ORGANIC AND CONVENTIONAL

VEGETABLE PRODUCTION

IN OKLAHOMA

By

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CHAPTER I

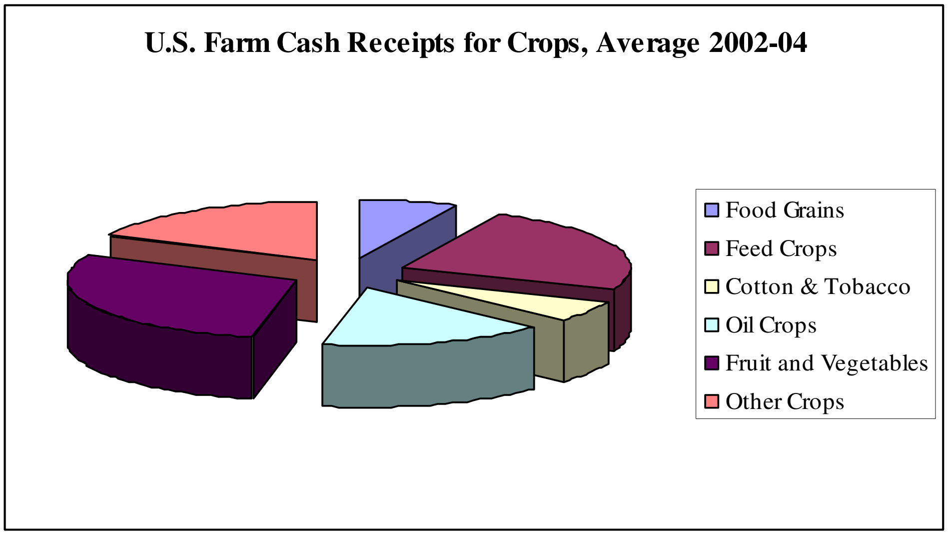
INTRODUCTION

Background

The fruit and vegetable industry ranks fifth in U.S. agricultural exports and this sector accounts for nearly a third of U.S. crop cash receipts (Lucier etal. 2006). Various consumer demand studies show the increase in fresh vegetable and fruit consumption in United States, but the consumption is still below the USDA recommended levels. This increase is mainly due to health consciousness, rise in disposable incomes of the consumers and the year round availability of fruits and vegetables as per the demand of consumers (El-Beheisi, 1991). Also immigration can be one factor in the changing tastes and preferences of consumers. U.S. Bureau of Labor Statistics (BLS) data shows that domestic consumption of fruit and vegetables was about 17 percent of all domestic food expenditure in 2004.

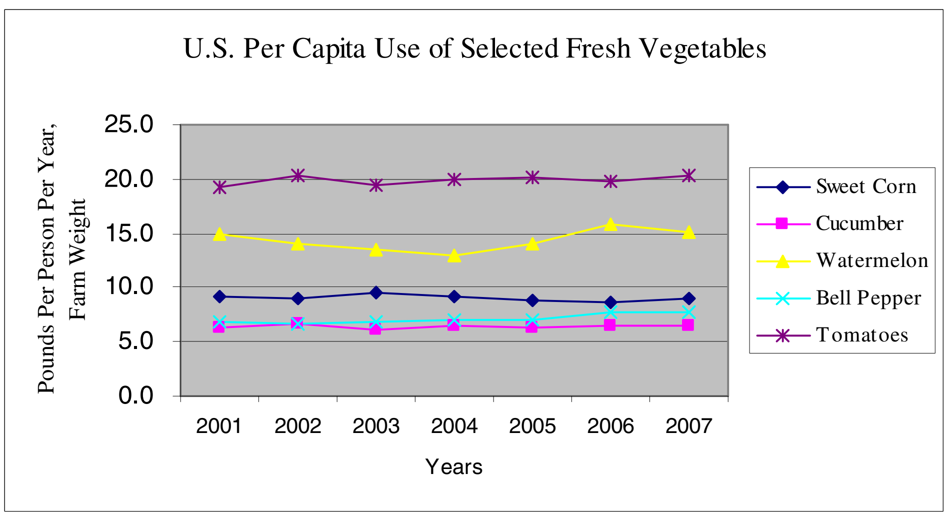
USDA, ERS (2006) data shows that fruits and vegetables (including tree nuts, pulse crops, and melons) account for 29 percent of 2002-04 farm cash crop receipts as shown in figure 1. Although vegetables and fruit share of farm cash crop receipts were high they were grown on only 3 percent of U.S. harvested cropland. The U.S per capita consumption of selected vegetables for this study can be seen in Figure 2.

Figure 1 U.S. Farm Cash Receipts for Crops, Average (2002-2004)



Source: USDA, Economic Research Service, Farm Income and Costs Briefing Room

Figure 2 U.S. Per Capita Use of Selected Fresh Vegetables (2001-2007)

