AGR-Lite projected revenue calculation is yield x price x acres = revenue for each crop.

These areas, “typical” farm definition, historical yields and prices, constitute a majority of the data sets used in this dissertation. Information was also collected from the Risk Management Agency (RMA) website for necessary insurances premiums and other information necessary for the risk management calculations. This data is in its original format as reported by the RMA.

In considering the futures market as a risk management strategy in became necessary to gather historical basis for corn and wheat. This information was secured from Utah State University Extension Agribusiness website (2007a). The basis reported in the month of November, for ten years, was gathered and Excel summary statistics generated. As will be described in the next chapter the variance of the basis was used to incorporate the effect of the futures market strategies. The historical basis summary statistics generated the minimum, maximum and the median values necessary for the stochastic generation functions. Since the variance was desired and not the actual minimum, maximum and median, the median was set equal to zero and the minimum and maximum were determined by subtracting or adding the summary statistic from the original median respectively. This created a minimum basis variance, a maximum basis variance and a median of zero that was used in the stochastic generation function.

CHAPTER IV

METHODOLOGY

Throughout the previous chapters, much insight has already been given as to how the research was conducted. In this chapter, an overview of the entire research process will be given to offer an explanation should a similar study need to be replicated. In order to complete this dissertation the objective was established and then one-by-one the tasks were accomplished to arrive at the results. Doing this accomplishes a broad to narrow and chronological approach. The tasks were listed in Chapter I and are once again listed with an explanation of each follows except for the first task which was accomplished in Chapter II. Finally the main objective of the research is listed with a brief description.

- To develop sufficient data to depict a “typical” farm found in the Box Elder County region of the Intermountain West in the state of Utah.

The characteristics of the “typical” farm were determined to be the following: 1,260 acres farmed, 570 acres of wheat, 180 acres of barley, 300 acres of alfalfa for hay, and 210 acres of corn for grain, all irrigated. It must be recognized that the data required to complete this research is “farm specific.” Each agricultural operation is unique, due to factors such as how an operator handles risk or the location of operation, many of the variables used in this study will change. This instilled the desire to organize the statistical and econometric tools used in such a manner that these unique variables can easily be changed and analysis redone. Making the “typical” farm in this dissertation is an example of what can be done to determine the validity of potential risk management strategies.

- To develop historical financial information for this “typical” farm.

Financial data for the “typical” farm is necessary to evaluate the economic feasibility of risk management strategies. RDFinancial, built by Duane Griffith (2008), offered a good starting point to having a set of working financial Excel spreadsheets that considers various aspects of an agricultural operation including insurance.

To appropriately calculate operating costs for each of the crops considered, the addition of local enterprise budgets from Utah State University (USU) for each of the crops in spreadsheet format was necessary (USU Extension 2007a). Adjustments and links were made to correctly incorporate these spreadsheets into the existing RDFinancial spreadsheets (Griffith 2008). The stochastic yields and prices generated were also linked within each crops enterprise budget to correctly allocate costs that fluctuate, particularly with yield. For example, the higher the yield in alfalfa he more product will have to be transported from the field to the buyer, thus costing more to complete that portion of production.

It is also necessary to consider fixed asset and liabilities for the “typical” farm. It was assumed that the “typical” farm owned 80 acres of land, a farmhouse, a shop, a grain storage bin and a variety of equipment necessary to conduct most production operations. The remaining ground was leased through a long term cash lease. Effort was taken to validate the cost and value of land, buildings, machinery and equipment and to approximate the established values for the “typical” farm generated from the 2002 USDA Census; those being $150,250 in machinery and equipment and $751,940 in land and buildings.

- To integrate the ability to manipulate the risk management economic effects in the financial information.

Control of the risk management strategies is an important step for the effectiveness of this dissertation. RDFinancial, by Duane Griffith (2008), provided the foundation upon which risk management strategies were incorporated into the worksheets. RDFinancial already considered Multi-Peril Crop Insurance within the existing Excel spreadsheets (Griffith 2008). The spreadsheets referenced in this and other sections can be viewed in Appendix C.

The MPCI worksheet had the ability to turn the strategy on or off. This was done by having a cell at the top of the worksheet in which a “Y” or “N” was entered. When turned on, the final outcome would be added into the appropriate place of the financial statements, thus affecting the net income of the operation.

A link to the final outcome cell of the MPCI strategy used an “=IF” function in Excel to input the outcome of the insurance product within the net income when a “Y” was entered or have no effect on net income when an “N” was entered.

In between this on/off cell and the net effect cell were the appropriate functions and input cells necessary to generate the net effect for the risk management strategy being considered. In this study those strategies are MPCI, Crop Revenue Coverage, Adjusted Gross Revenue – Lite, and a limited participation in the futures market. For each strategy an Excel worksheet was created and functioned in the same basic manner as the MPCI in the original RDFinancial. Therefore each risk management strategy could be considered individually or simultaneously with others.

Cost of implementation of risk management strategies needed to be accurate to effectively evaluate the economic feasibility of the strategy used. The USDA’s RMA has an online insurance premium calculator (RMA Premium Calculator 2007). The insurance spreadsheets of this study were built in such a manner that the information required by the online premium calculator was readily available for each strategy. The online calculator used the input information in a series of calculations for each insurance product and returned a cost per acre as well as a total cost for the product. In this dissertation the total cost or premium was used because the “typical” farm’s acreage did not change.

In all three insurance products considered, the total premium paid is entered just before the net benefit cell of the worksheet. Entering the cost information in this location versus on each enterprise budget or RDFinancial's expense page allows the premium to be turned on or off as the strategy is or is not considered (Griffith 2008). Therefore, the premium paid will only affect the net income of the farm if the product is used. If there is cause that an indemnity will be received for a specified scenario, the premium is subtracted from the indemnity received and the net benefit of the product is added to the financial worksheets.

Each of the three types of insurance products considered has different approaches to calculating if an indemnity payment needs to occur. MPCI uses APH multiplied by the coverage percentage to establish a minimum yield. When adversity arises, causing yields to be lower than the minimum yield, an indemnity payment will be made by the insurance company. The indemnity payment received by the insured producer is the chosen price election percentage multiplied by a FCIC established price multiplied by the difference in yield of the actual and the minimum yield. MPCI only protects the producer from production risks.

CRC uses APH and a RMA planting price to establish guaranteed crop revenue to be received by the producer. At harvest time, the RMA establishes another price and compares that to the planting price (RMA Information Memorandum 2007). The higher of the two is used if an indemnity payment is necessary. A payment will occur if the crop revenue falls below the established minimum set at the beginning of the term. This may be the result of loss in yield or a decrease in market prices. CRC protects a producer from both production and price risks.

AGR-Lite establishes the gross revenue the producer can be insured for. The established gross revenue is the farmer's five year averaged gross income reported to the Internal Revenue Service. By using a coverage level chosen multiplied by the average gross revenue, a "trigger point" or minimum revenue is established. If gross revenue falls below the "trigger point," the indemnity received can be up to the producer selected payment rate multiplied by the minimum guaranteed revenue. However, only the difference between the minimum guaranteed revenue and the actual revenue is considered for an indemnity. AGR-Lite protects a producer from both production and price risks.

To capture the costs and benefits of futures contracts, a similar approach of on/off capability was taken in building an associated Excel spreadsheet. In the case of this dissertation, only wheat and corn where considered for using futures contracts as a risk reducing tool. The futures market is used as a revenue guaranteeing option, thereby reducing the price risk associated with the two crops. A decision to adopt a more intense trading strategy including the use of options and cross commodity trading was rejected in this research in an effort to maintain simplicity. Costs such as account maintenance and broker fees of adopting this futures strategy were ignored due to the large commodity volumes and the resulting miniscule cost per unit of the commodity. However, it is assumed that most of the costs of participating in the futures market are captured in the basis variances used for the scenarios considered.

Futures contracts presented the necessity of using a slightly different approach to incorporate the potential costs and benefits in risk management. Instead of calculating a net benefit of futures contracts bought and sold as done with the other risk management strategies considered, it was realized the net benefit/loss of the futures market is essentially the variance in the basis. Basis is the difference between the local cash market and the futures market (Hudson 2007). Therefore, using the variance of the basis in the stochastic generation function becomes an estimated difference between the local cash market and the futures market, or the price to be received by the producer purchasing the futures contract.

A system of functions was required to input the stochastic variance of the basis and add it to the stochastic cash price in the corn and wheat enterprise budgets if trading occurred; thereby capturing the net effect of trading futures. Using the stochastic variance of the basis value required data to be gathered for historic basis for wheat and for corn from Utah State University Extension's Agribusiness website (USU Extension 2007).

This method allowed a limited risk reducing potential of trading futures contracts to be captured and simulated. More complex trading strategies could be developed and incorporated into the spreadsheets to attempt to achieve higher returns, but effective simplicity was more desirable. It is also assumed that the futures contracts purchased will be for 100% of the marketable stochastic crop yield or the total quantity produced.

The financial information in RDFinancial already incorporates a majority of the associated costs of agricultural production like the cost of leasing ground for production or family withdrawals. While not perfectly inclusive, assets, liabilities and owner's equity approach the "typical" farm structure observable in actual financial circumstances.

- To develop probability distributions for crop yields, harvest cash prices and variance of the basis values for the specified region.

RDFinancial asks for several input variables, yields achieved and prices received being among the most important (Griffith 2008). These two variables require stochastic generation in order to simulate several hundred iterations and generate probabilities of outcomes. In order to build a stochastic yield and price generation function historical data had to be collected. The data collected for each crop included ten years of annual data of RMA APH average yields and ten years of monthly data for harvest time cash prices. The process used to arrive at this information was previously described. Many more years of price data was available, but ten years was the time frame used to correlate with the period of yield data.

Historical yields and the harvest time cash prices were used to generate the necessary inputs for a function that generates stochastic yields and prices for use in simulation. An important determination is which type of distribution will be used in the stochastic generation process. This is an area of discussion that has undergone years of research in an effort to fully capture the randomness and correlated nature of yields and prices. Dr. Steve Vickner, described this issue in the following manner, "[If] you put 10 statisticians/ econometricians in a room with this data [and question], you'll get at least ten answers" (Vickner 2008).

Initially work was begun on completing the procedures for a multivariate empirical distribution as outlined by Richardson, Klose, and Gray (2000). Further discussion and research of which style of distribution to use revealed that an easier approach could be taken and the use of a three point or triangular distribution would satisfy for this research.

Both prices and yields theoretically could have values from zero to infinity. While zero is occasionally observed, infinity is rarely if ever observed in actual circumstances. For theoretical purposes, distributions that start on the left at zero and go to infinity on the right are could include, log-normal, exponential, or gamma distributions. However, no matter which of these distributions is chosen, the tail of the distribution to the right or towards infinity will be too large or too small because infinity has not yet been observed in actual circumstances leaving no historical data to generate a correct distribution. The triangular or min-max-median distribution allows the variables to be focused on the range of data that has been historically observed. This distribution keeps the results within a reasonable range or within the greatest probability occurrence (Vickner 2008).

The specific distribution chosen was the "GRK three point empirical random variable" function available in Simetar© 2006. This distribution can also be referred to as a triangular distribution. The GRK function was built into each enterprise budget for each crop for prices and yields. This allowed expense information to be calculated based upon the expected stochastic yields, and therefore, yield dependent expenses such as freight are entered into the RDFinancial worksheets accurately (Griffith 2008). The minimum, maximum and median values used by the GRK function were supplied by the summary statistics of the historical yield and price information described previously.

Similar to the harvest cash prices generated, it was also necessary to generate stochastic variances for the basis of wheat and corn. The process to accomplish this is almost identical to the process used for harvest cash prices with a difference being the final calculation to generate the variance. Another difference between the random generation of yields, prices and basis values is basis occurs in its own Excel worksheet and not within the crop enterprise budgets. This was done to allow easy management of considering or not considering the use of the futures market as a risk management strategy. When futures are being considered, the stochastic variance of the basis is added to the associated crop's cash price received.

- To simulate the selected risk management strategies for multiple scenarios for the established “typical” farm in the Intermountain West.

The strategies simulated are summarized in Table 4 below by the risk management tool considered and the corresponding coverage levels.

Table 4: Summary of Coverage Associated with Risk Management Strategies Considered.

Strategy	Yield Coverage %	Price Coverage %
No strategy		
MPCI All Crops	75% APH	100% Price Election
MPCI All Crops	65% APH	100% Price Election
MPCI All Crops	55% APH	100% Price Election
MPCI All Crops	75% APH	75% Price Election
MPCI Only Alfalfa	75% APH	100% Price Election
MPCI Only Barley	75% APH	100% Price Election
MPCI Only Corn	75% APH	100% Price Election
MPCI Only Wheat	75% APH	100% Price Election
CRC	75% APH	100% Price Election
AGR-Lite	75% Coverage	90% Payment Rate
Futures Contract for Corn	100% of estimated yield	
Futures Contract for Wheat	100% of estimated yield	
Futures Contract for Both	100% of estimated yield	
All Strategies	MPCI All 75-100, CRC	AGR-Lite, Futures Both

Each of these strategies was considered by turning on or off the appropriate spreadsheet cells for each type of strategy within the modified RDFinancial Excel workbook. It was also necessary to adjust the premiums of different insurance strategies as the coverage and price election percentages assumed changed between scenarios, this information had to be done manually at the change of each scenario. The Simetar 2006© simulation engine was then used to simulate net income of the “typical” farm for 500 iterations for each scenario. The simulation output was used with in conjunction with established decision criteria, explained in the next section, to choose the “best” scenarios. The results were also used to chart Cumulative Density Functions (CDF) and Probability Density Functions (PDF) for each scenario. These CDF and PDF charts allowed visual comparison of the resulting probabilities associated with each strategy and can be found in Appendix A and B. Appendix C contains depictions of the Microsoft Excel spreadsheets mentioned throughout the previous sections.

- To determine which risk management alternatives offer the “best” economic results based upon the simulation results.

Determining which scenario offered the “best” economic return could be done a variety of ways. An assumption was made that the higher the net income received the better, or that a producer will always prefer more to less. Initially, the results are organized and ranked by the probability that net income will exceed $0. Further analysis of the simulated output was based upon three decision criteria: a Maxi-min, Maxi-max and Safety-First approach. It should be noted this interpretation is the quantitative results of the study.

The later three decision criteria correspond to the three risk attitudes an individual may possess. A risk adverse approach will use the maxi-min criteria of selecting the largest minimum net income. A risk seeking individual will assume the maxi-max approach, selecting the highest or largest net income, regardless of probabilities. Finally, to include risk neutral producers, the Safety-First approach is used by first establishing the minimum net income at anything greater than zero that has a possibility of occurrence of 0.5 or 50%. Results for the risk management alternatives that meet these criteria are compared and ranked to select the highest net income (Boehlje &Eidman 1984). Net income is set at zero in this dissertation because fixed and variable costs are all included within the research and any positive net income is purely generated equity for the "typical" farm.

To simplify the comparisons, charts of the generated results were built, relevant to each of the decision criteria. Cumulative Distribution Functions and Probability Density Functions charts created for each risk management scenario considered formed a visual confirmation of the results and can be found in Appendix A and B.

It is also important to evaluate the qualitative aspects of the "best" options considered in relationship to the decision criteria used. There may exist influences that cannot or are very difficult to quantify. By discussing the outcomes in a qualitative manner, the final result may or may not be the same, and for this reason, each decision arrived at will be discussed in relationship to the next "best" alternative. This discussion cannot capture or highlight every possible aspect of the scenarios discussed, but effort is made to draw attention to a few issues that may influence the actual decision making processes a producer encounters.

CHAPTER V

FINDINGS

The results of the research returned positive and in some instances unexpected values for the risk management scenarios considered. In general the charted CDFs for each scenario followed a similar shape and pattern. The charted PDFs offer a visual confirmation that the distributions observed for each scenario are different.

Determining the “best” risk management tools was not quantitatively difficult, and generally there was enough difference in the simulated results that little argument can be made. The results naturally are dependant upon the assumptions made in this research for the “typical” farm. To present the findings, the results for each simulated scenario are summarized in Table 5 and reviewed by the probabilities of net income exceeding $0. Then the three decision criteria outlined in previous sections will be used to determine the “best” and next “best” scenarios for each category of risk attitude.

The following is a review of Table 4 and the management scenarios considered:

Table 4: Summary of Coverage Associated with Risk Management Strategies Considered.

Strategy	Yield Coverage %	Price Coverage %
No strategy		
MPCI All Crops	75% APH	100% Price Election
MPCI All Crops	65% APH	100% Price Election
MPCI All Crops	55% APH	100% Price Election
MPCI All Crops	75% APH	75% Price Election
MPCI Only Alfalfa	75% APH	100% Price Election
MPCI Only Barley	75% APH	100% Price Election
MPCI Only Corn	75% APH	100% Price Election
MPCI Only Wheat	75% APH	100% Price Election
CRC	75% APH	100% Price Election
AGR-Lite	75% Coverage	90% Payment Rate
Futures Contract for Corn	100% of estimated yield	
Futures Contract for Wheat	100% of estimated yield	
Futures Contract for Both	100% of estimated yield	
All Strategies	MPCI All 75-100, CRC	AGR-Lite, Futures Both

Each of the scenarios considered was simulated in RDFinancial for 500 iterations for net income in the Simetar© 2006 add-in in Microsoft Excel. (see Appendix C for RDFinancial and other relevant spreadsheets used) The results can be found in Table 5 a summary of the simulated results sorted from the highest to lowest probability that net income will exceed $0. For each scenario, a CDF and PDF were generated to offer a visual interpretation of the results, these can be found in Appendix A and B. The probabilities discussed in these findings are derived from the CDF charts generated from each scenario's results.

Table 5: Summary of the Simulated Results Sorted by P > 0.5 & N.I.>$0

	Minimum	Maximum	Mean	Standard Dev.	P > $0	P > $50,000
All Strategies	-$82,608	$506,643	$45,416	$97,278	0.615	0.407
CRC	-$147,768	$255,503	$21,451	$67,978	0.614	0.323
MPCI All 75-100	-$106,107	$199,533	$20,429	$54,075	0.603	0.267
MPCI All 65-100	-$130,004	$210,150	$17,242	$58,841	0.586	0.273
MPCI All 55-100	-$138,899	$215,898	$12,323	$63,466	0.561	0.268
MPCI All 75-75	-$109,626	$205,732	$14,162	$55,922	0.556	0.239
MPCI Alfalfa	-$244,575	$219,351	$4,661	$75,771	0.552	0.294
MPCI Wheat	-$154,826	$215,331	$6,516	$63,284	0.537	0.251
MPCI Barley	-$241,053	$222,873	-$2,858	$78,699	0.519	0.255
MPCI Corn	-$233,796	$216,892	$121	$76,554	0.518	0.255
No Strategy	-$239,517	$224,409	-$4,558	$78,580	0.510	0.262
Futures Both	-$220,046	$234,348	-$3,160	$83,294	0.482	0.247
Futures Corn	-$226,925	$201,290	-$4,042	$80,847	0.479	0.248
Futures Wheat	-$219,658	$240,026	-$3,841	$83,056	0.475	0.237
AGR-Lite	-$79,664	$204,173	$4,395	$63,663	0.465	0.222

The sorted values in Table 5 show that by using all of the risk management strategies in conjunction is the “most” favorable to generate a positive net income. This determination of the “best” risk management strategy is based solely on the probability of a positive net income. There is difference of 0.15 in the probability of AGR-Lite as the least favorable and All Strategies as the most favorable.

In addition to this, all of the strategies considered resulted in a probability near 0.5 at generating a positive net income. This may be a result of increased cash prices received for marketable crops produced during the later historical data used to generate stochastic prices. Consistently higher historical prices received by producers will cause the distribution assumed in the generation functions to more consistently return higher simulated cash prices, therefore increasing the net income observed for each simulation.

Using all strategies in conjunction could be considered maximum risk protection for production and price risks. In actual circumstances this is not the case as additional risk management tools exist that could be included would increase the maximum amount of protection available. However, in this dissertation the all strategies used is the maximum. All strategies also has the second lowest minimum net income, the highest maximum net income, the highest mean and the highest standard deviation.

Using all of the strategies together provides the most risk management protection and these results demonstrate that the risk management strategies are functioning properly in protecting the “typical” farm from adverse price and production risks. The standard deviation is $97,278 which is the highest of the observed standard deviations. This suggests a flatter distribution or a wider range of possible outcomes. Having a flatter distribution would decrease using all strategies’ favorability; however, the minimum observed net income is the second smallest at -$82,608.