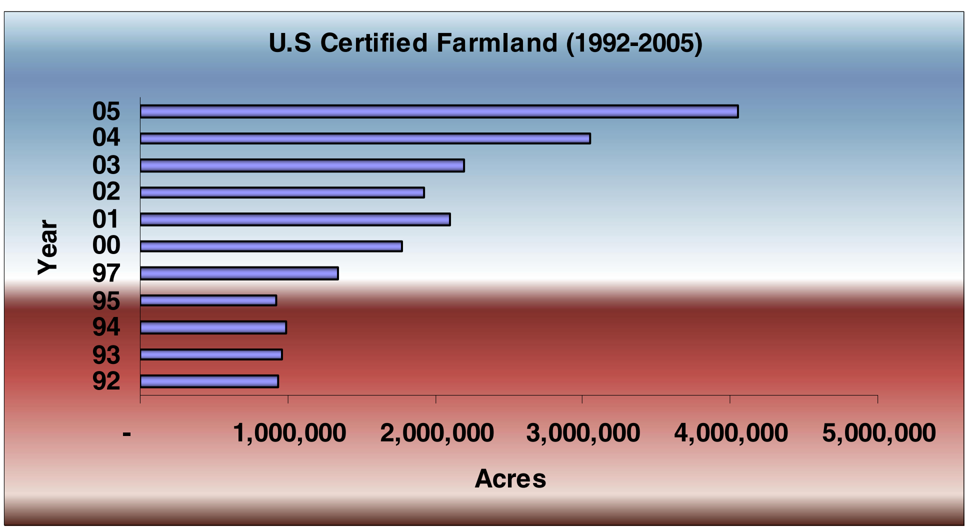


Source: USDA, Economic Research Service, 2007

For centuries, organic farming was the only way to farm, as all methods of food production consisted of techniques that are today considered to be organic. In the middle of the twentieth century, synthetic materials became available, and provided relatively inexpensive tools for plant nutrition and pest control. Over the last half century, the vast majority of food production has depended in some way upon non-organic methods of production and protection.

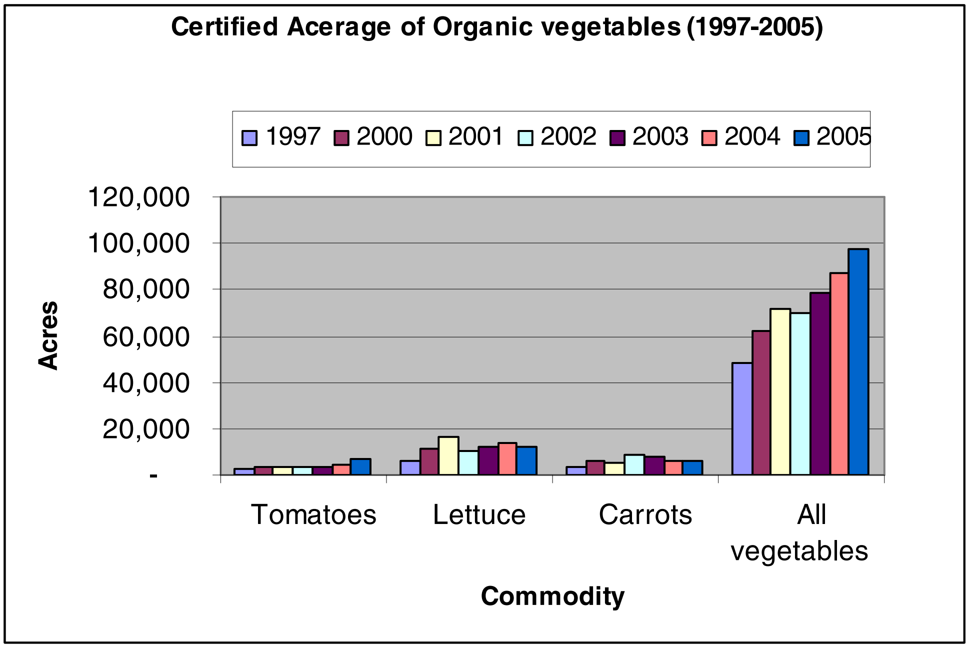
In the last quarter century, a small but consistent portion of the population of the United States has supported a return to organic methods of food production. Data show that total organic acreage as well as acreage of organic vegetables in the United States has been increasing since the early 90's as shown in figures 3 and 4. At first, the organic industry was un-organized, but over the years organization gradually developed in various parts of the country. Problems arose in trying to develop a definition of 'organic', as what people accepted as organic in one region of the United States might not be accepted in other regions. During the 1990's several states implemented a statewide certification process, whereby producers within the state could claim certification, if they met certain rules and followed certain guidelines. Still, there was variation from state to state concerning the definition of 'organic', and the tools and techniques that could be used in 'organic' production.

Figure 3 U.S. Certified Organic Farm Acreage (1992-2005)



Source: USDA, Economic Research Service, 2006.

Figure 4 U.S. Certified Organic Vegetables Acreage (1997-2005)



Source: National Agricultural Statistics Service, USDA

The term certified organic is important because it signifies a specific process of certification that has been regulated by the United States Department of Agriculture's National Organic Certification Standards since 2002 (Duram, 2005). Today the National Organic Program (NOP) has defined and established standards for organic production and sales throughout the United States. This program became effective October 21, 2002, and clarifies the circumstances under which food products grown or sold in the United States can be classified as organic. Organic production methods do not necessarily mean sustainability while sustainable agriculture aims to address both the ecological and social problems associated with modern industrialized agriculture. The organic label provides, at best, information on the environmental impacts at the production site (Conner and Christy, 2002).

Due to increase in consumer demand and changes in government policies for organic farming over the years, organic products are seen more in U.S. market these days. The year 2000 was an important year for Americans as it was the first time that more organic foods were sold in conventional supermarkets than in any other venue with natural foods. According to Dimitri and Greene (2002), the U.S. organic foods industry has grown considerably over the last decade and currently 72 percent of conventional grocery stores carry some organic food. The Nutrition Business Journal (NBJ) estimates U.S. sales of organic foods at nearly $10.4 billion in 2003, or about 1.8 percent of total U.S. retail sales of food, which is $3.5 billion more than that in 1997 (NBJ,2004). Growth in the organic industry is caused in part by consumer’s attitudes towards food production systems and product quality. With respect to product quality, surveys indicate that consumers consider organic foods to be more positive for the environment and human health and more flavorful than conventionally grown foods (Bourn, Prescott, 2002; Makatouni, 2002; Jolly, Schutz, Diaz-Knauf, and Johal, 1989).

Demand for organic products is also on the rise globally. Using 1997 sales data and annual growth rates from the International Trade Centre (ITC 1999), and assuming a linear trend, projected market size in 2010 will be at least $46 billion in the EU, $45 billion in the US, and $11 billion in Japan (Lohr and Krissoff, 2001). Several European Union countries subsidize farmers during their conversion to organic methods, assist in building organic marketing channels, and provide technical assistance and information specifically for organic farmers (Foster and Lampkin, 1999 and Padel et al. 1999).While government intervention in the United States has focused primarily on market facilitation, several States have begun subsidizing conversion to organic farming systems as a way to capture the environmental benefits of these systems (Klosky and Greene, 2005). Direct financial support for organic producers in many European countries may make them major low-cost suppliers of organic products and in the long run this may result in a decline of markets for U.S organic exports (Greene and Dobbs, 2001).

Successful marketing is an important determinant of profitability related to organic crops. More specifically, identification and maintenance of profitable marketing outlets is important (Lampkin and Padel 1999). Marketing organic farm products sometimes takes as much time as growing them, as organic farmers are trying to gain back the farmer's share of the customer's food dollar.

Problem Statement

In general organically grown produce refers to food that is free from preservatives, hormones or antibiotics, artificial pesticides and artificial fertilizers in the soil and on the plants. Organic agriculture is of growing importance to the agricultural sector of a number of countries including the United States. It has come to represent a significant portion of the United States food system with estimated growth rates that exceed 20% annually (Markle 1997; McEnery 1996).

The marketing and pricing of organically produced vegetables presents a number of challenges. Total volume or supply, quality of product, and consumer demand determine pricing of products in conventional markets. In the smaller organic market, these same variables exist but they are confounded by different perceptions of desirability, quality, and "healthfulness" as well as the storability or perishability of the product. Vegetables that are produced organically can often be sold for a premium price over conventionally grown products. However, the industry is extremely competitive and returns to growers are dictated by the total supply, consumer demand, and the availability of organic foods. Market saturation may occur and growers may be forced to accept lower returns or market their product without the organic designation at conventional prices. For example, Firth (2002) reported that the fast growing organic market in the United Kingdom became saturated in the 2001-2002 season and many growers had to accept extremely low prices while others plowed up their crops. Thus there is a need to consider possibly greater risk associated with the production and marketing of organic vegetables compared to crops grown under conventional methods.

In recent years there has been a growing interest in the consumption of organic crops. An estimation of Natural Food Merchandiser, a food industry publication, shows that U.S. Organic food sales were about $7.8 billion in 2000, which is nearly double the estimated 1996 value. In 2003 the marketing distribution of organic food was 47 percent through conventional channels, 44 percent through natural food stores and 9 percent through direct and other marketing channels such as farmer’s market, restaurants, exports etc. (Organic Trade Association, 2004). This shows the increasing share of organic foods. Many producers in the United States have used this niche market to increase their income.

Oklahoma farmers and ranchers are facing decisions concerning reduced government support, increasing foreign competition, a changing demographic make-up of the domestic population, and concentration of industry marketing power (Taylor, 2003). Many Oklahoma farmers continue to examine alternative production and marketing strategies to enhance their incomes. Horticultural crops may provide a niche for certain producers upon availability of adequate resources and the required management skills. With the commitment to revise and update existing vegetable crop budgets by the Department of Agricultural Economics at Oklahoma State University in 1997, economic feasibility of horticultural production has received increased attention in Oklahoma. The vegetable crop budgets are of particular interest to the horticultural industry. Information on wholesaler's interest and marketing alternatives also had been developed in late 80's and early 90's (Tilley, Falk, and Schatzer, 1986; Henneberry and Barron, 1990).

Some of the old studies have shown that Oklahoma's climatic condition is favorable for horticultural industry as it has a relatively long growing season during summer months, an abundance of good land, and a sufficient supply of water (Schatzer, Wickwire, and Tilley, 1986). Data indicate that there were 40 acres of certified organic vegetable production in Oklahoma in 2001 (USDA, 2002). Nevertheless, the potential for organic vegetable production in Oklahoma is much beyond what is currently being produced. In this aspect Russo and Taylor (2006) have stated that due to changes in demographics and economic hardships faced by people there is growing interest in converting land to crops that are not traditional in the southern plains of U.S. and one such use for portions in the southern plains is vegetable production. Their study also states that in the southern plains like Oklahoma the traditional use of land for row crops, or cow-calf operations, may be taken out of those type of production to be used for vegetables. Various scientific research and trade publications consider fresh vegetable enterprises to be "alternative enterprises" that may have profit potential (Authur 1988; Babb 1987; Rathwell 1987).