Using all risk management strategies in conjunction quantitatively is the “best” strategy when based upon the probability net income will exceed zero. The next “best” strategy is purchasing a Crop Revenue Coverage (CRC). There is very little difference in the probabilities observed. All Strategies exhibited a probability of 0.615 while CRC was observed at 0.614. There is a large difference in the other summary statistics. Standard deviation was observed at $67,978. This is nearly $30,000 less than the “best” strategy of using all options together. This large difference may in part be due to the more extensive and costly risk coverage from all of the strategies. Table 6 summarizes the estimated costs of the insurance policies considered.

Table 6: Summary of Insurance Policy Premiums

	Premium
AGR-Lite	$3,212
CRC	$23,062
MPCI All 75-100	$24,876
MPCI All 75-75	$18,087
MPCI All 65-100	$14,259
MPCI All 55-100	$8,511
MPCI Alfalfa	$6,745
MPCI Barley	$1,536
MPCI Corn	$7,517
MPCI Wheat	$9,078
No Strategy	$0

Cost of the insurance policies is a factor to consider as previously mentioned in relation to using all strategies together versus a single policy. The insurance policy premium of the all strategies scenario alone totals $51,150; this does not include costs associated with the futures market. This total is compared to CRC at $23,062 or MPCI All 75 – 100 at $24,876, which when purchased alone is less than half the premiums. The decision is then up to the producer as to whether or not the premium is worth the probability trade offs between using all strategies together and an individual policy.

When purchased, CRC offers the producer protection against price and production risks based upon the revenue the crop is anticipated to receive. In this study, the same two variables being manipulated, yield and price, are also the two revenue determining variables CRC uses to protect against losses due to adverse incidents. Therefore, as yield or price decreases in this research, CRC would be the most responsive when one, the other or both variables change.

All strategies includes MPCI for all crops at 75-100, CRC, futures trading and AGR-Lite. AGR-Lite also uses revenue received as the method of determining whether a loss has occurred and an indemnity payment is due. However, based upon probability of exceeding a net income of $0, AGR-Lite was ranked last when considered by itself.

This difference in rankings comes from gross revenue versus individual crop revenue used in AGR-Lite and CRC respectively. AGR-Lite is an approach that tries to keep total farm gross revenue positive and therefore net income positive. CRC is only available for corn and wheat in Box Elder County. If a farm consisted of larger acreages in another crop such as alfalfa, CRC would not be as effective of a risk reducing tool. The “typical” farm considered has wheat being the largest contributor of risk when based upon the percentage of the acreage farmed of the total. As wheat is the largest acreage based crop produced, CRC provides good management against risk for the “typical” farm.

If using the greatest probability of occurrence that net income will exceed zero as the decision criteria, all of the risk management strategies together is the "best" strategy quantitatively, CRC being the next "best." When considering these findings qualitatively it appears that the actuality of a producer using all of the strategies consider in conjunction is minimal. Especially when an option such as CRC exists that performs almost as well based upon the observed probabilities. It would also seem that if using all strategies performed well all of the time in actual circumstances producers would be using this management strategy more extensively. A variety of reasons may exist as to why this form of management is not used more. One of those reasons might be the greater amount of work that would be required to successfully implement and manage all of the strategies at the same time. It would also require higher premiums and costs to use all of the strategies together in comparison to just a CRC policy.

Risk Attitudes

In this dissertation, it is also informative to determine the "best" strategy according to the three common risk attitudes. This is because each individual producer views risk differently. Based upon a categorized risk attitude a producer can more closely approximate his attitude with the results of this study. It is important to realize that even with further definition of decision criteria by using risk attitudes; there are assumptions made and other forms of risk that will undoubtedly vary the results observed in this study.

First, consider the risk adverse attitude. The decision criterion for this attitude is the maxi-min criteria of selecting the greatest of the minimum values observed. Table 7 displays the results from each scenario, sorted by the minimum net income observed in the research:

Table 7: Summary of the Simulated Results Sorted by Minimum Net Income

	Minimum	Maximum	Mean	Standard Dev.	P > $0	P > $50,000
AGR-Lite	-$79,664	$204,173	$4,395	$63,663	0.465	0.222
All Strategies	-$82,608	$506,643	$45,416	$97,278	0.615	0.407
MPCI All 75-100	-$106,107	$199,533	$20,429	$54,075	0.603	0.267
MPCI All 75-75	-$109,626	$205,732	$14,162	$55,922	0.556	0.239
MPCI All 65-100	-$130,004	$210,150	$17,242	$58,841	0.586	0.273
MPCI All 55-100	-$138,899	$215,898	$12,323	$63,466	0.561	0.268
CRC	-$147,768	$255,503	$21,451	$67,978	0.614	0.323
MPCI Wheat	-$154,826	$215,331	$6,516	$63,284	0.537	0.251
Futures Wheat	-$219,658	$240,026	-$3,841	$83,056	0.475	0.237
Futures Both	-$220,046	$234,348	-$3,160	$83,294	0.482	0.247
Futures Corn	-$226,925	$201,290	-$4,042	$80,847	0.479	0.248
MPCI Corn	-$233,796	$216,892	$121	$76,554	0.518	0.255
No Strategy	-$239,517	$224,409	-$4,558	$78,580	0.510	0.262
MPCI Barley	-$241,053	$222,873	-$2,858	$78,699	0.519	0.255
MPCI Alfalfa	-$244,575	$219,351	$4,661	$75,771	0.552	0.294

According to the output using the maxi-min decision criteria, the favored risk management strategy would be to use an AGR-Lite policy at 75% coverage – 90% payment rate. The minimum net income observed in the simulated results was -$79,664. The margin of difference is quite large from the least favorable to the “best” strategy at nearly $165,000 in net income. However, the next “best” strategy is different by $2,944, which is using all strategies in conjunction. This is a small margin when compared to the difference of the most favorable to the least favorable.

AGR-Lite is the “best” risk management strategy for a reducing risk based solely upon the maximum - minimum net income observed. One of the goals of any risk reducing tool is to minimize losses to the operation. AGR-Lite being the newest strategy introduced to the region shows a greater understanding by insurance policy creators at how best to mitigate risks for agricultural producers while at the same time minimizing indemnity payments for insurance companies.

AGR-Lite's effectiveness as an insurance product is further confirmed by the observed mean of $4,395, close to zero but still positive. AGR-Lite has a standard deviation of $63,663, among the lowest observed as well as the maximum net income observed be smaller at $204,173. A lower maximum is not a cause for concern under this decision criterion for a risk adverse attitude. This type of individual will not be concerned with the maximum, only the minimum. AGR-Lite, just as CRC was in the previous decision criteria, is not as extensive of a process to secure coverage as would the next "best" strategy of using all management tools considered.

It is also interesting to note that the scenarios using MPCI for Barley and MPCI for Alfalfa are the worst management tools for mitigating risk on the "typical" farm considered. This is most likely due to the fact that the percentage of total acreage for these crops combined is less than wheat alone. It is evident from this that insurance policies or future market interaction needs to relate to the crop representing the largest portion of the farm's operations. When pursuing strategies only for crops representing smaller portions of total acreage risk is not reduced efficiently for the entire farm.

This may seem intuitive, but is quantitatively reaffirmed through the results of this decision criterion. When all of the crops are insured through MPCI the results show strong performance for reducing risk. In fact, all four MPCI strategies that consider all of the crops produced at various levels of coverage are ranked as third through sixth best as a risk adverse management strategy.

Qualitatively speaking, AGR-Lite is favorable as a risk reduction strategy because there is less required to use the insurance product and generate better results than the next “best” strategy. Using all of the risk management strategies considered would require more information, as well as a larger premium paid by the producer. More work and the requirement of more money in premiums would not sound appealing if trying to “sell” the use of all the strategies in conjunction. Therefore, for the maxi-min risk adverse decision criterion using AGR-Lite is the “best” strategy given the “typical” farm considered.

The second risk attitude considered is the opposite of risk adverse, being risk preferring or seeking. This category of attitude uses the maxi-max decision criteria. The “best” strategy is selected by the greatest observed maximum net income. Table 8 displays the results sorted by the maximum net income.

Table 8: Summary of the Simulated Results Sorted by Maximum Net Income

	Minimum	Maximum	Mean	Standard Dev.	P > $0	P > $50,000
All Strategies	-$82,608	$506,643	$45,416	$97,278	0.615	0.407
CRC	-$147,768	$255,503	$21,451	$67,978	0.614	0.323
Futures Wheat	-$219,658	$240,026	-$3,841	$83,056	0.475	0.237
Futures Both	-$220,046	$234,348	-$3,160	$83,294	0.482	0.247
No Strategy	-$239,517	$224,409	-$4,558	$78,580	0.510	0.262
MPCI Barley	-$241,053	$222,873	-$2,858	$78,699	0.519	0.255
MPCI Alfalfa	-$244,575	$219,351	$4,661	$75,771	0.552	0.294
MPCI Corn	-$233,796	$216,892	$121	$76,554	0.518	0.255
MPCI All 55-100	-$138,899	$215,898	$12,323	$63,466	0.561	0.268
MPCI Wheat	-$154,826	$215,331	$6,516	$63,284	0.537	0.251
MPCI All 65-100	-$130,004	$210,150	$17,242	$58,841	0.586	0.273
MPCI All 75-75	-$109,626	$205,732	$14,162	$55,922	0.556	0.239
AGR-Lite	-$79,664	$204,173	$4,395	$63,663	0.465	0.222
Futures Corn	-$226,925	$201,290	-$4,042	$80,847	0.479	0.248
MPCI All 75-100	-$106,107	$199,533	$20,429	$54,075	0.603	0.267

For the risk preferring individual, using all of the risk management strategies in conjunction with each other is again the “best” risk management strategy for the “typical” farm in Box Elder County, Utah. The next “best” strategy is CRC using this decision criterion. It is also interesting to note that two of the three futures market strategies and no strategy at all finish out the top five risk management strategies for this criterion.

It seems counter intuitive that a risk preferring individual would use “all strategies” as a mode of action to generate higher levels of net income. The risk preferring individual tries to minimize inputs or costs while maximizing outputs or net income. An extensive cost comparison is not done in this study, but using all of the risk management strategies would have higher costs due to insurance premiums as well as the costs of trading in the futures market. (See Table 6)

With the exception of using CRC, the top five risk management strategies for the risk preferring individual have corresponding higher standard deviations observed in this study. Higher standard deviations correspond to the attitude being discussed, as higher deviations express corresponding increases in risk due to a wider variation of observable net incomes. A risk preferring individual would disregard this higher risk to an extent in order to capture the highest net income possible.

While it seems contradictory for a risk preferring individual to purchase and use all of the risk management strategies considered in this study, it is the “best” option given the decision criterion used. The next “best” result offers an opportunity of less involvement in trying to maximize net income through the use of CRC. Close behind CRC is also the use of the futures market.

Observation of the PDFs (see Appendix B) associated with the top ranking strategies of this decision criterion shows that all strategies together have a long and flatter tail to the right. This means the probability that the highest observed net income has a much smaller chance of occurrence. CRC or the Futures market observed PDFs show a less flat or taller/skinnier distribution, meaning there is a higher likelihood of realizing the greater net incomes possible with these strategies. Using all strategies together could also be viewed as a diversification strategy or seeking risk coverage through several different mediums. Diversification is not commonly considered a risk preferring strategy of finding the maximum output that requires the minimum inputs.

Due to a higher standard deviation and a flatter distribution a risk preferring individual would not use “all strategies.” Instead, pursuing the use of a CRC policy would achieve the goal of a risk preferring individual to maximize net income while minimizing costs. It would also be appropriate for a risk preferring producer to be involved in the futures market hedging wheat or both corn and wheat as well as using no strategy at all.

The final category of risk attitudes is that of the risk neutral individual. This decision criterion resembles a Safety-First approach. The criterion establishes the minimum net income at anything greater than $0 and that has a possibility of occurrence of 0.5 or 50%. Table 9 is the results of the Safety-First criterion sorted by net income observed at P = 0.5.

The Table 9: Results of the Safety-First Criterion Sorted by Net Income Observed at P = 0.5

Strategy	Mean	Standard Deviation	P > $50,000	Net Income Obs. at P = 0.5
All Strategies	$45,416	$97,278	0.407	$26,047
MPCI All 75-100	$20,429	$54,075	0.267	$14,732
CRC	$21,451	$67,978	0.323	$13,757
MPCI All 65-100	$17,242	$58,841	0.273	$12,312
MPCI All 55-100	$12,323	$63,466	0.268	$10,033
MPCI All 75-75	$14,162	$55,922	0.239	$8,289
MPCI Alfalfa	$4,661	$75,771	0.294	$7,941
MPCI Wheat	$6,516	$63,284	0.251	$5,032
MPCI Barley	-$2,858	$78,699	0.255	$2,870
No Strategy	-$4,558	$78,580	0.262	$2,785
MPCI Corn	$121	$76,554	0.255	$2,348
Futures Corn	-$4,042	$80,847	0.248	-$1,805
Futures Both	-$3,160	$83,294	0.247	-$3,125
Futures Wheat	-$3,841	$83,056	0.237	-$4,704
AGR-Lite	$4,395	$63,663	0.222	-$6,272

This decision criteria for the risk neutral individual resulted in the “best” strategy being once again using all risk management strategies in conjunction. The next “best” strategy is using a MPCI for all crops at 75% APH and 100% price coverage policy as a risk management strategy.

Again for all strategies the large standard deviation observed suggests there is a greater risk when compared to the standard deviation of MPCI All 75-100. In fact the all strategies scenario resulted in the highest standard deviation observed. Previous discussion of using all strategies together has been done in the previous decision criteria and applies here as well. High standard deviation, more cost and work associated to use all strategies and a flat distribution render using all strategies together relatively inefficient when compared with the results of the next “best” strategies.

Using the futures market or an AGR-Lite policy are immediately removed from consideration as the observed income at P = 0.5 is less than $0. MPCI policies for all crops ranked well using this decision criterion as well as a CRC policy. The results do favor using all strategies when considering the decision criteria quantitatively. In actual circumstances, purchasing a MPCI for all crops or a CRC policy may offer the producer less involvement in the management strategy. MPCI All 75-100 offers risk reduction associated with crop production. A CRC insurance policy offers protection against production and price risk. The observed net income at P = 0.5 is less than $1,000 different from the MPCI policy. Either of these two strategies would function well given these results for the risk neutral producer. Based solely upon the decision criterion using all strategies is the “best” risk management tool for the risk neutral individual. However, the MPCI All 75-100 policy as the next “best” strategy offers good risk reducing protection for those producers not wishing to pursue all strategies as a risk management strategy.

Appendix A and B contain the CDF and PDF for each simulated scenario. It is clearly visible that the CDF for all scenarios have a similar shape and curve. While not identical, the similarity is apparent. This gives rise to the question as to why this similarity exists. One of the most striking differences between each of the risk management strategies appears to be the cost the producer incurs by using a particular strategy. (See Table 6) If this is the case the similarity between the CDF is explainable by this medium, or that the only real difference between the management strategies is the cost.

However, that cannot be the case because all of the scenarios used together would only benefit the firm if they were the least costly option. After time, the more expensive strategies would cease to exist. Therefore, something else is affecting the way each risk management strategy influences the operation. This is known to be true through an approach of comparing the use of the futures market and the use of MPCI on all available crops.

First consider the futures market. It requires the contract buyer or seller to have cash on hand to make the hedge and to maintain the hedge during periods of fluctuation. The producer in this circumstance is taking the price risk found in the cash market and minimizing it by contracting at a set price in the futures market. This market switching does reduce the risk associated with an unknown selling price, but the overall price risk is still being borne by the producer / operation.

Using MPCI has a different approach to managing risk. When the producer purchases an MPCI product for each of the crops produced the production risk is shifted to the insurance company through which the policy was purchased. This removes the risk almost entirely from the producer / operation for the associated type of risk. Therefore MPCI is different in this particular regard from the risk reducing effects of the futures market.

Considering this example of the different risk reducing effects of the different tools illustrates the diverse interaction these tools have with the operation's risk management choices. Closer inspection of the CDFs shows minor dissimilarities in the slopes and shapes of the lines for each strategy. These minor variations are most likely the true effect of each of the strategies, whereas the major similarities of the CDF results from holding constant other variables within the "typical" farm's operating structure (e.g. same acreages for each crop, same asset base, no changes in management, etc…). The CDF charts can be viewed in Appendix A.

CHAPTER VI

CONCLUSION & RECOMMENDATIONS

The “typical” farm considered in this research tried to approximate an operation found in Box Elder County, Utah in the Intermountain West of the United States of America. Each of the risk management tools considered are not exclusively offered to this area of agricultural production; however, use of these tools is not as extensive as it is in other areas of the USA. Little research has been completed to evaluate the economical effectiveness of risk management strategies that can be used by producers in this region and caused this research to be conducted in the manner it was.

Completing this research highlighted some expected as well as unexpected results in relation to the economic effectiveness of risk management strategies. There were a few preconceived notions as to how the results would turn out and the complexity required for decision criteria to distinguish between strategies. This thinking was proved wrong by the end of the research as the necessary decision criteria did not need to be complex and in several instances what was initially thought to be the better strategy in fact resulted in being one of the worst given the decision criteria.

This dissertation considered the economic effects of Multi-Peril Crop Insurance, Crop Revenue Coverage, Adjusted Gross Revenue – Lite, and a limited interaction with the futures market. Several combinations of coverage were considered in MPCI and the futures market as well as a combination of all the considered strategies being used simultaneously.

The results were first organized by their associated probability of exceeding a net income of $0. This resulted in all strategies together being the most probable of exceeding $0 as the net income. The next "best" strategy was using a CRC policy. Due to all strategies having a high standard deviation, a flatter distribution observable in the PDF and more work and costs required, using all strategies effectiveness was diminished as an actual risk management strategy to be used by a producer.

It was also deemed necessary to try and differentiate risk management strategies by the risk attitude a producer may possess. These three attitudes were risk adverse, risk preferring or seeking, and risk neutral. To assimilate a risk adverse attitude a maxi-min approach was used. This decision criterion chooses the largest minimum net income observed in the simulation results. The "best" strategy for this criterion was using AGR-Lite to reduce risk.

Using an AGR-Lite policy fits well with a risk adverse individual as the nature of the policy is not meant to make the producer richer, but to minimize adverse effects on the "typical" farm. The strategy had a smaller standard deviation suggesting strong performance at delivering indemnity payments sufficient to continue production.

The next "best" strategy was using all of the strategies in conjunction. As previously mentioned in actual circumstances it seems illogical to pursue all of these risk management strategies at the same time. However, for the extremely risk adverse individual this strategy fits. It was also noted that the MPCI policies for all of the crops performed well under this decision criteria.

The next attitude considered was the risk preferring individual, which engaged the use of the maxi-max decision criteria. This criterion separates the results by selecting the maximum value observed in the simulated results. Under these conditions the “best” risk management strategy was again using “all strategies” in conjunction with each other. The next “best” strategy was using CRC as a risk management strategy followed by two of the three futures market strategies considered.

In this case using all strategies is counter intuitive to what would be considered a risk preferring or seeking individual. Therefore this strategy is mainly disregarded as the “best” strategy for a risk preferring individual. The next four strategies appear to fit well with a risk preferring producer. In a risk preferring situation, the producer would want to minimize expenses associated with risk management while still increasing the gains received at the end of production.

For the risk preferring individual, the next “best” option of using CRC to reduce risk while maximizing net income should be used given the results. Using the futures market also offers another good alternative for risk management and achieving the most net income possible. Therefore the risk preferring individual may also consider the use of the available futures market contracts.

The final risk attitude considered was that of a risk neutral producer. For this attitude, a decision criterion similar to a Safety-First approach is utilized. In this situation the minimum net income was established that the strategy needed to exhibit a possibility of occurrence of 0.5 or 50% and net income greater than zero. The resulting “best” strategy was using the futures market for corn and wheat. The next “best” strategy again using all strategies in conjunction followed by MPCI for all crops at 75% APH and 100% price coverage.