Oklahoma vegetable producers may find new marketing opportunities by becoming certified growers of produce that is consumed in the Dallas/Ft. Worth, Oklahoma City and Tulsa areas. In these markets, like other metropolitan areas, the demand for organically grown produce has been on a steady increase. However, successful production of certified organic crops depends upon development of effective production strategies that fit the USDA organic production guidelines. Until recently, little research-based information and/or few education programs that address organic vegetable production have been developed for the south central region of the U.S.

To evaluate the feasibility of the production of organic crops in Oklahoma the producer needs to compare the profitability of organic production with that of the conventional production. This study focuses on calculating economic profitability of organic production in Oklahoma and to compare it with economic profitability associated with vegetables produced under conventional methods. Vegetables being perishable crops the level of risk associated with the production and marketing of fresh vegetables is one of the major obstacles faced by Oklahoma growers. And there exist chances of higher loss in case of a bad season. Thus, risk analysis related to price and production issues is important for increasing the number of growers in Oklahoma. More specifically; this study will focus on several selected vegetables that constitute a large share of the value of vegetable production in Oklahoma. The selected vegetables are tomatoes, watermelons, southern peas, sweet corn, pickling cucumber and bell pepper. The research performed will focus on answering the following question, “In comparing conventional and organic vegetable production methods, which method is more profitable and what are the associated risks?”

Objectives

General Objective

To identify the optimal mix of alternatives, expected revenues, and risks associated with organic vegetable production methods compared to conventional vegetable production methods. The selected vegetables for this study include watermelon, tomatoes, southern peas, sweet corn, pickling cucumber, and bell pepper.

Specific Objectives

- To calculate cost and returns of selected vegetables for both conventional and organic systems in Southeastern Oklahoma
- To determine profit maximizing vegetable mix for both production methods in different types of farm scenarios
- To analyze risk for selected vegetables for both production methods

CHAPTER II

CONCEPTUAL FRAMEWORK AND THEORY

Conceptual Framework

The expected cost for production of organic vegetables is considered to be greater than that of conventional vegetables. This higher cost may be due to higher cost of inputs and lower yields per acre. Some consumers are willing to pay higher for organic products but the organic acreage data in Oklahoma show that not many Oklahoma growers have make an effort to convert into certified organic growers. This may be because farmers have less information about the opportunity cost and returns associated with organic vegetable production. Or it may be due to the fact that subjective beliefs about profitability and risks are expected to be important factors in choosing organic vegetable production by farmers. Thus a possible belief that there is a higher risk associated with organic vegetable production could be limiting the quantity of production of organic vegetables. In this context of limited knowledge or subjective beliefs the supply of organic produce has been slow to increase. The above conceptual framework leads to the following hypotheses for this study.

1. The expected net return of organic produce is less than net returns of conventional produce.
2. The risk associated with production of organic vegetables is greater than that associated with production of conventional vegetables.

Theory

The most fundamental decision for farm managers is what to produce. Therefore, they must make choices between numerous alternatives. The enterprise decision is based on the goals and objectives of the farm manager. Among different objectives could be to maximize short run profits, maximize the chance for long run survival, and maximize leisure while guaranteeing suitable profits (Wickwire, 1981).

Budgeting Procedures

Enterprise budgeting is a systematic method of developing a statement of what is generally expected by using particular production practices when producing a specified quantity of product. It uses economic theory, farm records and is an important tool for planning and for ongoing financial management. (Casey, Jobes, and Walker, 1977). Enterprise budgets generally include variable operating costs, fixed costs and expected production returns. Six steps are stated in the budgeting procedure by Jobes (1984, pp 139).

1. Appraisal of the goals and objectives of the farm firm.

2. Inventory of the farm resources available.

3. Selection of physical data to be used in the production process.

4. Selection of enterprises to be budgeted.

5. Selection of prices to apply to physical data.

6. Calculation of expected cost and returns.

Wickwire (1981, p.11) considers budgets alone as useful tools, but states budgets may have limitations when inferences are drawn from one budget to a farm firm having different resources. He also thinks the reliability of budgets can be limited since budgets are based on predictions of output and input prices.

Linear Programming Theory

In its simplest form, linear programming (LP) is a method of determining a profit maximizing combination of farm enterprises that are feasible with respect to a set of fixed farm constraints. For a given farm, the three components of (LP) model are: an objective function, fixed resource constraints, and enterprises that require various combinations of the resources. The general form of a linear programming model used for a maximization problem may be written as:

$$\max Z = \sum_{j=1}^{n} c_j \, x_j \qquad (2.1)$$

Subject to

$$\sum_{j=1}^{n} a_{ij} x_j \le b_i, \quad \text{all } i\text{=1 to } m \qquad (2.2)$$

And

$$X_j \geq 0, \qquad \text{all } j=1 \text{ to } n \qquad (2.3)$$

Where,

Z = the objective function

c_j = forecasted per unit return of the j^{th} activity (e.g., dollars per acre).

x_j = the possible alternative activity (enterprise)

a_{ij} = the quantity of the i_{th} resource (e.g., acres of land or days of labor) required to produce one unit of the j^{th} activity. Let m denote the number of resources; then i=1 to m

b_i = the amount of i_{th} resource available (e.g., acres of land or days of labor).

A number of assumptions about the nature of the production process, the resources, and activities should hold for a valid linear programming model (Hazell and Norton, 1986, pp-101-102).