A risk neutral individual would basically have no preference between strategies; he would be interested in maximizing net return to the operation at a moderate level of risk. All strategies together offers higher returns in the scenario considered. However, in the case of the risk neutral producer, using all strategies again exhibits unfavorable characteristics when compared to the next “best” strategy. Therefore a policy of MPCI at 75% APH and 100% price is a good strategy to reduce risk and maximize returns. CRC also performed well in this decision criterion.

The results were not the same as initially thought. Initial perception was AGR-Lite would be a top contender as a “best” strategy in all decision criterion. It was not expected that using “all strategies” in conjunction would be the “best” management tool in two categories of the three risk attitudes. It was also interesting to have CRC be a strong risk management tool for the “typical” farm.

Below is a quick review of the observed results of this study they are:

P= Net Income > $0 = “Best” = All Strategies; Next “best” = CRC

Risk adverse: “Best” = AGR-Lite; Next “best” = All Strategies

Risk preferring: “Best” = All Strategies; Next “best” = CRC

Risk Neutral: “Best” = All Strategies; Next “best” = MPCI All 75-100

While some risk management strategies considered in this study performed well given the data and assumptions used it is clear that no one strategy by itself consistently outperforms all others. While several of the strategies consistently performed well, such as CRC or MPCI All 75-100, none always out performed the others when considered individually. It can also be concluded that using some form of risk management strategy is better than using no strategy at all.

It can also be concluded that the policies that performed well corresponded to the makeup of the farm. For example, MPCI for all crops for the several coverages considered performed for the most part better than the MPCI strategies that considered only one crop at a time. CRC performed well in several criterions, but CRC policies are only available for wheat and corn in Box Elder County, Utah. If the “typical” farm consisted of a greater percentage of alfalfa and barley acreage versus corn and wheat CRC would not have performed as well at reducing risk.

Recommendations

By analyzing these risk management tools, it is clear that each of the strategies considered has something to offer producers. AGR-Lite is a good product for the risk adverse individual. CRC and MPCI All 75% APH -100% price election are also good insurance products available for use by farmers in Box Elder County, Utah. While “all strategies” presented very positive results, it was disregarded as a viable option in actual circumstances due to a flatter distribution (i.e. smaller probabilities of achieving higher net incomes) and increased work and costs to secure all risk management tools. Careful evaluation needs to be done when considering which policy best fits the producer’s operating structure as the structure of the farm does appear to influence the effectiveness of the strategy pursued.

After completing this research, it was realized that several improvements or variations could be done with regards to researching the economic effectiveness of risk management tools available to agricultural producers in the Intermountain West. The first of these is the consideration of the futures market in reducing risk within an operation. More time could be spent in manipulating the true effect of the futures market through more region specific costs and basis information. This research assumed that cost information for using the futures market was already incorporated in the variance of the basis observed. It may be beneficial to not make this assumption and specify to a more accurate degree the associated costs and benefits.

It may also be beneficial to include risk reduction through the futures market for other crops considered. Barley is traded on the Winnipeg Commodity Exchange in Canada. Barley was not considered in this research as consideration would then have to be given to international exchange rates between the United States and Canada. There are also ways or methods to secure crops not exchanged in the futures market by substitution. For example, alfalfa is not traded on any commodity exchange, however to minimize price risk a producer could trade in another commodity's futures contracts in equivalent dollar amounts to cover alfalfa price risks. There are a variety of methods, theories and mechanisms that can be further researched in relation to the effects of using the futures market to reduce risk in an agricultural operation.

A further recommendation for future research is to extensively gather local data to further specify the characteristics of the "typical" farm used in the research. This may be done through incorporating new data to be released by the USDA in 2008 from the 2007 agricultural census, which was not available as this research was being completed. Surveys of local producer could also be used to generate region specific characteristics. For example, risk attitudes could be surveyed in relation to the crops and scenarios considered to further identify topics of interest for producers in the region.

It may also be beneficial to further research to explore other distributions to be used in random yield and price generation for the simulated scenarios. In this research, a triangular distribution was assumed. There is a lot of research already completed and being completed on this topic of the correct distribution for use in agricultural related simulation. As the efficiency of forecasting the stochastic variables increases, so too does the efficiency of the hypothesis being tested that uses those stochastic variables, in this research that is specifically yield and price.

During the past few years commodity and agricultural input prices have seen drastic increases in value. This is the reason consideration of cost and price information only went to 2006 in this research. The drastic increase in these values during 2007 began to skew the data, making it inefficient for use. As time passes and more price and cost information becomes available the economic efficiency of the scenarios and risk management strategies considered may be altered.

The final recommendation to be mentioned is the consideration of other risk management tools or varying the combination or values used in the considered coverages. With an almost unlimited combination of possibilities, the results will undoubtedly vary as Actual Production History changes, or as the RMA and FCIC election prices change. This makes researching this category difficult as the choices vary greatly and depend largely on the producer’s risk attitude and financial circumstances.

One of the goals of this research was to create a mechanism that would allow for quick and easy manipulation of the variables that can offer results based upon those inputs. While not perfect, a sound base has been established through this research that has taken a large step towards accomplishing the aforementioned goal.

CHAPTER VII

SELF REFLECTION

Interests and Benefits

I have grown up working in the agricultural sector and enjoy the accomplishments of that lifestyle. Past success now motivates me to continue to pursue a career in agriculture. Some of my endeavors were in management farming by being the owner/operator of several pieces of small grains harvesting equipment in a custom harvesting business, as well as operating several hundred acres of crops. This enabled me to experience first-hand the pressures associated with bearing risk in an operation. Previous to this dissertation my knowledge of risk management tools was not very extensive, nor did I comprehend in full the economic benefits that could be realized by utilizing these tools.

During the course of carrying out the coursework associated with this degree, the opportunity arose to complete this research. My background as previously described drove my interests in assuming the task of researching the subject matter contained herein. Acquiring this knowledge for me will benefit my future approaches in successfully running an agricultural operation. There is also the realization that other producers may also benefit from this research, and that further motivates my interest in completing this dissertation.

Reflections

As I reflect upon my experience in completing this research, major educational expansion has occurred throughout the duration of the dissertation and its associated processes. While the results were not all expected, the complexity of this issue was realized. My knowledge of risk and managing risks in agriculture has expanded, but has only “touched the tip of the iceberg,” as it is said. As I have composed the literature review, the data manipulation processes, and interpreting the output of those processes, I now appreciate my predecessors whose research helped increase the validity of this dissertation’s topic.

This dissertation and degree program have helped me build researching skills. Undoubtedly, I will need to do research, compose reviews of literature, and formulate reports based upon research in the future. Completing this project has been a growing experience as to the methods of researching. I now feel comfortable with the research processes, of which the variety to choose from is almost endless.

Numerless nights, I would lie in bed thinking and reflecting upon the research I had completed that previous day. If that is the true sign of a researcher or a stressed student, I definitely fit both categorizations. I find myself confident in the use of Microsoft Excel, Simetar and other economic analysis methods. Many times I find myself using these learned approaches in everyday non-research experiences. This is easy to do, as economics is a social science, studying the actions and reactions of individuals in the marketplace. While a variety of sciences are involved in agriculture, I often find myself relying upon skills learned through economics to solve issues.

I am grateful for this experience. I have no doubt that growth has occurred within me in several areas. I accomplished one of my personal goals of expanding my knowledge of risk management in agriculture. The subject of risk management is not going to disappear any time soon, and I find myself now interested in staying abreast in the subject matter. In my current employment position, my knowledge of risk management is not critical to my immediate success. However, my ambitious goals will require the use of this experience, knowledge and acquired skills in future positions of employment.

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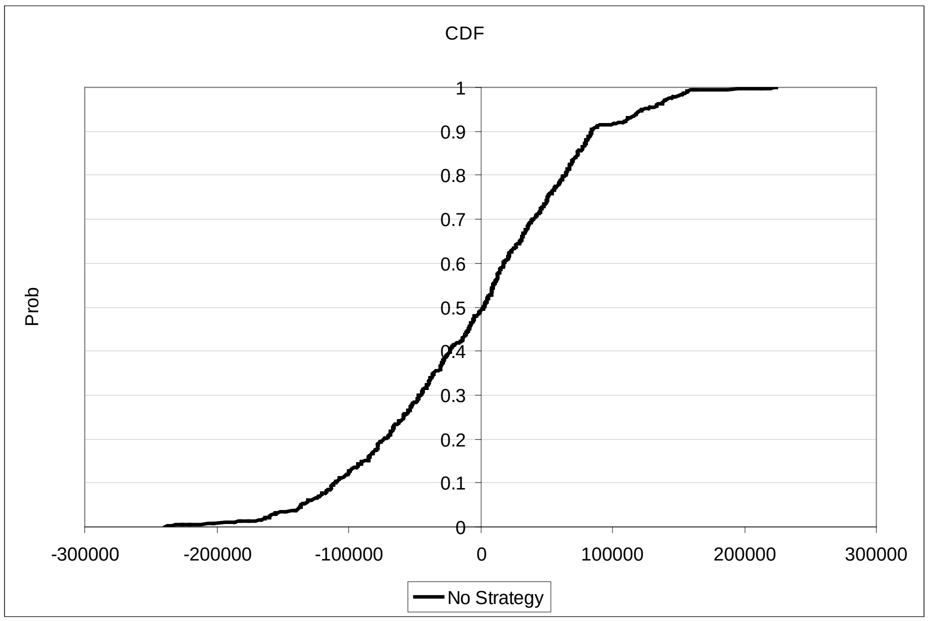
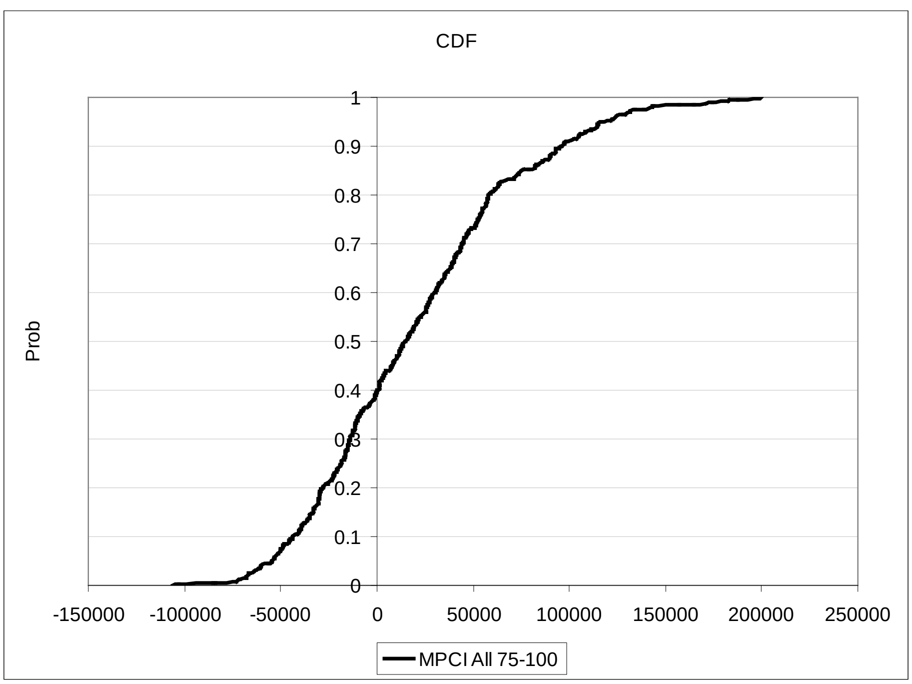
APPENDIX A

OBSERVED CUMULATIVE DISTRIBUTION FUNCTION CHARTS

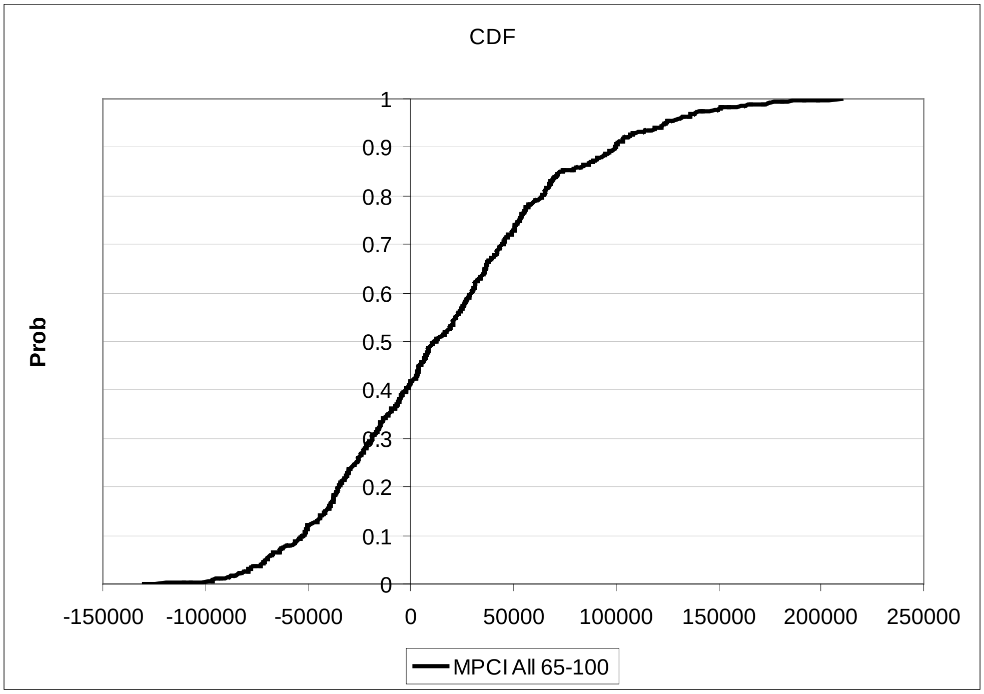
Using no Risk Management Strategy



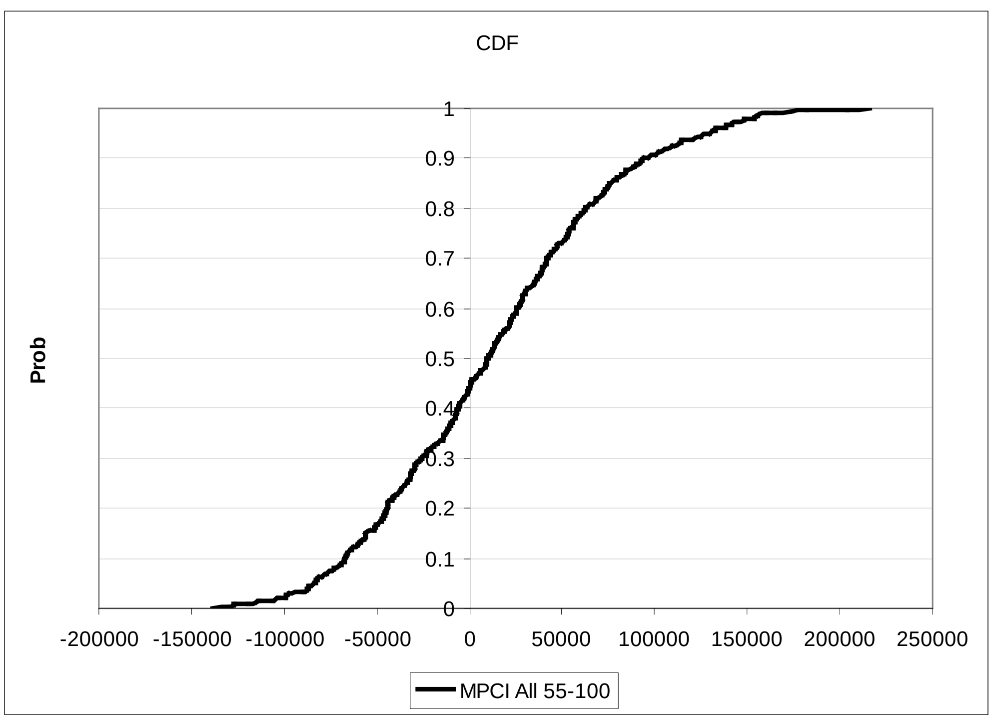
MPCI All 75% APH -100% price election



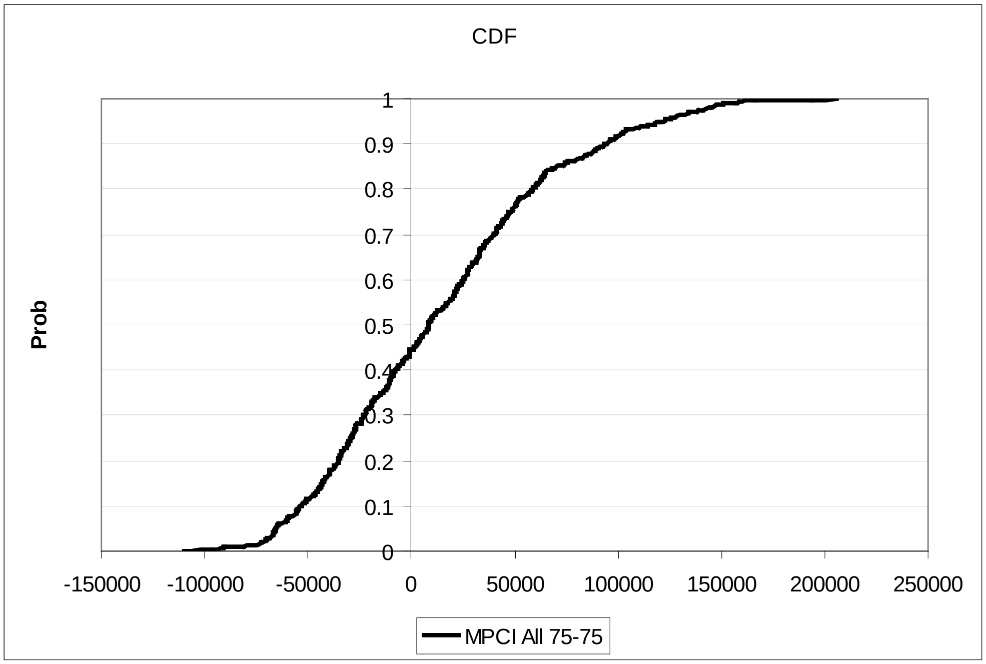
MPCI All 65% APH -100% price election



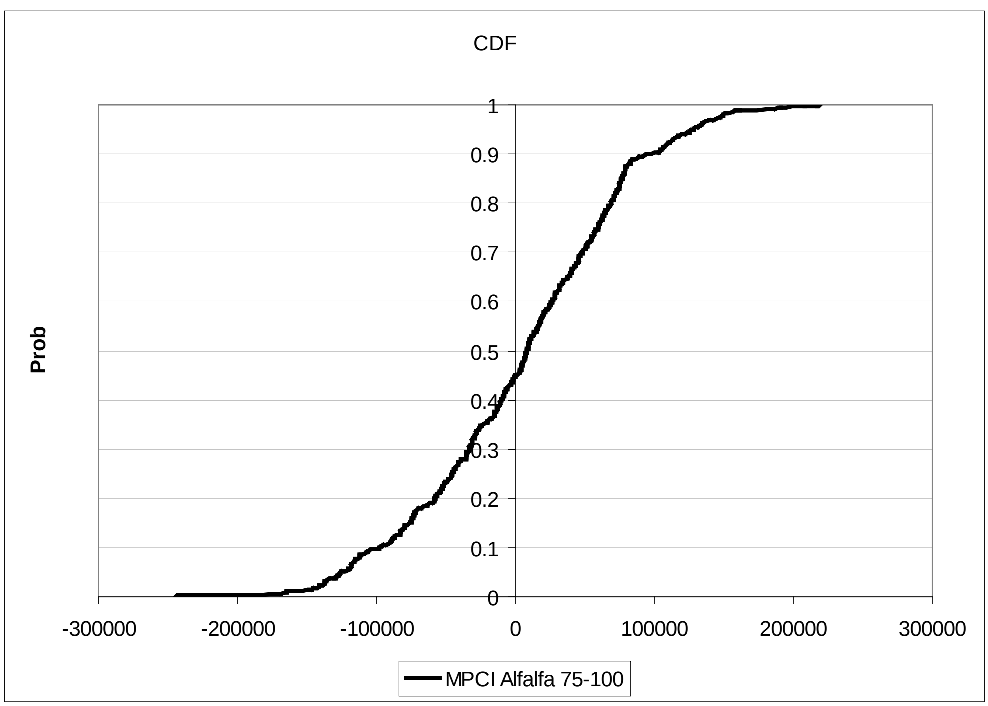
MPCI All 55% APH -100% price election



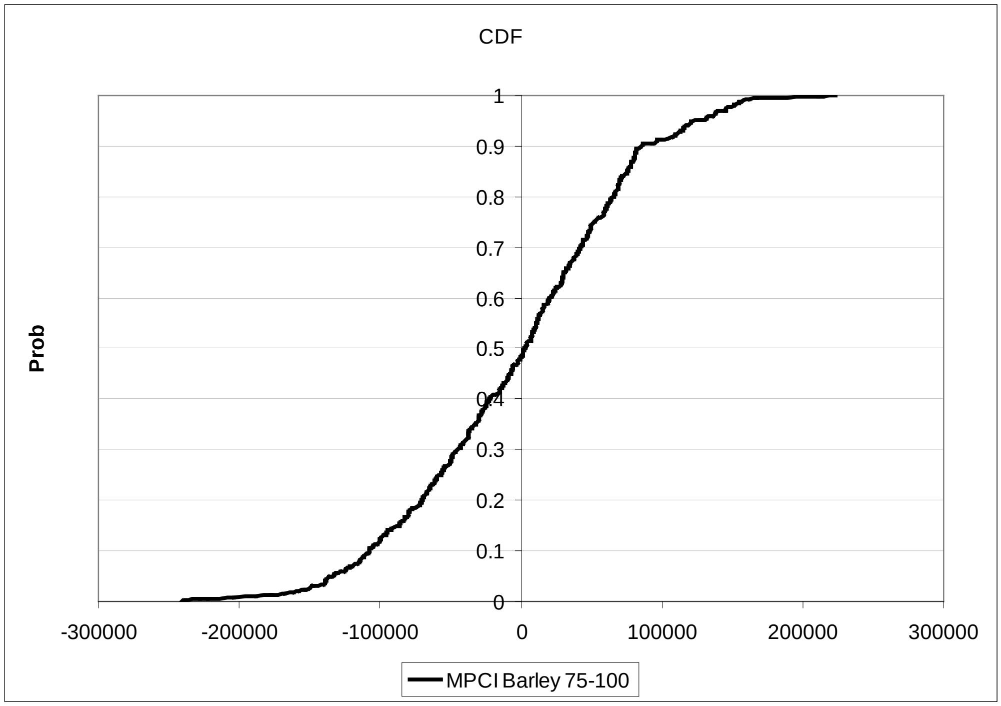
MPCI All 75% APH -75% price election



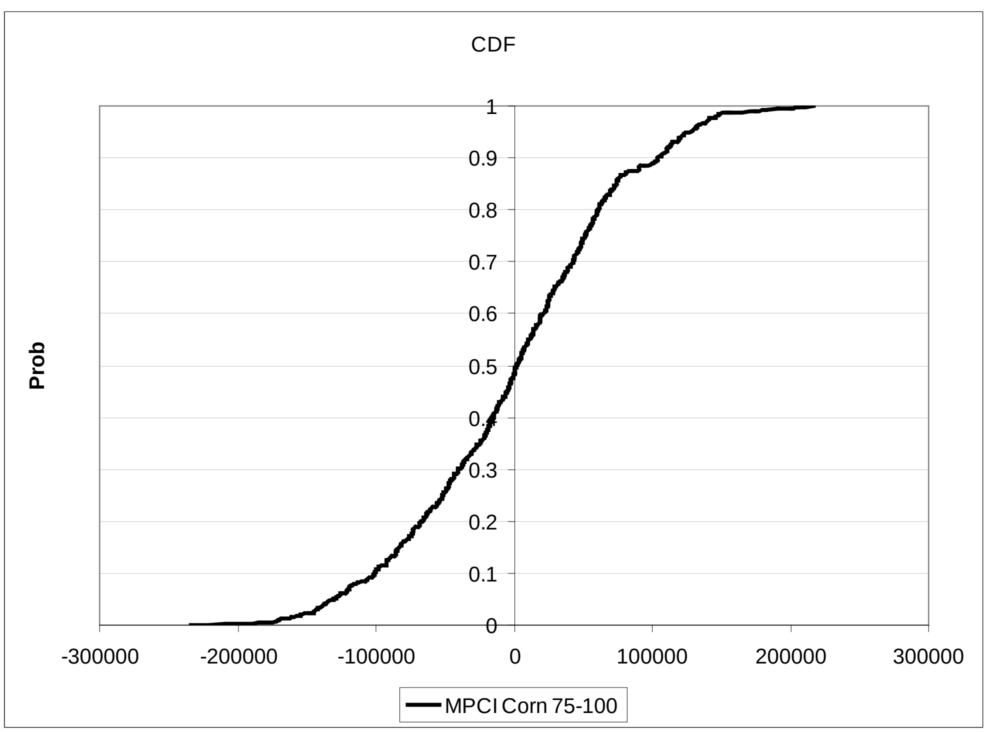
MPCI Alfalfa 75% APH -100% price election



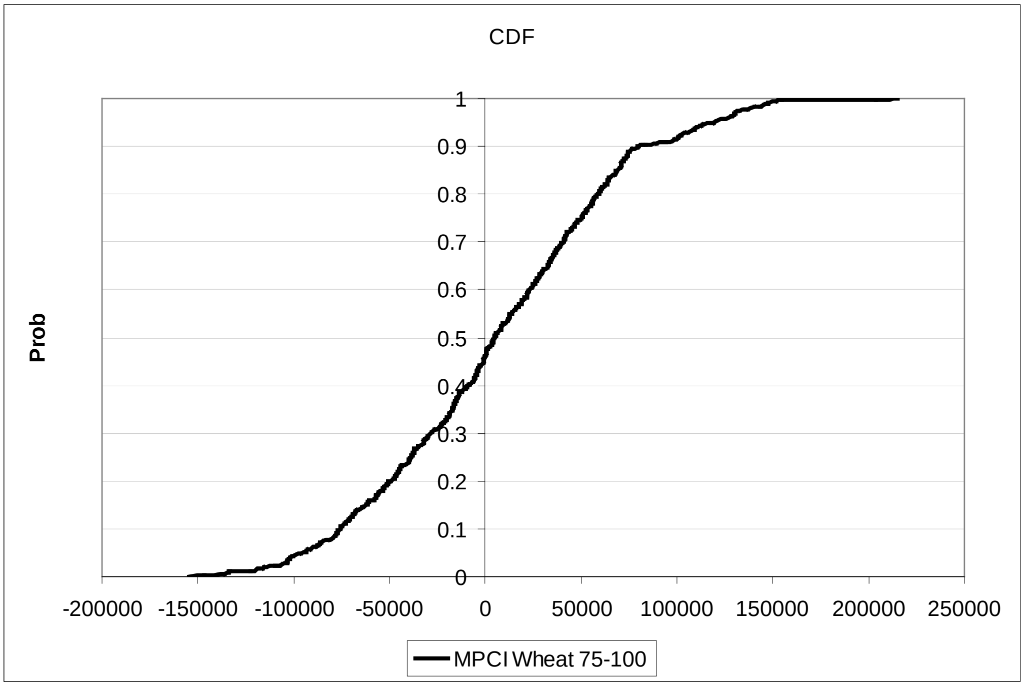
MPCI Barley 75% APH -100% price election