1. Optimization. This assumes minimization or maximization of appropriate objective function.
2. Fixedness. At least one constraint has a nonzero right hand side coefficient.
3. Finiteness. This assumes that there are only a finite number of activities and constraints to be considered so that a solution may be sought.
4. Determinism. All c_j, a_{ij}, and b_i coefficients in the model are assumed to be known constants.
5. Continuity. Resources and activities can be used in fractional quantities.
6. Homogeneity. All units of the same resource or activity are assumed to be identical.

7. Additivity. The activities are assumed to be additive, i.e. when two or more activities are used; their total product is the sum of their individual products. No interaction effects between activities are permitted.
8. Proportionality. A linear relationship between activities and resources is implied. Degree one homogeneous production functions are assumed.

The assumptions of additivity and proportionality together define linearity in the activities; this derives the name linear programming. They also define linear isoquants in factor use between pairs of activities. Most importantly, additivity and proportionality lead to an aggregate whole farm production function relating the value of the objective function Z and the fixed resources b that has constant returns to size.

There can be many methods of increasing the flexibility of the model without violating the assumptions. Parametric programming, integer programming, non-linear programming are different forms of the programming model. LP models also can be used in risk programming. One such risk programming model used in this study is Target Minimization of Total Absolute Deviations (MOTAD) model here after referred to as Target MOTAD model.

Target MOTAD Model

Many risk models may be concerned with increasing a farmer's utility by minimizing an appropriate measure of the variability of farm income. The model used in this study is a safety-first model, which has a different perspective. The safety first model is designed to help a farmer insure that he attains the minimum income necessary to meet his fixed costs (including credit repayment), and to meet his family's living costs each year. Safety- first models are most appropriate where the risk of catastrophe is large, either because of an inherently risky environment, or because the farmer is poor and has minimal reserves to fall back on in a bad year.

One of the models that follow the safety-first criterion is Tauer's (1983) target MOTAD model. Tauer (1983, pp 607) also shows that the target MOTAD model, unlike MOTAD, provides farm plans that are always second-degree stochastic dominant. This model is formulated as follows.

$$\max E(z) = \sum_{j=1}^{n} c_j x_j \qquad (2.4)$$

Subject to

$$\sum_{j=1}^{n} a_{kj} x_j \le b_k \qquad k = 1\ldots\ldots, m \qquad (2.5)$$

$$T - \sum_{j=1}^{n} c_{rj} x_j - y_r \le 0 \qquad r = 1\ldots\ldots\ldots, s \qquad (2.6)$$

$$\sum_{r=1}^{s} p_r y_r = \lambda \qquad \lambda = M \qquad (2.7)$$

In all the above equations x_j and y_r ≥ 0, where

E (z) = expected return of the plan or solution

c_j = expected return of activity j

x_j = level of activity j

a_{kj} = technical requirement of activity j for resource or constraint k

T = target level of return

c_{rj} = return of activity j for state of nature or observation r

y_r = deviation below T for state of nature or observation r

p_r = probability that state of nature or observation r will occur

λ = constant parameterized from M to 0

m = number of constraint and resource equations

s = number of states of nature or observations

M = a large number

Equation (2.4) maximizes expected return of the solution set. Equation (2.5) fulfills the technical constraints. Equation (2.6) measures the revenue of a solution under state r. If that revenue is less than the target T, the difference is transferred to equation (2.7) via variable y_r. Equation (2.7) sums the negative deviations after weighting them by their probability of occurring, p_r. In farm planning a state of nature typically corresponds to a particular type of year, eg. a wet or dry year, or a high price or low price year. Not all states of nature need to be equally likely, and each may be assigned a probability p_r.

CHAPTER III

LITERATURE REVIEW

The purpose of this review is to give an overview 1) of organic farming and how it is spreading worldwide, 2) to examine the motivations underlying the willingness to pay higher prices for organic commodities over conventional commodities, 3) to evaluate the uniformity of global standards for organic commodities and 4) to explain the idea about risks associated with organic production.

History

The term organic farming goes back to the 1940s when a British writer, Lord Northbourne, described an integrated farm as a dynamic living organic whole. This idea of wholeness and complexity is still present within the definition of organic farms today (Hogh-Jensen, 1998). An integral part of organic farming means using "beneficials". This refers to using beneficial insects such as ladybugs that destroy the bad bugs like aphids, and beneficial inter-planting of certain plants to keep pests away (Lampkin, 1992). Organic farming also means unique farm management decisions in terms of crop choice, planning, harvesting and marketing (Gaskell et al. 2000).

One government estimation shows that 0.28 percent of total U.S. cropland is devoted to certified organic methods although this amount doubled between 1992 and 1997 (Greene, 2001) and continues to grow. The increase in organic crop agriculture acreage and quantity produced world-wide in the last years is due to a growing number of consumers preferring organic products (Bourn and Prescott, 2002; OTA, 2004). In 2001, certified organic cropland totaled 2.34 million acres (Greene and Kremen, 2003). But there exists variations by crop type, with approximately 2 percent of the major fruit and vegetable crops including apples, carrots, lettuce and grapes and 1 percent of all the tomatoes, grown by certified organic methods (Greene, 2001).

A wide range of geographic variation also exists in the U.S. in terms of organic crop land and intensity; especially among states like California, North Dakota, Minnesota, Wisconsin, Iowa, and Montana. Montana has the largest certified organic acreage (influenced by the large areas of pasture and rangeland), while California, Washington, Wisconsin, Minnesota, Iowa, Pennsylvania, Ohio, New York, Vermont, and Maine have a large number of certified organic farmers (Greene and Kremen, 2003).