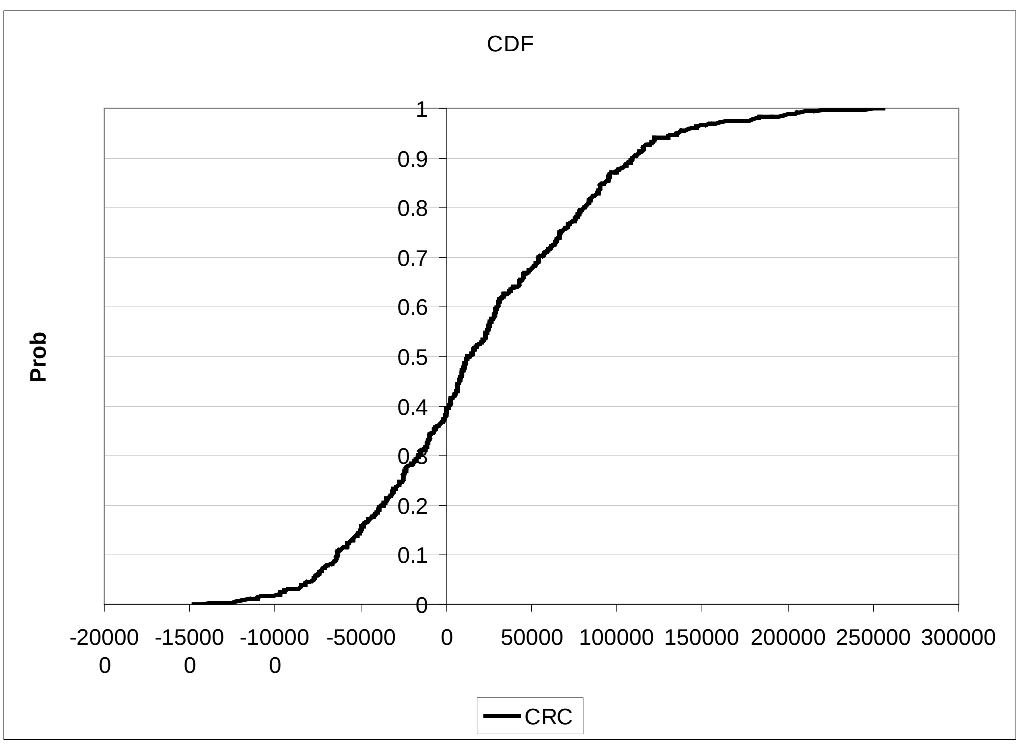
MPCI Corn 75% APH -100% price election



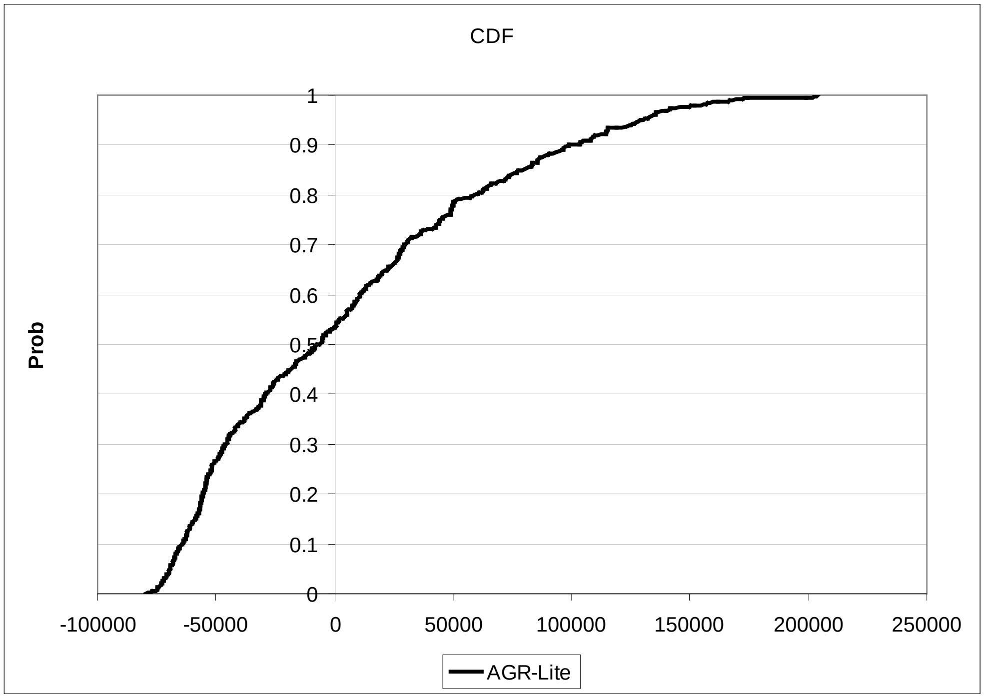
MPCI Wheat 75% APH -100% price election



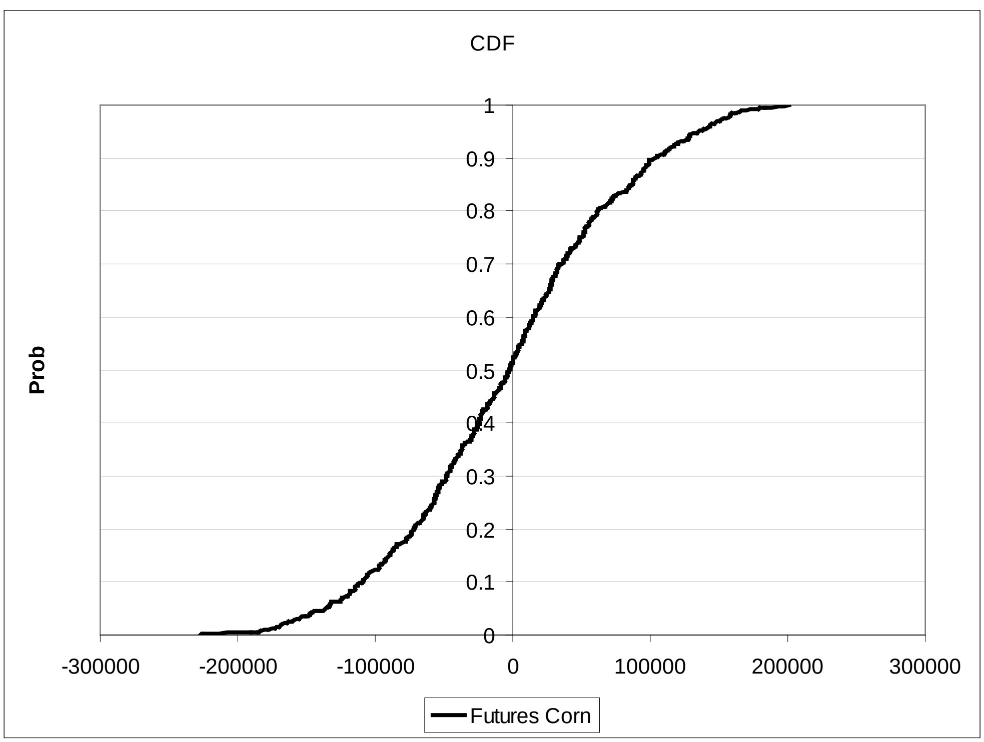
Crop Revenue Coverage



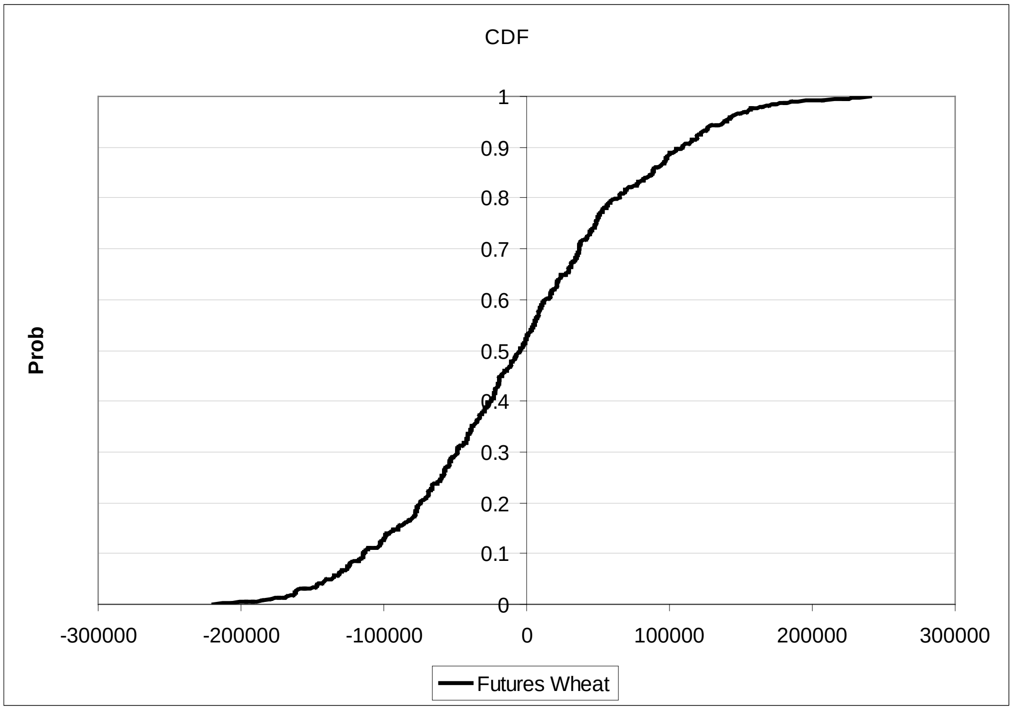
Adjusted Gross Revenue – Lite



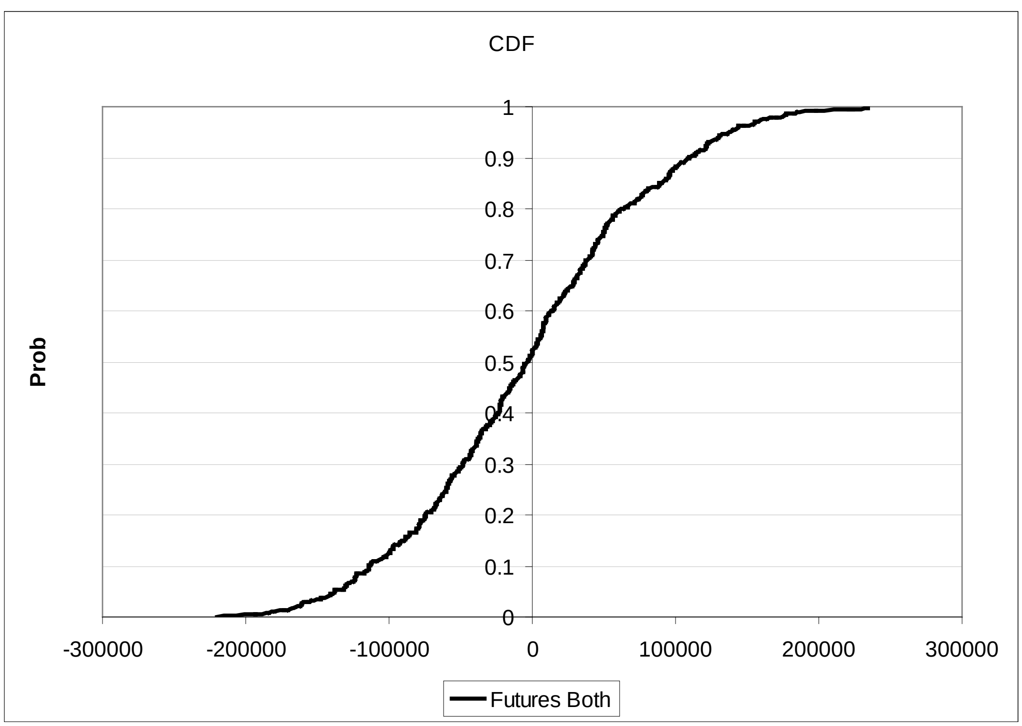
Using the Futures Market for Corn



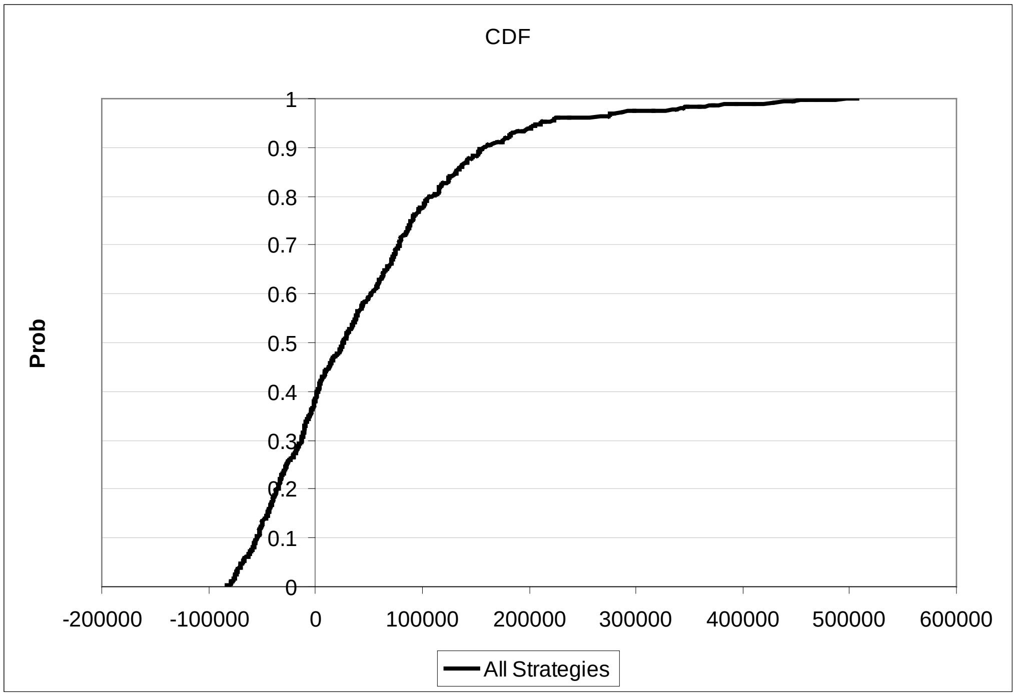
Using the Futures Market for Wheat



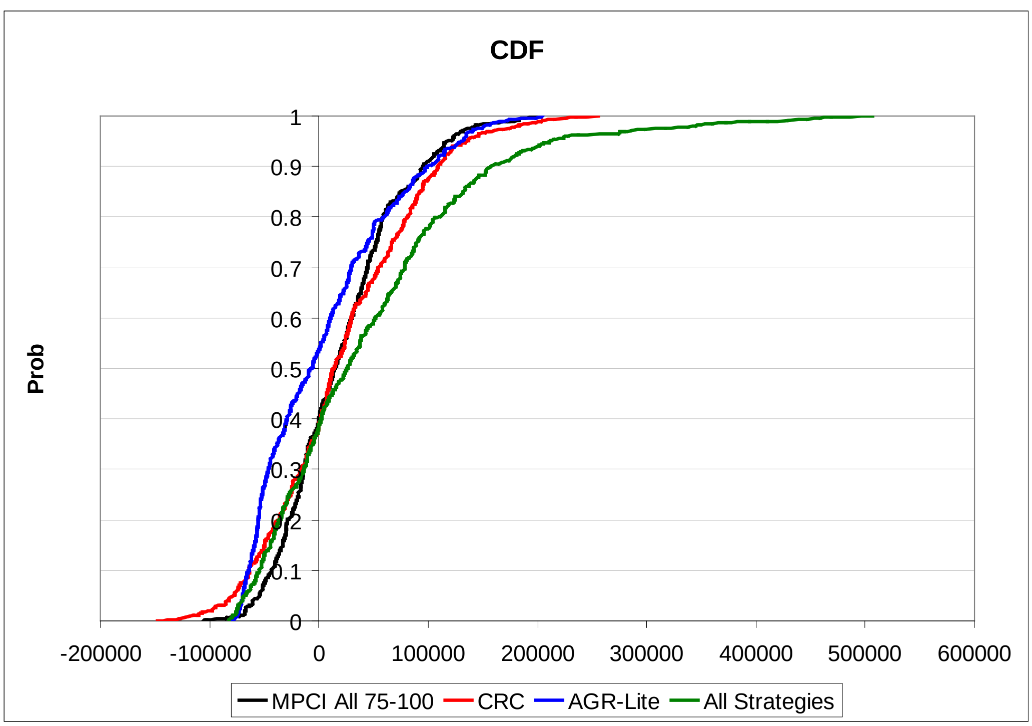
Using the Futures Market for Both Corn and Wheat



Using All Strategies Considered in Conjunction



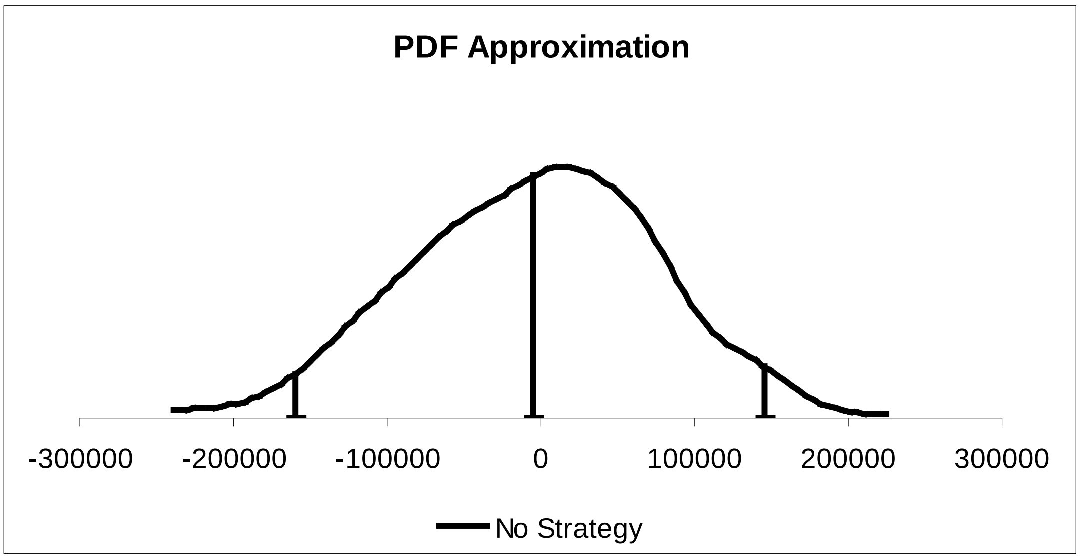
The “Best” and Next “Best” Strategies Observed in Study



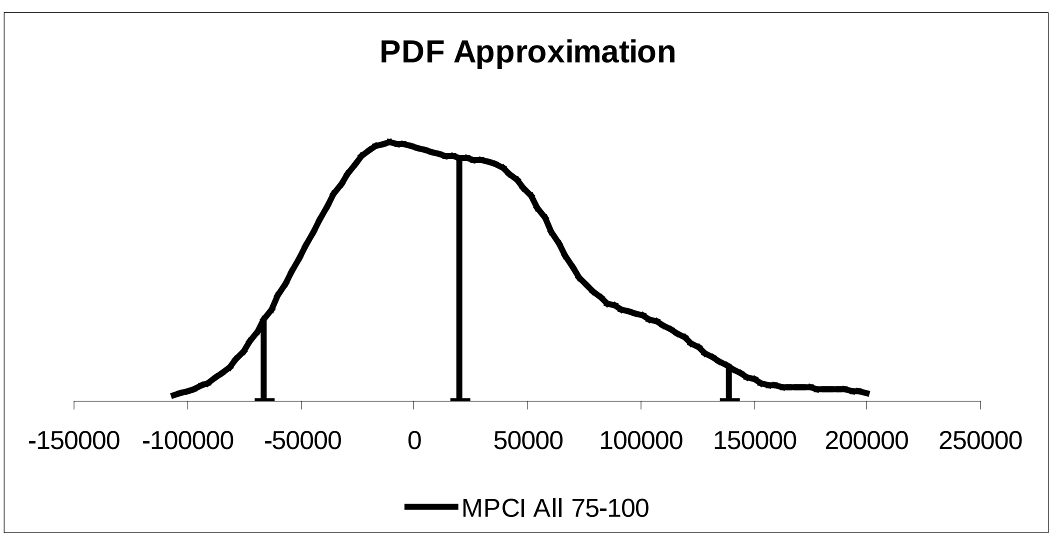
APPENDIX B

OBSERVED PROBABILITY DENSITY FUNCTION CHARTS

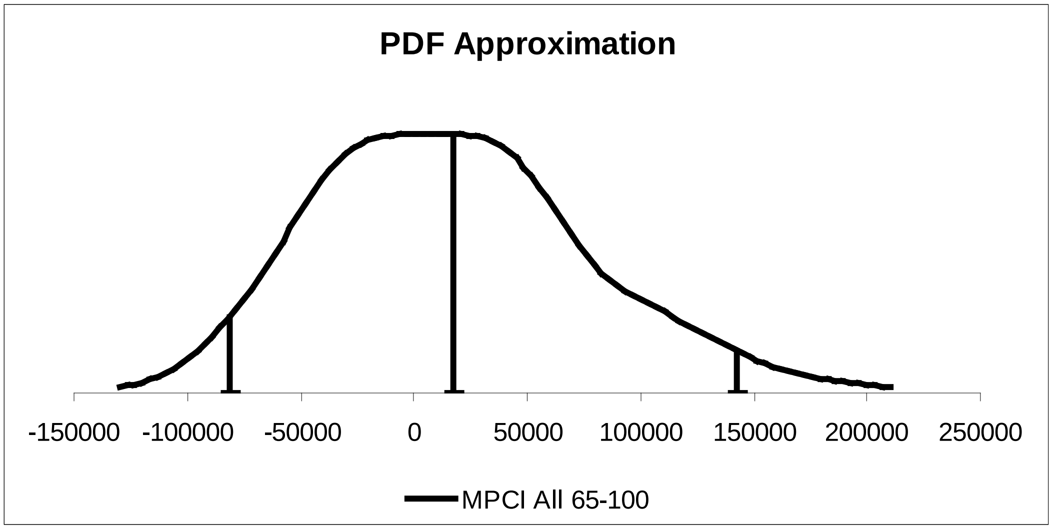
Using no Risk Management Strategy



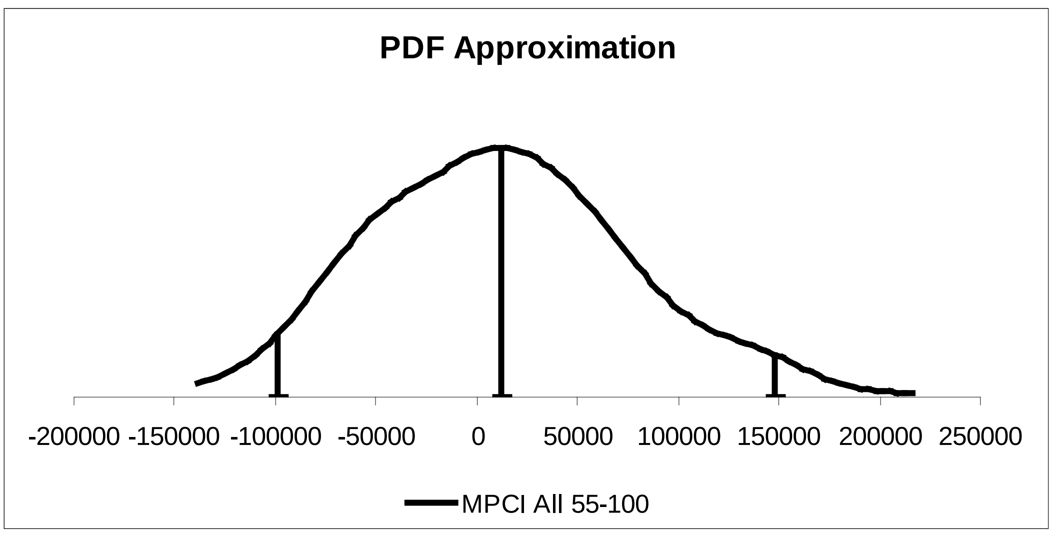
MPCI All 75% APH -100% price election



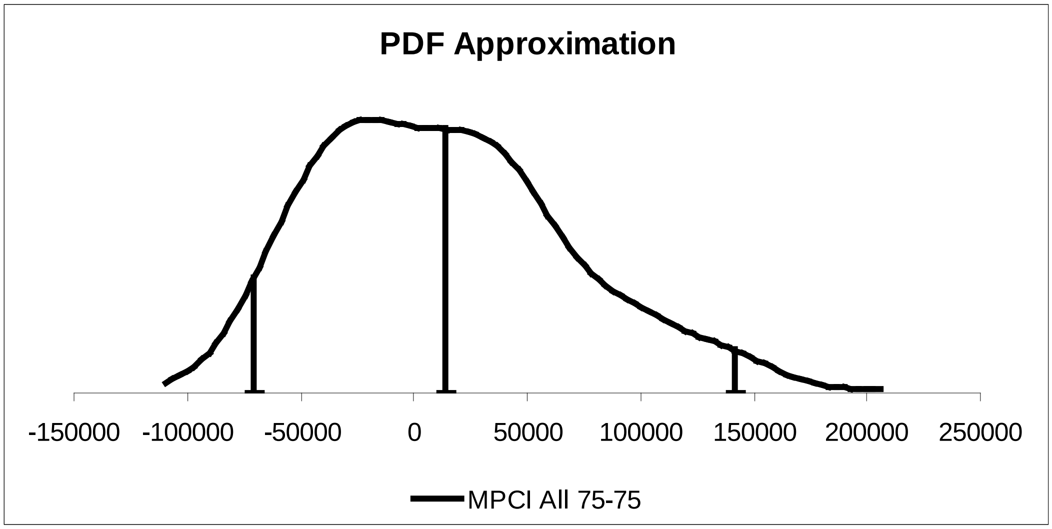
MPCI All 65% APH -100% price election



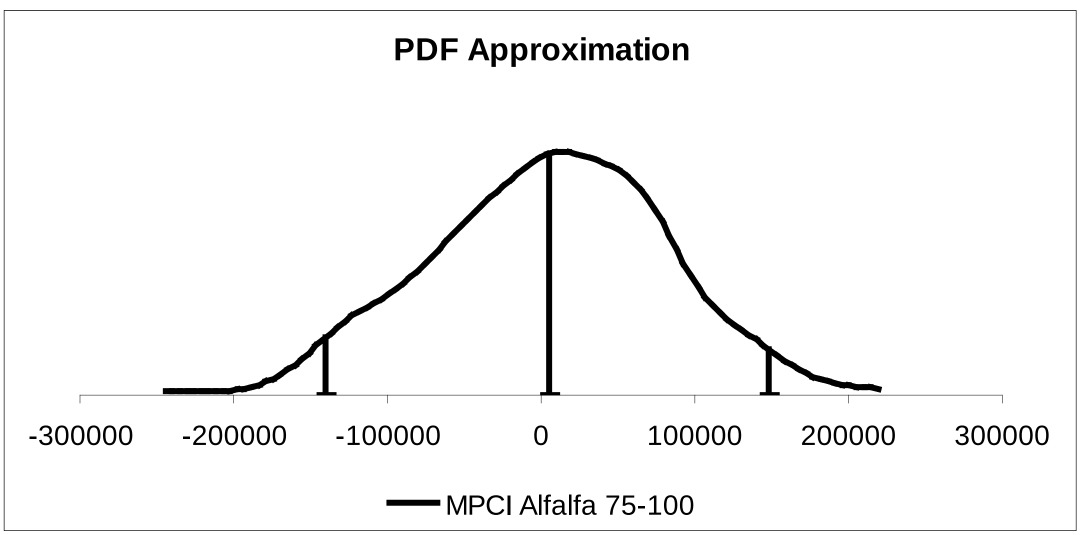
MPCI All 55% APH -100% price election



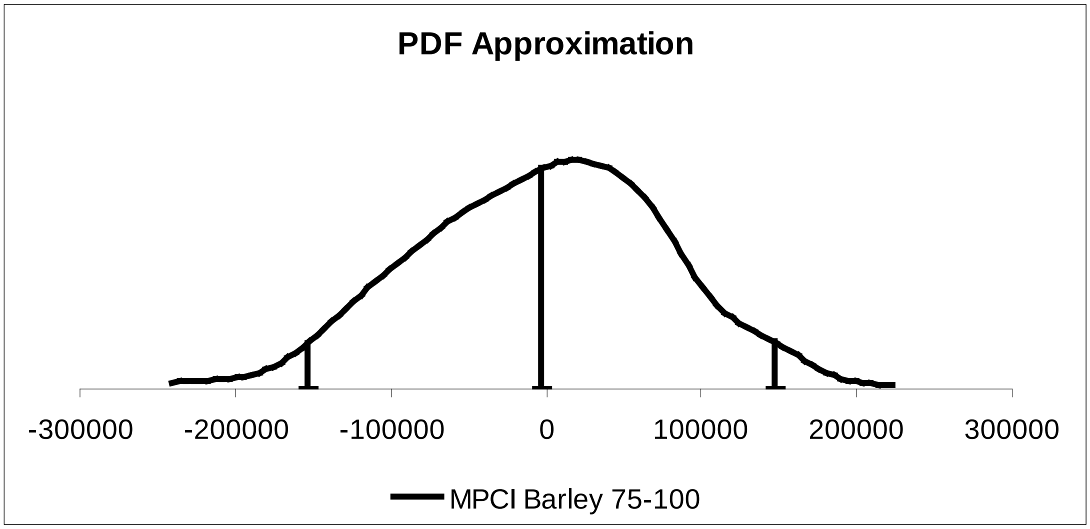
MPCI All 75% APH -75% price election



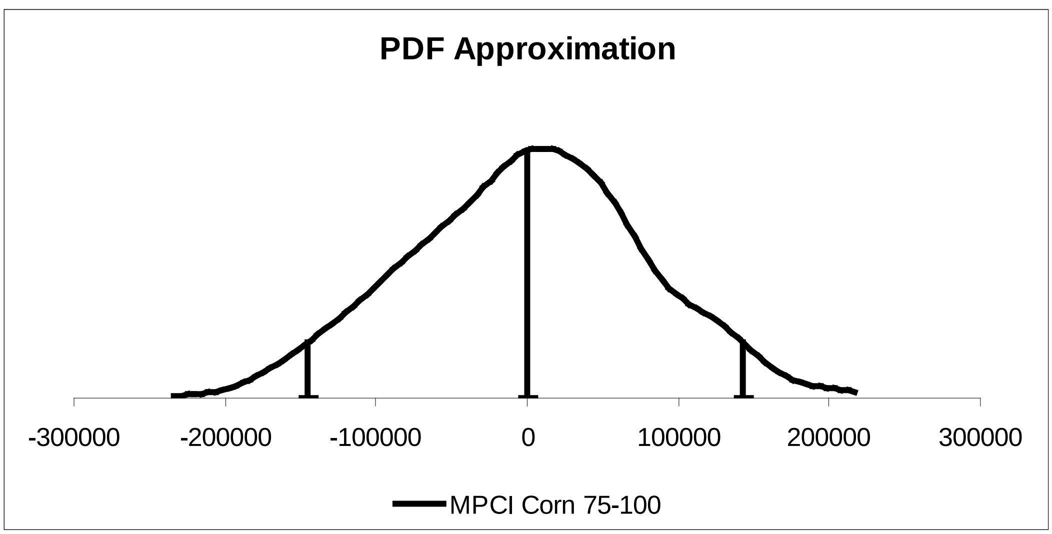
MPCI Alfalfa 75% APH -100% price election



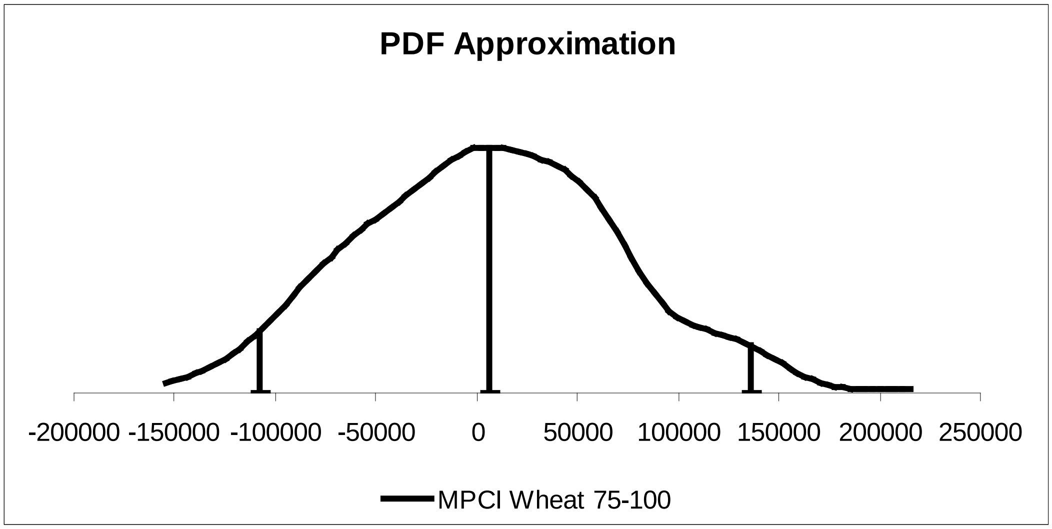
MPCI Barley 75% APH -100% price election



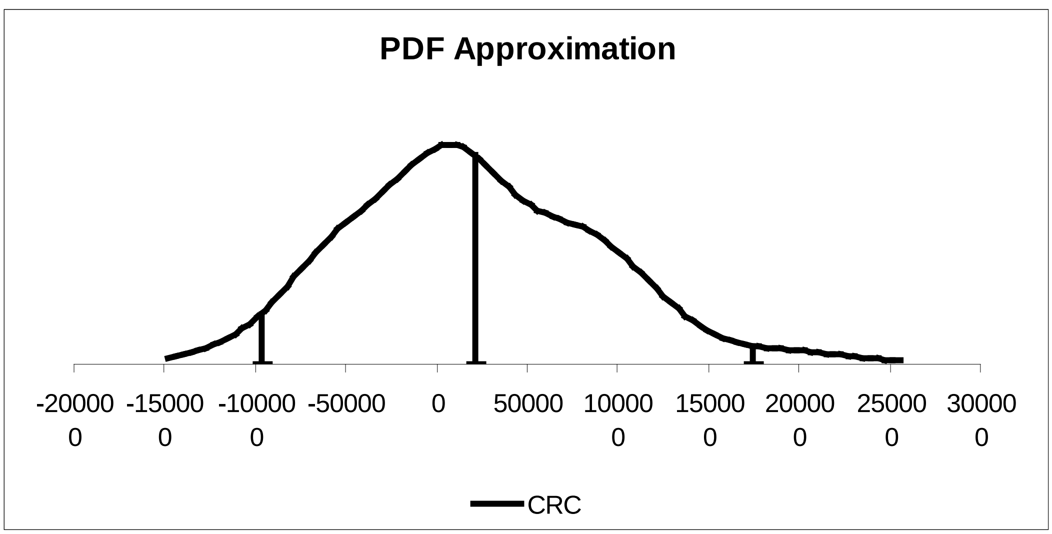
MPCI Corn 75% APH -100% price election



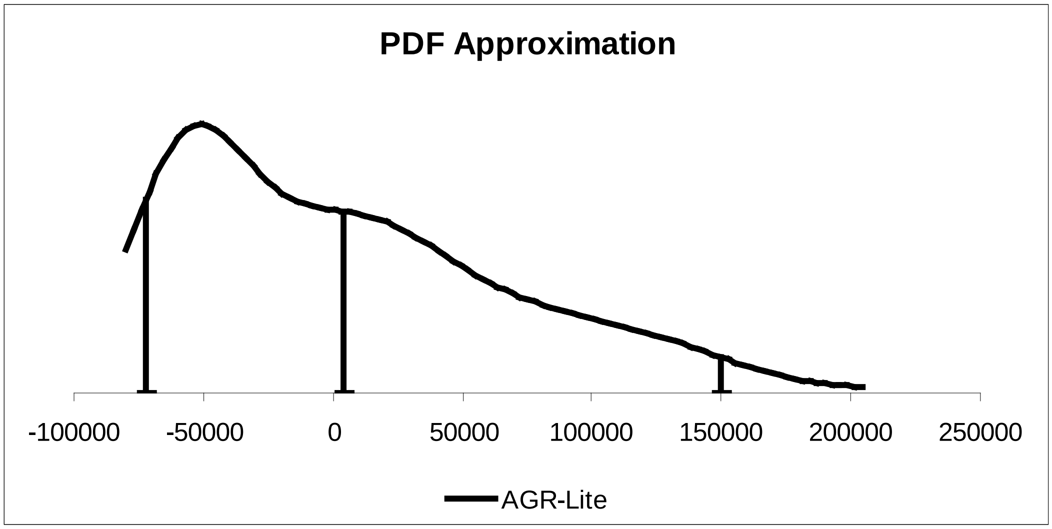
MPCI Wheat 75% APH -100% price election



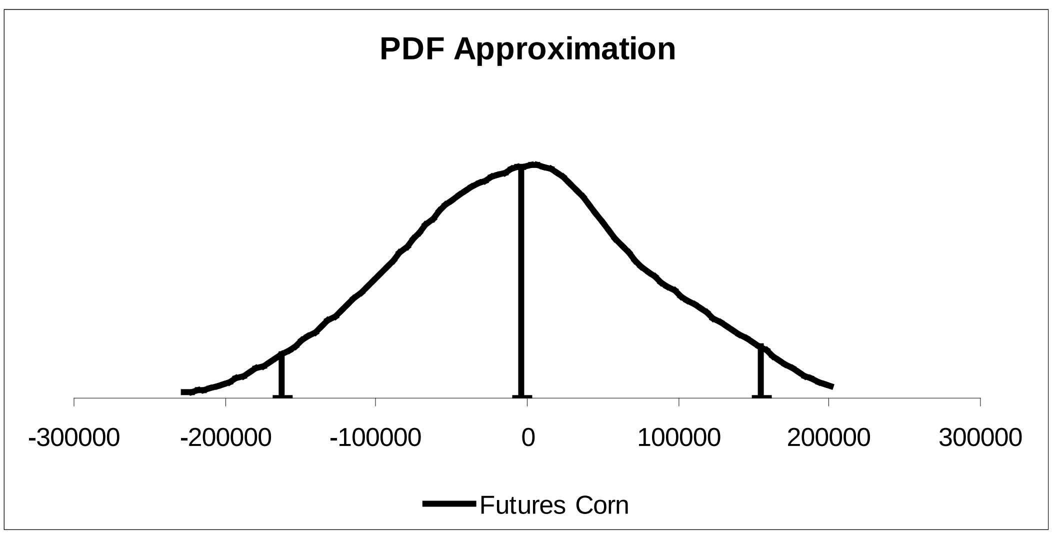
Crop Revenue Coverage



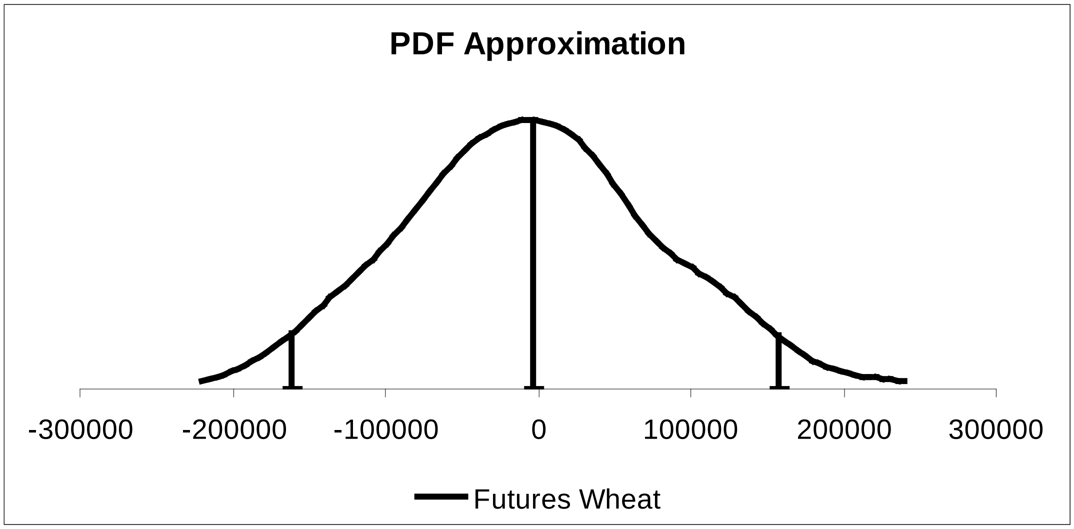
Adjusted Gross Revenue – Lite



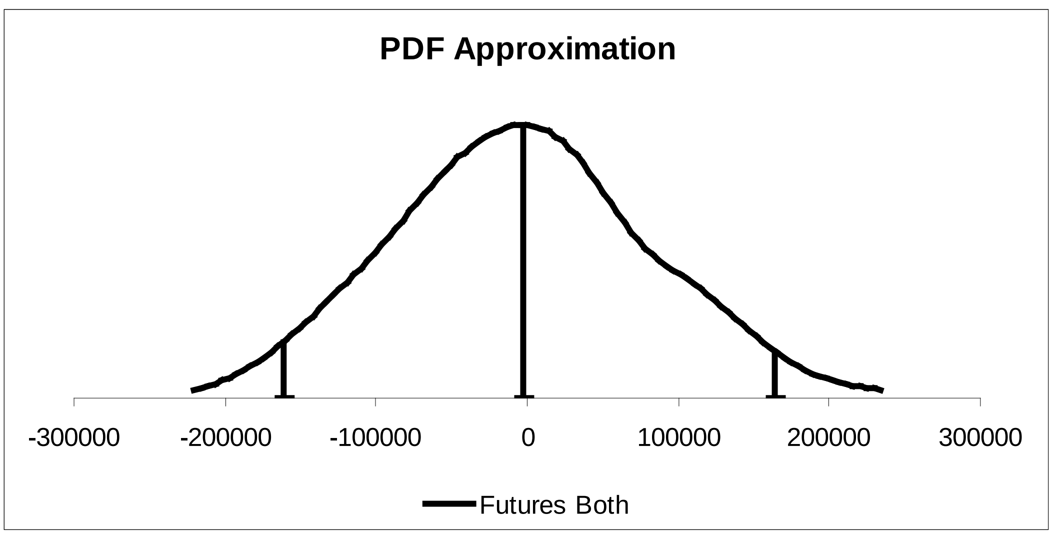
Using the Futures Market for Corn



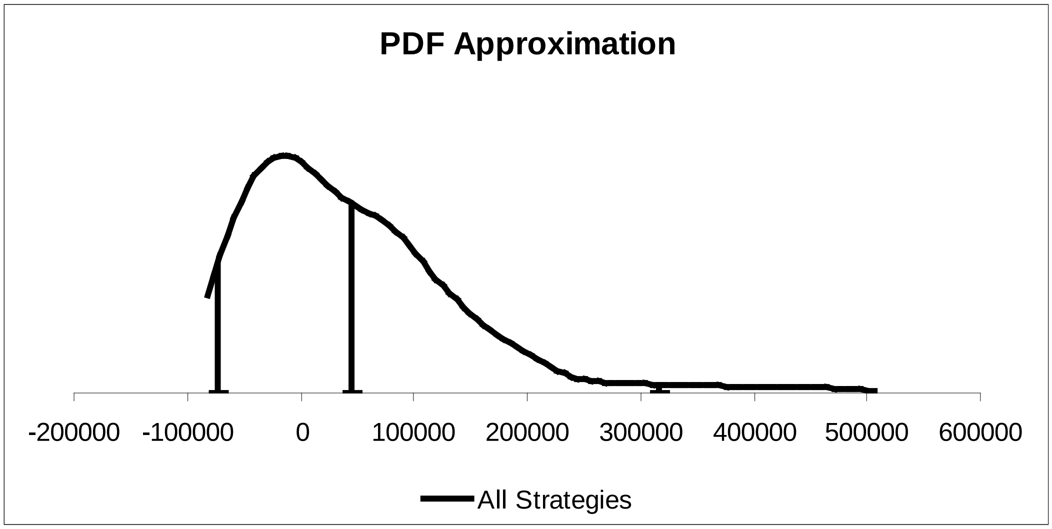
Using the Futures Market for Wheat



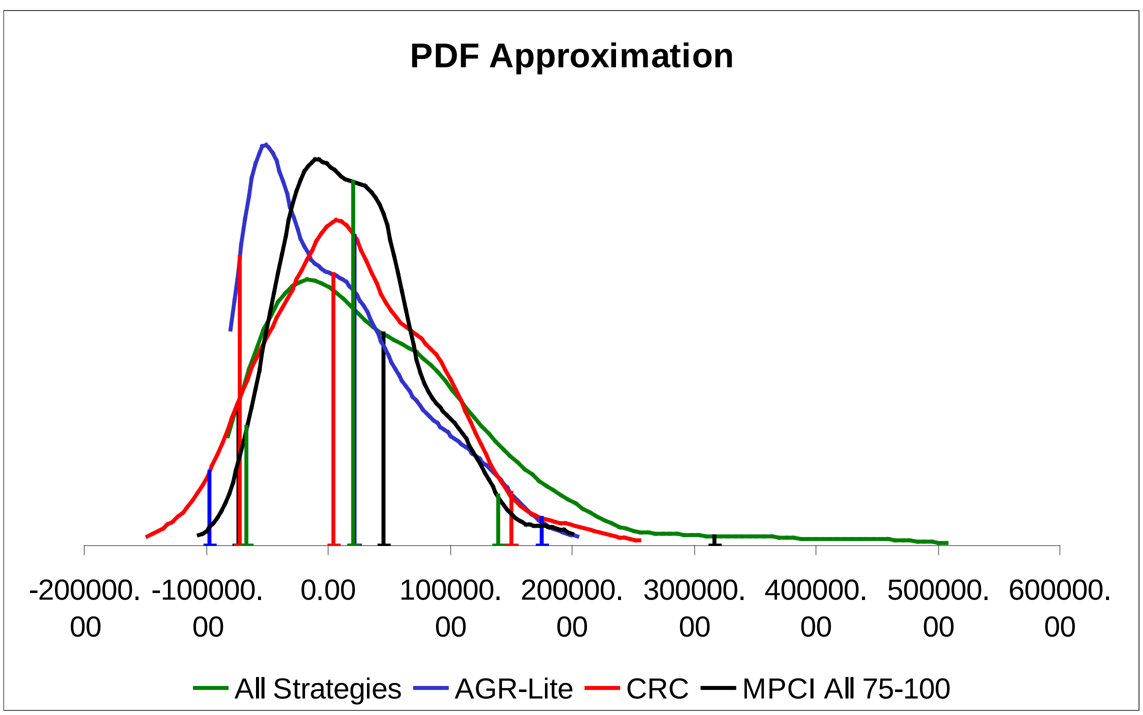
Using the Futures Market for Both Corn and Wheat



Using All Strategies Considered in Conjunction



The “Best” and Next “Best” Strategies Observed in Study



APPENDIX C

SPREADSHEETS USED IN THE RESEARCH

Crop Enterprise Budgets

Alfalfa

Utah State University
Extension Economics

Modify Colored Columns

Costs and Returns per acre from growing alfalfa hay, 2006
Box Elder County

	Quantity per acre	Unit	Price/cost per unit	Value/cost per acre	Base Value	Value/cost per Bushel
Receipts						
Alfalfa hay	2.64	tons	$75.95	$200.88	$531.40	$60.61
Residue	-	AUM	$0.00	$0.00	$0.00	
Subtotal				$200.88	$531.40	
Operating costs						
Fertilization						
Phosphate (11-52-0)	96	pounds	$0.18	$17.14	$17.14	
Custom application	1	acre	$7.82	$7.82	$7.82	
Pesticides/herbicides						
Furadan	1	pint	$10.50	$10.50	$10.50	
Velpar	2	quart	$16.50	$33.00	$33.00	
Custom application	1	acre	$7.82	$7.82	$7.82	
Irrigation (siphon)	6	irrigations				
Labor	2.33	hours	$10.00	$23.33	$23.33	
Water assessment	1	share	$10.00	$10.00	$10.00	
Repairs/maintenance	1	acre	$2.30	$2.30	$2.30	
Pumping	-	acre inch	$0.00	$0.00	$0.00	
Harvesting						
Swathing	4	acre	$4.03	$16.14	$16.14	
Turning/raking	4	acre	$1.39	$5.57	$5.57	
Baling	2.64	tons	$4.79	$12.67	$28.74	
Hauling/stacking	2.64	tons	$3.63	$9.60	$21.78	
Crop insurance (75% Yield, 100% Price)	-	acre	$24.22	$0.00	$24.22	
Interest on operating capital			7.61%	$4.42	$5.42	
Subtotal				$160.30	$213.77	
Ownership costs (excludes cost of land)				$69.10	$69.10	
Farm insurance	1	acre	$2.00	$2.00	$2.00	
Machinery ownership costs	1	acre	$58.85	$58.85	$58.85	
Irrigation equipment costs	1	acre	$8.25	$8.25	$8.25	
Total costs				$229.40	$282.87	
Net returns to owner for unpaid labor, management, equity and risk						
Above operating costs				$40.57	$317.63	
Above total listed costs				-$28.52	$248.53	

AlfalfaBudget / BarleyBudget / CornGrainBudget / WheatBudget / Income / Expen

Barley

Microsoft Excel - GrandFile.xls

A1 Utah State University

	A	B/C/D	E	F	G	H	I	J	K
1	Utah State University								
2	Extension Economics					Modify Colored Columns			
3		**Costs and Returns per acre from growing barley, 2006**							
4		**Box Elder County**							
5			**Quantity**		**Price/cost**	**Value/cost**			**Value/cost**
6		**Receipts**	**per acre**	**Unit**	**per unit**	**per acre**	**Base Value**		**per Bushel**
7		Barley	139.9	bushels	$2.32	$325.36	$210.28		$1.29
8		Straw	0.50	tons	$43.00	$21.50	$21.50		
9		**Subtotal**				$346.86	$231.78		
10		**Operating costs**							
11		Land preparation							
12		Plowing (every 3rd year)	1/3	acre	$5.88	$1.96	$1.96		
13		Discing w/ packer	1	acre	$3.73	$3.73	$3.73		
14		Land plane	2	acre	$3.34	$6.69	$6.69		
15		Planting	1	acre	$2.96	$2.96	$2.96		
16		Seed	110	pounds	$0.17	$18.70	$18.70		
17		Fertilization							
18		Nitrogen (34-0-0)	308	pounds	$0.18	$54.98	$54.98		
19		Phosphate (11-52-0)	48	pounds	$0.18	$8.57	$8.57		
20		Custom application	1	acre	$7.82	$7.82	$7.82		
21		Pesticides/herbicides							
22		2-4-D	1.25	pints	$2.75	$3.44	$3.44		
23		Custom application	1	acre	$7.82	$7.82	$7.82		
24		Irrigation (siphon)	3	irrigations					
25		Labor	1.00	hours	$10.00	$10.00	$10.00		
26		Water assessment	1	share	$10.00	$10.00	$10.00		
27		Repairs/maintenance	1	acre	$2.30	$2.30	$2.30		
28		Pumping	-	acre inch	$0.00	$0.00	$0.00		
29		Harvesting							
30		Custom combine	1	acre	$26.00	$26.00	$26.00		
31		Haul grain (custom)	139.9	bushel	$0.06	$8.40	$5.57		
32		Baling	0.50	tons	$4.79	$2.40	$2.40		
33		Haul/stack straw	0.5	tons	$3.63	$1.82	$1.82		
34		Crop insurance (75% Yield, 100% Price)	-	acre	$8.53	$0.00	$11.64		
35		Interest on operating capital			7.61%	$3.29	$3.29		
36		**Subtotal**				$180.87	191.24		
37									
38		Ownership costs (excludes cost of land)				$60.87	$60.87		
39		Farm insurance	1	acre	$2.00	$2.00	$2.00		
40		Machinery ownership costs	1	acre	$50.62	$50.62	$50.62		
41		Irrigation equipment costs	1	acre	$8.25	$8.25	$8.25		
42		**Total costs**				$241.74	$252.11		
43									
44		Net returns to owner for unpaid labor, management, equity and risk							
45		Above operating costs				$165.99	$40.54		
46		Above total listed costs				$105.12	-$20.33		