The international organic food market is also rapidly growing, despite its very small share of the total food market. The Organic Trade Association survey (2004) suggests that the growth in the organic market since 2000 is primarily due to organic consumers increasing their organic purchases rather than the number of organic consumers increasing.

On the production side, the incentives for farmers to use organic methods are many (social, environmental and economic). However the higher price received is one of the most important factors affecting profitability and consequently incentive to produce

(Burton, Rigby and Young, 2003). Whereas, on the demand side, there is a mixed view on whether the relatively higher price associated with organic products have discouraged consumption. Sylvander and le Floch (2002) stated that in spite of higher prices of organic vegetables, high demand exists in Europe. For example, a United Kingdom based study shows that consumers demand for organic produce is currently growing faster than supply, despite the fact that a large number of farms are converting from conventional to organic (Rigby and Burton, 2001). On the other hand, another study by Gil, Gracia and Sanchez (2002) shows that although consumers search for more diverse, higher quality and healthier food products; organic products face problems because of high price and inefficient distribution channels. Likewise the production side faces high costs, especially labor costs and the difficulty of shifting from conventional to organic farming. Seasonality also influences marketing activities.

Organic Standards

In present time consumer concern towards health and general well-being is increasing so consumers demand more information about their food attributes such as quality, nutrition content, production process, safety, and the origin of their foods (Henneberry and Armbruster, 2003). Nevertheless, organic may be considered credence attribute. That is a consumer can not easily verify whether an item is truly organic either by observation (search goods) or consuming (experience goods) trait (Darby and Karni, 1973). Consequently, a third party is needed to verify such claims to protect consumers from fraud and to legitimize producers, processors etc. Lohr (1999) observed that creating a unified national set of standards would help to clarify the confusion over the exact meaning of organic; facilitating both international and domestic commerce of organic foods by decreasing transaction costs.

Organic agriculture actually started as a social movement, which in the long term has helped to define commercial and public standards for food (Campbell and Liepins, 2001). Organic standards are temporary attempts to serve organic values or ideas (Michelsen, 2001). More than 100 regional or national standards have been enacted worldwide, and numerous private sector standards exist today so international trade organizations have stated that no single international regulation establishes uniform standards for organic certification and no single agency or body is designated to accredit certifiers (ITC 1999).

In summary, organic food production faces a rapidly growing consumer demand in the U.S. and other industrialized countries, along with a globalized regulatory framework and development of support infrastructure (Klonsky and Greene, 2005). Klonsky and Greene also saw the possibility of expanding the U.S. organic food market by: a) increasing the number of retail outlets, b) increasing the availability of organic products, c) entry of mainstream food manufacturer's into organic, d) branding of organic, and e) increased exports. On the international trade side, organic agricultural imports have played a significant role in the U.S. market expansion for organic products. USDA estimates that imports from other countries with the majority of exporters being European countries, accounted for between $1billion and $1.5 billion of the $8.6 billion in U.S. organic retail sales in 2002(USDA, 2005). The organic market growth has also meant the evolution of regulation of organic production and label standards to assure consumer confidence (Armah, 2002). He states that increased awareness of organic produce necessitates new research to document the current dynamics of the organic market.

Comparative Studies of Organic Versus Conventional Food

A study by the Consumers Union shows significantly lower pesticide residues on organic compared with conventional foods (Burros, 2002; Goldberg, 2002). Moreover, parental concern about the safety of their children's food has been an important motivation behind organic food purchases. A recent study shows that children who eat organic food have significantly lower levels of pesticides in their urine. This research indicated that " consumption of organic fruits, vegetables, and juice can reduce children's exposure levels from above to below the United States Environmental Protection Agency (EPA) current guidelines, thereby shifting exposures from a range of uncertain risk to a range of negligible risk" (Curl, Fenske and Elgethun, 2003, p 337).

An inclusive report of Soil Association, a leading organic certification agency and educational organization in Great Britain called "Organic Farming, Food Quality, and Human Health", identifies clear benefits of organically grown food in terms of food safety and higher nutrient content (Heaton, 2001). They found that organic foods have lower pesticide and nitrate residues and no increased risk of food poisoning compared with conventional food. German researchers evaluated 150 comparative studies from 1929 to 1994 and found that organic foods provide a better option over conventional foods. Specifically, organic vegetables, particularly leafy, tuber or root varieties are found to have much lower nitrate levels than the conventionally grown ones(Grinder-Pedersen *etal*. 2003) In an important Swedish review of the health benefits of organic food (Lundegardh and Martensson 2003, p 12), the authors state that organic foods can strengthen the immune system and other defense systems depending on an interaction between various favorable properties of organic foods. The balance between mineral nutrients, content of pesticides and other contaminants and the contents of secondary metabolites may be most important for beneficial effect. A study by Hammitt (1986) also explains the lower rate of cancer or other adverse health outcomes associated with residual pesticide by substituting organic for conventional produce.

Danish researchers show that organic food is higher in secondary metabolites (the nutrients one level below vitamins) and that this added nutrition would benefit human health more than non-organic foods (Brandt and Molgaard, 2001). In a study comparing organic and conventionally grown strawberries, blackberries, and corn, Asami et. al (2003) found that organic food had higher levels of antioxidants like vitamins C and E (Byrum, 2003). Because of nutritional superiority, food safety, fresher taste, and environmental concern, consumer demand is clearly strong and growing, as is the consumer willingness to pay more for organically grown foods in the United States. Estimates of the price variations between organic and conventional are commonly in the range of 10-30 percent (Sok and Glaser, 2001). Still consumers are demanding more organic foods which show an increasing acceptance of organic agriculture in the United States.

The increased consumer demand for all organic foods over the conventional ones is likely linked to consumer concern about pesticide residues and genetically modified organisms (GMOs) in their food (Klonsky 2000; Kouba 2003). Eating certified organic food can help reduce uncertainties about chemical residues in our food supply (Leon and DeWaal, 2002).

Regarding economic profitability study on U.S. organic crops price premiums are key in giving the organic farming systems comparable or higher whole farm profits. Dimitri and Greene (2002) stated that organic systems may be more profitable than conventional systems, even without price premiums giving examples of Midwestern organic grain and soybean production which was found to be more profitable than conventional systems, even without price premiums, due to higher yields in drier areas or periods, lower input costs, or crop mix. For vegetables, however, there is no clear consensus regarding profitability.

Many other past studies also suggested that increased awareness of the subtle difference of organic produce and conventional produce necessitates new research to document the current dynamics of the organic market. Armah (2002) also has suggested the necessity of site-specific organic research. This study is expected to perform a Southern Oklahoma based comparative study of conventional and organic vegetables. Sales of organic food products have been increasing for the last ten years with sales of organic vegetables increasing at a twenty percent rate per year for the last five years. It is perceived by many consumers that organically produced vegetables are more tasty, healthier and safer than conventionally grown vegetables. Because of this strong belief, the organic market is expected to continue to expand. While the volume of the organic vegetable market is quite small relative to that of conventionally produced vegetables, there appears to be opportunities for Oklahoma growers to enter this niche market as a possible alternative to conventional production (Taylor, Roberts, Edelson, Russo, Pair, Davis, Webber, 2006). Basic information on what is involved in organic vegetable production such as required practices, acceptable varieties, costs of production and expected returns are in limited availability. This study will attempt to answer many of the questions regarding organic vegetable production.

Risk in Agricultural Production

Output risk is an inherent part of the production process in most primary industries; e.g. agriculture, aquaculture, fisheries, mining and oil extraction. The way risk is incorporated into production analysis varies among studies. A study by Antle (1983) shows that risk matters primarily because production is a dynamic phenomenon and, therefore, production and price uncertainty affect expected productivity and expected income. Variability of yields and prices should be considered in making crop choice decisions since uncertainty of yield results from the unpredictable nature of the weather and performance of crops, whereas uncertainty of prices comes from the market conditions (Anderson, Dillon and Harderker, 1977).

According to Taylor and Robinson (2004), the focus in risk management should be on reducing the variability of income, not increasing net income. They indicate that income stability helps the producer meet personal and business obligations. They further consider production risk, marketing risk, financial risk, legal and environmental risk and human resources risk as the major sources of risk in agriculture. Each of the five sources of risk can increase the variability of expected net returns.

Ramaswami (1992) addressed how production uncertainty affects optimal input decisions. His work shows that for all risk averters, marginal risk premium is positive (negative); if and only if, the input is risk-increasing (decreasing). Accounting for production and marketing associated risks are important when it comes to crop production decisions; especially, where the accumulated effect of repeated choices may have a significant impact on overall business performance (Hardaker, 2000).

Decision makers always have to choose among uncertain alternatives. One of the earliest methods for ordering risky alternatives is Mean-Variance analysis (E-V Method), (Markowitz, 1959). The same level of expected return, but smaller in variance is preferred by this method. Mean-variance analysis is appropriate when returns are normally distributed and/or the utility function is quadratic. The utility function may also differ among decision makers. In addition, only two moments of the probability distributions are considered in making decisions by E-V method (Hadar and Russell, 1969).

The perception of the level of risk associated with an outcome differs among decision makers. Different decision makers or farmers may have different attitudes towards risk and therefore risk impacts cannot be assessed without accounting for the attitude of the decision maker. Choice of favorable and unfavorable outcomes can only be evaluated and compared knowing the decision maker's relative preferences for such outcomes (Hardaker et al., 2004).

Risk averse decision makers are assumed to prefer an investment with a certain outcome to an investment with the same expected value but an uncertain outcome. Whereas, risk preferring decision maker is assumed to prefer an investment with the same expected value but an uncertain outcome to an investment with a certain outcome. The more risk averse a farmer, the more likely he or she is to make managerial decisions that emphasize the goal of reducing variation in income rather than the goal of maximizing income.

Subjective expected utility (SEU) hypothesis states that the decision maker's utility function for outcomes needs to be incorporated to assess risky alternatives (Anderson, Dillon and Hardaker,1977). Zuhair, Taylor and Kramer (1992) stated that the producer risk attitudes may vary under different functional forms. A similar study by Binici et al. (2003) indicates that negative exponential functional forms best describes the risk attitudes in some cases. There is a rich body of literature that shows negative exponential utility function and the power utility functional form that best describe the farmers' attitudes towards risk (Zuhair, Taylor and Kramer 1992, Mussar etal. 1984, Yassour, Zilberman and Rausser, Binici et al.2003). Kumbhakar (2002) introduced a new approach to derive the risk preference function in the presence of output price uncertainty. From the estimated risk preference function, one can easily obtain predicted values of absolute, relative and downside risk aversion functions.