AlfalfaBudget | BarleyBudget | CornGrainBudget | WheatBudget | Income | Expen

Ready NUM

Corn

Utah State University
Extension Economics

Modify Colored Columns

Costs and Returns per acre from growing corn for grain, 2006

Box Elder County

	Quantity per acre	Unit	Price/cost per unit	Value/cost per acre	Base Value	Value/cost per Bushel
Receipts						
Corn grain	187.9	bushels	$2.56	$480.83	$487.15	$1.82
Residue	-	AUM	$0.00	$0.00	$0.00	
Subtotal				$480.83	$487.15	
Operating costs						
Land preparation						
Plowing (every 3rd year)	1/3	acre	$5.88	$1.96	$1.96	
Discing w/ packer	2	acre	$3.73	$7.47	$7.47	
Land plane	2	acre	$3.34	$6.69	$6.69	
Planting	1	acre	$5.28	$5.28	$5.28	
Seed	0.5	bags	$90.00	$45.00	$45.00	
Cultivations						
first	1	acre	$2.94	$2.94	$2.94	
second	1	acre	$2.94	$2.94	$2.94	
Fertilization						
Nitrogen (34-0-0)	561	pounds	$0.18	$100.14	$100.14	
Phosphate (11-52-0)	163	pounds	$0.18	$29.10	$29.10	
Custom application	1	acre	$7.82	$7.82	$7.82	
Pesticides/herbicides						
Lasso	3.00	quart	$6.50	$19.50	$19.50	
Phorate	6.75	pounds	$2.40	$16.20	$16.20	
2-4-D	2.50	pints	$2.75	$6.87	$6.87	
Custom application	1	acre	$7.82	$7.82	$7.82	
Irrigation (siphon)	6	irrigations				
Labor	2.00	hours	$10.00	$20.00	$20.00	
Water assessment	1	share	$10.00	$10.00	$10.00	
Repairs/maintenance	1	acre	$2.30	$2.30	$2.30	
Pumping	-	acre inch	$0.00	$0.00	$0.00	
Harvesting						
Custom combine	1	acre	$32.00	$32.00	$32.00	
Haul grain (custom)	187.9	bushel	$0.06	$11.27	$10.16	
Crop insurance (75% Yield, 100% Price)	-	acre	$35.80	$0.00	$35.80	
Interest on operating capital			7.61%	$6.82	$6.82	
Subtotal				$342.12	$352.03	
Ownership costs (excludes cost of land)				$60.17	$60.17	
Farm insurance	1	acre	$2.00	$2.00	$2.00	
Machinery ownership costs	1	acre	$49.92	$49.92	$49.92	
Irrigation equipment costs	1	acre	$8.25	$8.25	$8.25	
Total costs				$402.29	$412.20	
Net returns to owner for unpaid labor, management, equity and risk						
Above operating costs				$138.71	$135.12	
Above total listed costs				$78.54	$74.95	

Wheat

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G8 | 48

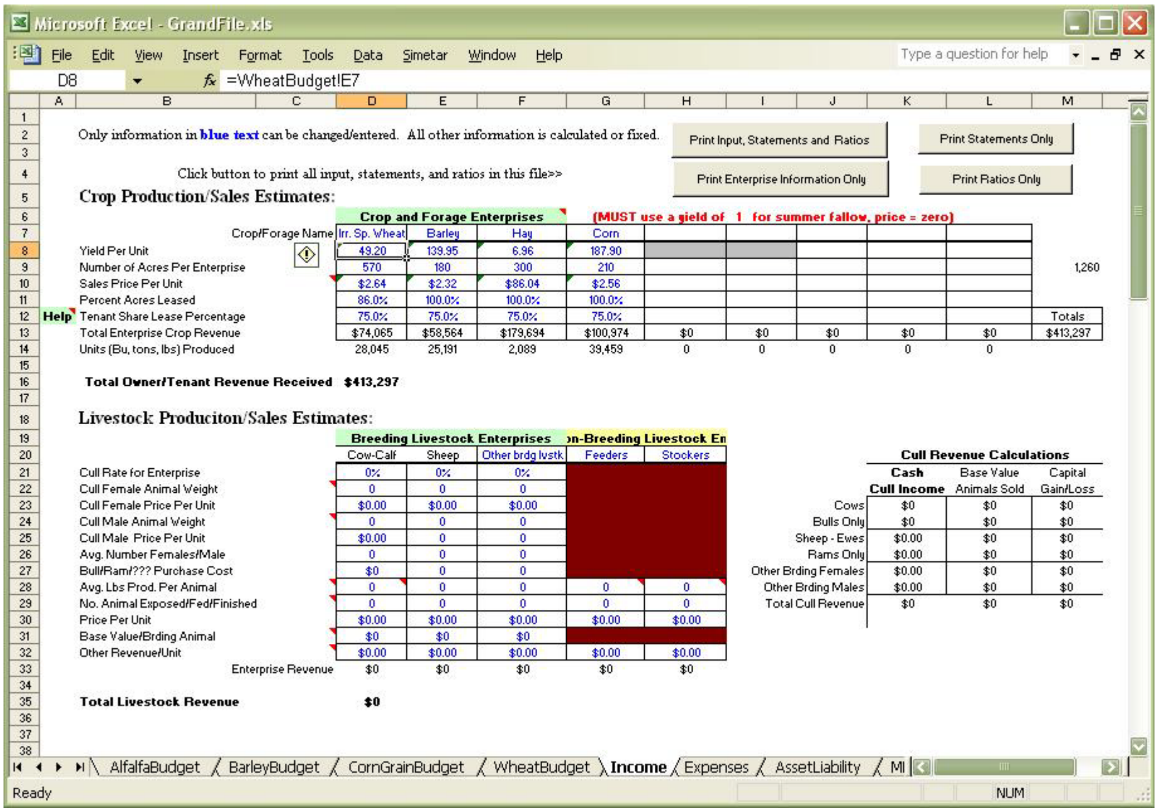
	A–D	E	F	G	H	I	J	K
1	Utah State University							
2	Extension Economics				Modify Colored Columns			
3	**Costs and Returns per acre from growing soft white wheat, 2006**							
4	**Box Elder County**							
5		**Quantity**		**Price/cost**	**Value/cost**			**Value/cost**
6	**Receipts**	**per acre**	**Unit**	**per unit**	**per acre**	**Base Value**		**per Bushel**
7	Wheat	49.2	bushels	$2.64	$129.94	$395.35		$3.77
8	Straw	0.70	tons	$48.00	$33.60	$33.60		
9	**Subtotal**				$163.54	$428.95		
10	**Operating costs**							
11	Land preparation							
12	Plowing (every 3rd year)	1/3	acre	$5.88	$1.96	$1.96		
13	Discing w/ packer	2	acre	$3.73	$7.47	$7.47		
14	Land plane	2	acre	$3.34	$6.69	$6.69		
15	Planting	1	acre	$2.96	$2.96	$2.96		
16	Seed	100	pounds	$0.17	$17.00	$17.00		
17	Fertilization							
18	Nitrogen (34-0-0)	308	pounds	$0.18	$54.98	$54.98		
19	Phosphate (11-52-0)	48	pounds	$0.18	$8.57	$8.57		
20	Custom application	1	acre	$7.82	$7.82	$7.82		
21	Pesticides/herbicides							
22	Glean	0.25	ounce	$17.85	$4.46	$4.46		
23	Custom application	1	acre	$7.82	$7.82	$7.82		
24	Irrigation (siphon)	4	irrigations					
25	Labor	1.33	hours	$10.00	$13.33	$13.33		
26	Water assessment	1	share	$10.00	$10.00	$10.00		
27	Repairs/maintenance	1	acre	$2.30	$2.30	$2.30		
28	Pumping	-	acre inch	$0.00	$0.00	$0.00		
29	Harvesting							
30	Custom combine	1	acre	$26.00	$26.00	$26.00		
31	Haul grain (custom)	49.2	bushel	$0.06	$2.95	$5.54		
32	Baling	0.70	tons	$4.79	$3.35	$3.35		
33	Haul/stack straw	0.70	tons	$3.63	$2.54	$2.54		
34	Crop insurance (75% Yield, 100% Price)	-	acre	$15.93	$0.00	$13.64		
35	Interest on operating capital			7.61%	$5.06	$5.06		
36	**Subtotal**				$185.27	$202.34		
37								
38	Ownership costs (excludes cost of land)				$60.87	$60.87		
39	Farm insurance	1	acre	$2.00	$2.00	$2.00		
40	Machinery ownership costs	1	acre	$50.62	$50.62	$50.62		
41	Irrigation equipment costs	1	acre	$8.25	$8.25	$8.25		
42	**Total costs**				$246.14	$263.21		
43								
44	Net returns to owner for unpiad labor, management, equity and risk							
45	Above operating costs				-$21.73	$226.61		
46	Above total listed costs				-$82.60	$165.74		

AlfalfaBudget / BarleyBudget / CornGrainBudget / **WheatBudget** / Income / Expen

Ready NUM

Modified RDFinancial Spreadsheets

Income Input



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D8 =WheatBudget!E7

Only information in **blue text** can be changed/entered. All other information is calculated or fixed.

Click button to print all input, statements, and ratios in this file>>

Print Input, Statements and Ratios | Print Statements Only | Print Enterprise Information Only | Print Ratios Only

Crop Production/Sales Estimates:

(MUST use a yield of 1 for summer fallow, price = zero)

	Crop and Forage Enterprises									
Crop/Forage Name	Irr. Sp. Wheat	Barley	Hay	Corn						
Yield Per Unit	49.20	139.95	6.96	187.90						
Number of Acres Per Enterprise	570	180	300	210						1,260
Sales Price Per Unit	$2.64	$2.32	$86.04	$2.56						
Percent Acres Leased	86.0%	100.0%	100.0%	100.0%						
Help Tenant Share Lease Percentage	75.0%	75.0%	75.0%	75.0%						Totals
Total Enterprise Crop Revenue	$74,065	$58,564	$179,694	$100,974	$0	$0	$0	$0	$0	$413,297
Units (Bu, tons, lbs) Produced	28,045	25,191	2,089	39,459	0	0	0	0	0	

Total Owner/Tenant Revenue Received $413,297

Livestock Produciton/Sales Estimates:

	Breeding Livestock Enterprises			on-Breeding Livestock En	
	Cow-Calf	Sheep	Other brdg lvstk	Feeders	Stockers
Cull Rate for Enterprise	0%	0%	0%		
Cull Female Animal Weight	0	0	0		
Cull Female Price Per Unit	$0.00	$0.00	$0.00		
Cull Male Animal Weight	0	0	0		
Cull Male Price Per Unit	$0.00	0	0		
Avg. Number Females/Male	0	0	0		
Bull/Ram/??? Purchase Cost	$0	0	0		
Avg. Lbs Prod. Per Animal	0	0	0	0	0
No. Animal Exposed/Fed/Finished	0	0	0	0	0
Price Per Unit	$0.00	$0.00	$0.00	$0.00	$0.00
Base Value/Brding Animal	$0	$0	$0		
Other Revenue/Unit	$0.00	$0.00	$0.00	$0.00	$0.00
Enterprise Revenue	$0	$0	$0	$0	$0

Total Livestock Revenue $0

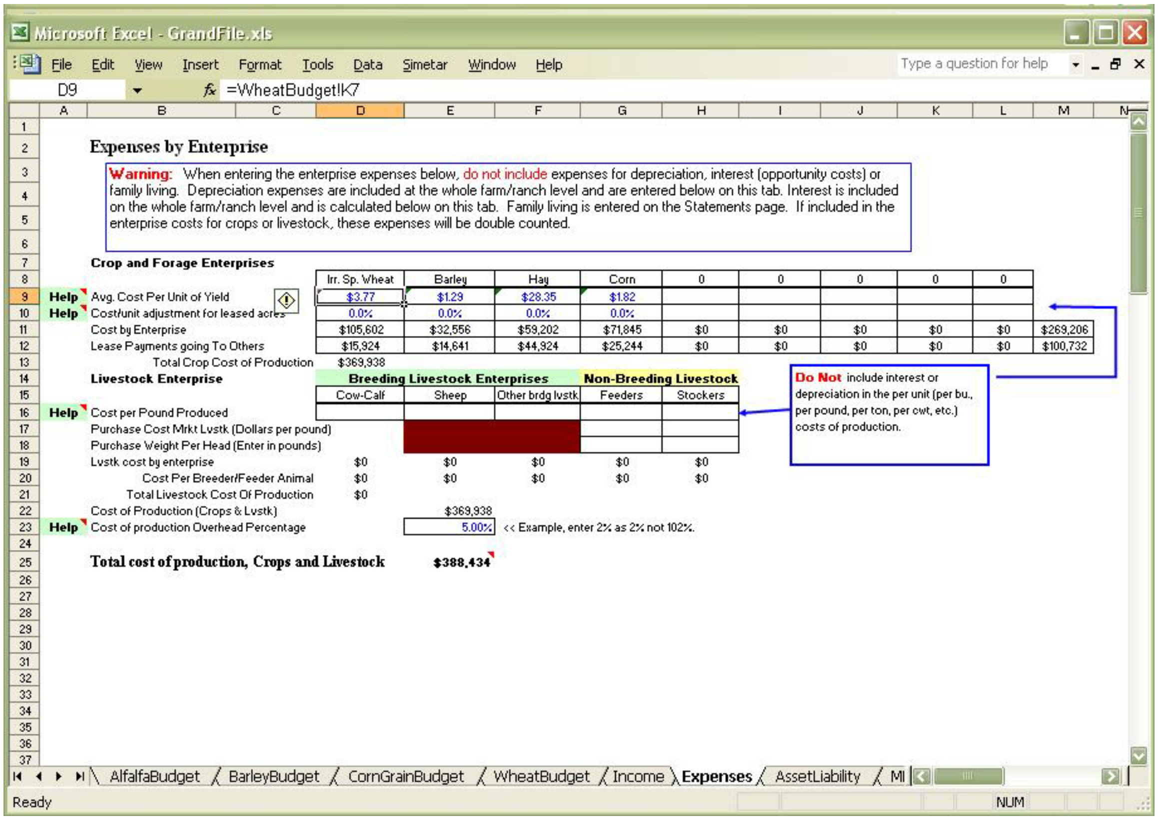
Cull Revenue Calculations

	Cash Cull Income	Base Value Animals Sold	Capital Gain/Loss
Cows	$0	$0	$0
Bulls Only	$0	$0	$0
Sheep - Ewes	$0.00	$0	$0
Rams Only	$0.00	$0	$0
Other Brding Females	$0.00	$0	$0
Other Brding Males	$0.00	$0	$0
Total Cull Revenue	$0	$0	$0

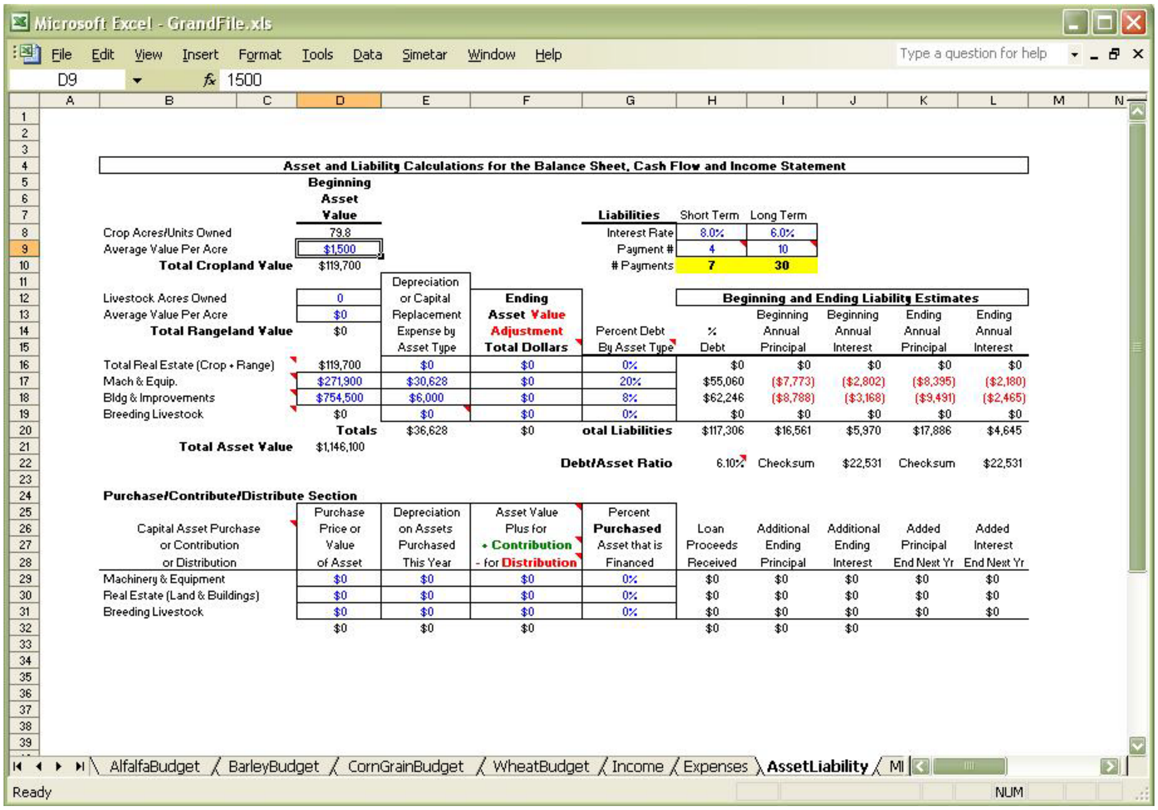
AlfalfaBudget / BarleyBudget / CornGrainBudget / WheatBudget / Income / Expenses / AssetLiability / MI

Ready NUM

Expense Input



Asset and Liability Input



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D9 1500

Asset and Liability Calculations for the Balance Sheet, Cash Flow and Income Statement

	Beginning Asset Value
Crop Acres/Units Owned	79.8
Average Value Per Acre	$1,500
Total Cropland Value	$119,700

Liabilities	Short Term	Long Term
Interest Rate	8.0%	6.0%
Payment #	4	10
# Payments	7	30

	Beginning Asset Value	Depreciation or Capital Replacement Expense by Asset Type	Ending Asset Value Adjustment Total Dollars	Percent Debt By Asset Type	% Debt	Beginning Annual Principal	Beginning Annual Interest	Ending Annual Principal	Ending Annual Interest
Livestock Acres Owned	0								
Average Value Per Acre	$0								
Total Rangeland Value	$0								
Total Real Estate (Crop + Range)	$119,700	$0	$0	0%	$0	$0	$0	$0	$0
Mach & Equip.	$271,900	$30,628	$0	20%	$55,060	($7,773)	($2,802)	($8,395)	($2,180)
Bldg & Improvements	$754,500	$6,000	$0	8%	$62,246	($8,788)	($3,168)	($9,491)	($2,465)
Breeding Livestock	$0	$0	$0	0%	$0	$0	$0	$0	$0
	Totals	$36,628	$0	**otal Liabilities**	$117,306	$16,561	$5,970	$17,886	$4,645
Total Asset Value	$1,146,100								
				Debt/Asset Ratio	6.10%	Checksum	$22,531	Checksum	$22,531

Beginning and Ending Liability Estimates

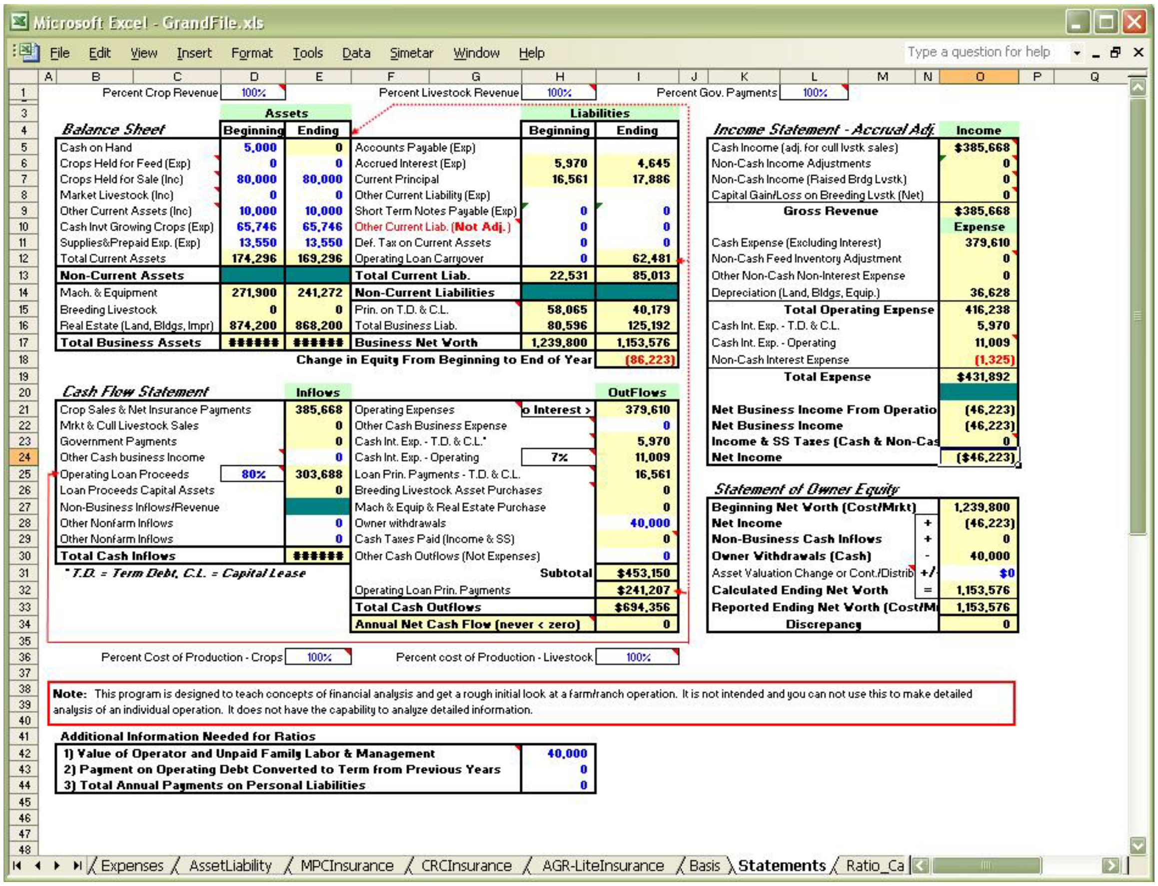
Purchase/Contribute/Distribute Section

Capital Asset Purchase or Contribution or Distribution	Purchase Price or Value of Asset	Depreciation on Assets Purchased This Year	Asset Value Plus for + Contribution - for Distribution	Percent **Purchased** Asset that is Financed	Loan Proceeds Received	Additional Ending Principal	Additional Ending Interest	Added Principal End Next Yr	Added Interest End Next Yr
Machinery & Equipment	$0	$0	$0	0%	$0	$0	$0	$0	$0
Real Estate (Land & Buildings)	$0	$0	$0	0%	$0	$0	$0	$0	$0
Breeding Livestock	$0	$0	$0	0%	$0	$0	$0	$0	$0
	$0	$0	$0		$0	$0	$0		

AlfalfaBudget / BarleyBudget / CornGrainBudget / WheatBudget / Income / Expenses / AssetLiability / MI

Ready NUM

Simple Financial Statements



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Percent Crop Revenue 100% | Percent Livestock Revenue 100% | Percent Gov. Payments 100%

Balance Sheet	Assets: Beginning	Assets: Ending		Liabilities: Beginning	Liabilities: Ending
Cash on Hand	5,000	0	Accounts Payable (Exp)		
Crops Held for Feed (Exp)	0	0	Accrued Interest (Exp)	5,970	4,645
Crops Held for Sale (Inc)	80,000	80,000	Current Principal	16,561	17,886
Market Livestock (Inc)	0	0	Other Current Liability (Exp)		
Other Current Assets (Inc)	10,000	10,000	Short Term Notes Payable (Exp)	0	0
Cash Invt Growing Crops (Exp)	65,746	65,746	Other Current Liab. (Not Adj.)	0	0
Supplies&Prepaid Exp. (Exp)	13,550	13,550	Def. Tax on Current Assets	0	0
Total Current Assets	174,296	169,296	Operating Loan Carryover	0	62,481
Non-Current Assets			**Total Current Liab.**	22,531	85,013
Mach. & Equipment	271,900	241,272	**Non-Current Liabilities**		
Breeding Livestock	0	0	Prin. on T.D. & C.L.	58,065	40,179
Real Estate (Land, Bldgs, Impr)	874,200	868,200	Total Business Liab.	80,596	125,192
Total Business Assets	######	######	**Business Net Worth**	1,239,800	1,153,576
			Change in Equity From Beginning to End of Year		(86,223)

Income Statement - Accrual Adj.	Income
Cash Income (adj. for cull lvstk sales)	$385,668
Non-Cash Income Adjustments	0
Non-Cash Income (Raised Brdg Lvstk)	0
Capital Gain/Loss on Breeding Lvstk (Net)	0
Gross Revenue	$385,668
	Expense
Cash Expense (Excluding Interest)	379,610
Non-Cash Feed Inventory Adjustment	0
Other Non-Cash Non-Interest Expense	0
Depreciation (Land, Bldgs, Equip.)	36,628
Total Operating Expense	416,238
Cash Int. Exp. - T.D. & C.L.	5,970
Cash Int. Exp. - Operating	11,009
Non-Cash Interest Expense	(1,325)
Total Expense	$431,892
Net Business Income From Operatio	(46,223)
Net Business Income	(46,223)
Income & SS Taxes (Cash & Non-Cas	0
Net Income	($46,223)

Cash Flow Statement		Inflows			OutFlows
Crop Sales & Net Insurance Payments		385,668	Operating Expenses	o Interest >	379,610
Mrkt & Cull Livestock Sales		0	Other Cash Business Expense		0
Government Payments		0	Cash Int. Exp. - T.D. & C.L.*		5,970
Other Cash business Income		0	Cash Int. Exp. - Operating	7%	11,009
Operating Loan Proceeds	80%	303,688	Loan Prin. Payments - T.D. & C.L.		16,561
Loan Proceeds Capital Assets		0	Breeding Livestock Asset Purchases		0
Non-Business Inflows/Revenue			Mach & Equip & Real Estate Purchase		0
Other Nonfarm Inflows		0	Owner withdrawals		40,000
Other Nonfarm Inflows		0	Cash Taxes Paid (Income & SS)		0
Total Cash Inflows		######	Other Cash Outflows (Not Expenses)		0
**T.D. = Term Debt, C.L. = Capital Lease*				**Subtotal**	$453,150
			Operating Loan Prin. Payments		$241,207
			Total Cash Outflows		$694,356
			Annual Net Cash Flow (never < zero)		0

Statement of Owner Equity		
Beginning Net Worth (Cost/Mrkt)		1,239,800
Net Income	+	(46,223)
Non-Business Cash Inflows	+	0
Owner Withdrawals (Cash)	-	40,000
Asset Valuation Change or Cont./Distrib	+/-	$0
Calculated Ending Net Worth	=	1,153,576
Reported Ending Net Worth (Cost/M		1,153,576
Discrepancy		0

Percent Cost of Production - Crops 100% | Percent cost of Production - Livestock 100%

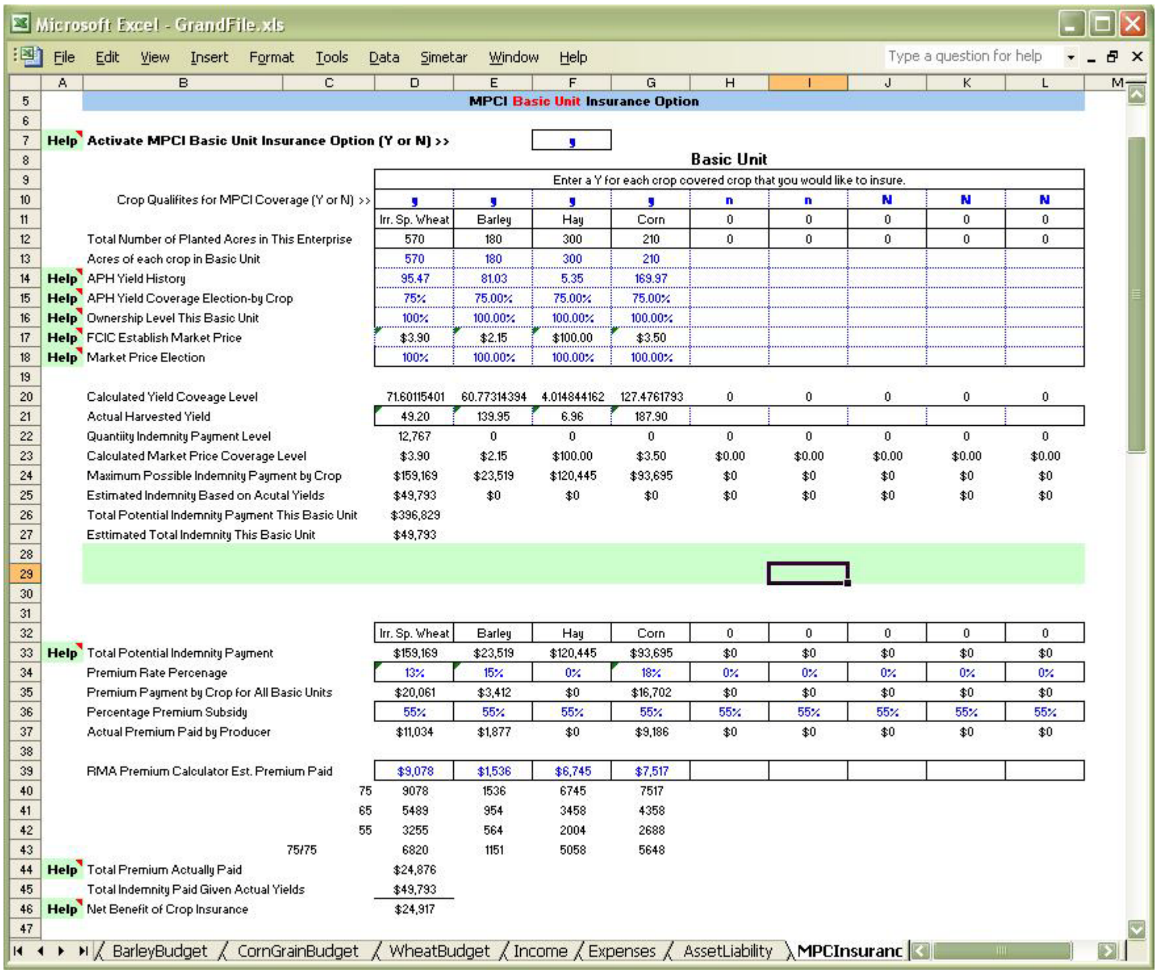
Note: This program is designed to teach concepts of financial analysis and get a rough initial look at a farm/ranch operation. It is not intended and you can not use this to make detailed analysis of an individual operation. It does not have the capability to analyze detailed information.

Additional Information Needed for Ratios	
1) Value of Operator and Unpaid Family Labor & Management	40,000
2) Payment on Operating Debt Converted to Term from Previous Years	0
3) Total Annual Payments on Personal Liabilities	0

Expenses / AssetLiability / MPCInsurance / CRCInsurance / AGR-LiteInsurance / Basis / **Statements** / Ratio_Ca

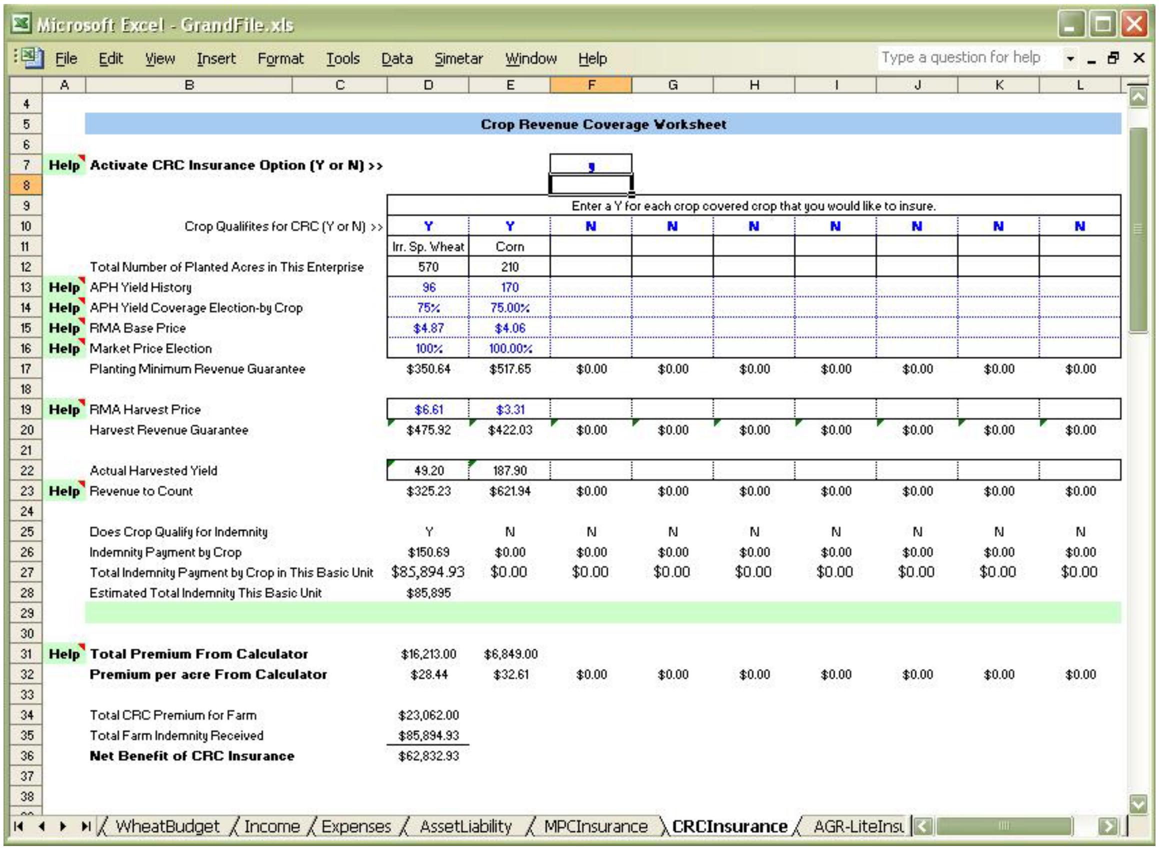
Risk Management Spreadsheets within RDFinancial

MPCI



	A	B	C	D	E	F	G	H	I	J	K	L
5						MPCI Basic Unit Insurance Option						
6												
7	Help	Activate MPCI Basic Unit Insurance Option (Y or N) >>				y						
8								Basic Unit				
9								Enter a Y for each crop covered crop that you would like to insure.				
10		Crop Qualifites for MPCI Coverage (Y or N) >>		y	y	y	y	n	n	N	N	N
11				Irr. Sp. Wheat	Barley	Hay	Corn	0	0	0	0	0
12		Total Number of Planted Acres in This Enterprise		570	180	300	210	0	0	0	0	0
13		Acres of each crop in Basic Unit		570	180	300	210					
14	Help	APH Yield History		95.47	81.03	5.35	169.97					
15	Help	APH Yield Coverage Election-by Crop		75%	75.00%	75.00%	75.00%					
16	Help	Ownership Level This Basic Unit		100%	100.00%	100.00%	100.00%					
17	Help	FCIC Establish Market Price		$3.90	$2.15	$100.00	$3.50					
18	Help	Market Price Election		100%	100.00%	100.00%	100.00%					
19												
20		Calculated Yield Coveage Level		71.60115401	60.77314394	4.014844162	127.4761793	0	0	0	0	0
21		Actual Harvested Yield		49.20	139.95	6.96	187.90					
22		Quantiity Indemnity Payment Level		12,767	0	0	0	0	0	0	0	0
23		Calculated Market Price Coverage Level		$3.90	$2.15	$100.00	$3.50	$0.00	$0.00	$0.00	$0.00	$0.00
24		Maximum Possible Indemnity Payment by Crop		$159,169	$23,519	$120,445	$93,695	$0	$0	$0	$0	$0
25		Estimated Indemnity Based on Acutal Yields		$49,793	$0	$0	$0	$0	$0	$0	$0	$0
26		Total Potential Indemnity Payment This Basic Unit		$396,829								
27		Esttimated Total Indemnity This Basic Unit		$49,793								
28												
29												
30												
31												
32				Irr. Sp. Wheat	Barley	Hay	Corn	0	0	0	0	0
33	Help	Total Potential Indemnity Payment		$159,169	$23,519	$120,445	$93,695	$0	$0	$0	$0	$0
34		Premium Rate Percenage		13%	15%	0%	18%	0%	0%	0%	0%	0%
35		Premium Payment by Crop for All Basic Units		$20,061	$3,412	$0	$16,702	$0	$0	$0	$0	$0
36		Percentage Premium Subsidy		55%	55%	55%	55%	55%	55%	55%	55%	55%
37		Actual Premium Paid by Producer		$11,034	$1,877	$0	$9,186	$0	$0	$0	$0	$0
38												
39		RMA Premium Calculator Est. Premium Paid		$9,078	$1,536	$6,745	$7,517					
40			75	9078	1536	6745	7517					
41			65	5489	954	3458	4358					
42			55	3255	564	2004	2688					
43			75/75	6820	1151	5058	5648					
44	Help	Total Premium Actually Paid		$24,876								
45		Total Indemnity Paid Given Actual Yields		$49,793								
46	Help	Net Benefit of Crop Insurance		$24,917								
47												

CRC



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Type a question for help

Crop Revenue Coverage Worksheet

Help **Activate CRC Insurance Option (Y or N) >>** y

Enter a Y for each crop covered crop that you would like to insure.

			D	E	F	G	H	I	J	K	L
10		Crop Qualifites for CRC (Y or N) >>	Y	Y	N	N	N	N	N	N	N
11			Irr. Sp. Wheat	Corn							
12		Total Number of Planted Acres in This Enterprise	570	210							
13	Help	APH Yield History	96	170							
14	Help	APH Yield Coverage Election-by Crop	75%	75.00%							
15	Help	RMA Base Price	$4.87	$4.06							
16	Help	Market Price Election	100%	100.00%							
17		Planting Minimum Revenue Guarantee	$350.64	$517.65	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
19	Help	RMA Harvest Price	$6.61	$3.31							
20		Harvest Revenue Guarantee	$475.92	$422.03	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
22		Actual Harvested Yield	49.20	187.90							
23	Help	Revenue to Count	$325.23	$621.94	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
25		Does Crop Qualify for Indemnity	Y	N	N	N	N	N	N	N	N
26		Indemnity Payment by Crop	$150.69	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
27		Total Indemnity Payment by Crop in This Basic Unit	$85,894.93	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
28		Estimated Total Indemnity This Basic Unit	$85,895								
31	Help	**Total Premium From Calculator**	$16,213.00	$6,849.00							
32		**Premium per acre From Calculator**	$28.44	$32.61	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
34		Total CRC Premium for Farm	$23,062.00								
35		Total Farm Indemnity Received	$85,894.93								
36		**Net Benefit of CRC Insurance**	$62,832.93								

WheatBudget / Income / Expenses / AssetLiability / MPCInsurance / CRCInsurance / AGR-LiteInsu

AGR - Lite

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AGR-Lite Insurance

Activate AGR-Lite Basic Unit Insurance Option (Y or N) >> y

AGR-Lite Histories Calculation

Part I Income	**Year -1 (2005)**	**Year -2 (2004)**	**Year -3 (2003)**	**Year -4 (2002)**	**Year -5 (2001)**
Allowable Income	$406,479	$508,870	$429,222	$475,570	$478,370
Indexing Calculations (if Applicable):					

5 - Year Total AGR	$2,298,512
5 - Year Average Preliminary AGR	$459,702
AGR Index Factor	1
Indexed Adjusted Preliminary AGR (if Applicable):	$459,702

Part II Expenses	**Year -1 (2005)**	**Year -2 (2004)**	**Year -3 (2003)**	**Year -4 (2002)**	**Year -5 (2001)**
Allowable Expenses	$394,956	$485,136	$433,503	$428,949	$455,035
Indexing Calculations (if Applicable):					

5 - Year Total Expenses	$2,197,579
5 - Year Average Preliminary Expenses	$439,516
Expenses Index Factor	1
Indexed Adjusted Preliminary Expenses (if Applicable):	$439,516

Projected 2007 Expected Revenue

Commodity	**Amount (ac.)**	**Yield/Quantity Produced**	**Value**	**Total Value**
Irr. Sp. Wheat	570	95.47	$6.00	$326,501
Barley	180	81.03	$5.00	$72,928
Hay	300	5.35	$130.00	$208,802
Corn	210	169.97	$4.10	$146,343
			Total Projected Receipts	$754,574

Approved AGR	$459,702		
Coverage Level	75%		
Payment Rate	90%		
Trigger Point	$344,777		
Max AGR Liability	$310,299	Max MPCI Liability	$155,150
Revenue to count	$452,023		
Revenue loss triggered?	N		
Calculated loss	$0		
Indemnity Payment	$0		
Total Premium Actually Paid	$3,212		
Net Benefit of Crop Insurance	-$3,212		

Income / Expenses / AssetLiability / MPCInsurance / CRCInsurance

Futures Market (Variance of the Basis)