Various risk programming techniques also have been extensively used for policy analysis at farm level assuming risk neutrality or risk aversion to find optimal solutions when decision variables are continuous (CAPRI, 2002). Most risk-programming applications in agriculture are based on either mean-variance or MOTAD (minimization of total absolute-deviations). MOTAD results are supposed to approach mean variance results if returns are normally distributed. Also it is possible to consider preference for risk even when decision variables are continuous and one way of doing that is to apply a general version of MOTAD model referred to as the Target MOTAD model (McCamley and Rudel, 1999).

The target MOTAD model includes risk in a multi period approach and it entails fixing a static target over several years. It treats the sample of variables as an empirical distribution and optimizes over the column space of the sample. The results of the optimization are valid as long as the empirical distribution accurately represents the true underlying distribution. Application of the Target MOTAD model requires the decision maker to select a risk level for the expected deviation from an objective, and the scientific basis for selecting a reasonable risk level (Qiu, Prato and McCamley, 2001).

As organic crop production increases this might lead to the reduction in price premium. The reduced price premiums for organic products or lower profitability may discourage organic farming. Thus, this study will help to disseminate information about profitability of organic production system, under various risk scenarios compared to production under conventional methods.

CHAPTER IV

PROCEDURES AND DATA SOURCES

Procedures

The procedures will be different for each of the three specific objectives. Procedure one is to prepare enterprise budgets of selected vegetables for both organic and conventional systems for 2004, 2005 and 2006. Procedure two is to use a programming model to find the optimal mix of selected vegetables for both organic and conventional systems. And the third procedure is to do profitability analysis of selected vegetables in different risk scenarios using a target MOTAD model.

Budgeting

To accomplish the first objective, enterprise budgets for selected vegetable enterprises are developed for both organic and conventional systems. Budgeting is helpful to the decision maker in determining the costs and returns associated with specific enterprises. Each enterprise uses a different combination of inputs, but the basis for each budget is similar so that cost and returns can be compared.

Seven fresh vegetable budgets are developed for three years 2004, 2005, 2006 for both organic and conventional systems; which makes a total of forty-two budgets for this study. These budgets are shown in the Appendices A and B. Each budget consists of variable costs, fixed costs and expected revenues. The budgets are developed for the climatic and soil conditions of Wes Watkins Agricultural Research and Extension Center at Lane, Oklahoma for both Organic and Conventional systems. All the budgets are standardized so as to fix some exceptions and extremities. For example in one the years tomato had to be replanted because of pest damage, but the replanting cost was not included in that year's tomato budget so that bias in results can be minimized. The costs in each budget are average over three years and kept fixed in each year. Budgets from several states like Oklahoma, Mississippi, Alabama, Arkansas etc. are refereed to for the standardization process. These budgets are:

1. Tomato for fresh market -2004, 2005 and 2006;
2. Southern pea-Indeterminate variety for fresh market -2004, 2005 and 2006;
3. Southern pea-Determinate variety for fresh market -2004, 2005 and 2006;
4. Watermelon for fresh market -2004, 2005 and 2006;
5. Sweet corn for fresh market -2004, 2005 and 2006;
6. Bell pepper for fresh market -2004, 2005 and 2006;
7. Pickling cucumber -2004, 2005 and 2006.

The estimated costs of watermelon, tomato, sweet corn, southern peas, pickling cucumber and bell pepper (organic and conventional) in this study are based on data obtained from Wes Watkins Agricultural Research and Extension Center, Lane Oklahoma and incorporating information from different series of extension fact sheets from Oklahoma State University; Oklahoma State University enterprise budgets, enterprise budgets prepared by Mississippi State University, University of Arkansas, University of Missouri at Columbia, University of Alabama at Malta, Penn State University and University of Florida. Also additional information regarding enterprise budgets was obtained from personal communication with Dr. Mike Kizer (Extension Irrigation Specialist, Oklahoma State University) and Roger Sahs (OSU enterprise budget specialist). Yield information for some conventional vegetables also is taken from study reports on varietal trials conducted by the Department of Horticulture and Landscape Architecture at Oklahoma State University. Different technicians and scientists at Wes Watkins Research and Extension Center at Lane, Oklahoma, also provided some useful information. These cost estimates are representative of average costs for farms in Southeastern Oklahoma. Larger and smaller farms may have lower or higher costs per acre.

Fixed Costs

Fixed costs are the costs associated with buildings, machinery, and equipment which can be used over a period of years. This category includes depreciation, interest, insurance, and taxes on individual buildings and pieces of machinery and equipment that can be allocated to an individual enterprise (Doye, Kletke and Hardin, 2004). Machinery cost and irrigation costs can differ greatly depending upon the type, size, expected life of equipment, and the type of fuel used. Estimating machinery costs is a complicated and tedious job if done accurately. Machinery ownership might be profitable, yet it still may not be in the best interest of the business to purchase it. Most machines last more than 10 years but financing their purchase through borrowing generally requires a payback period of 3 to 5 years (James and Eberle, 2000). If the loan payment period is shorter than the life of the machine, it may cause cash flow problems and create financial stress. Even if the machine is not debt financed, there is an opportunity cost of ownership that should be recognized when justifying a purchase.

All of the machinery costs in the budgets prepared for this study are based on custom hired machines. The general assumptions made during preparation of budgets can be seen in table one and the custom hire rates can be seen in table two. Custom hire is a common method for gaining short-term use of machinery services particularly for harvesting and applying fertilizers and pesticides. Custom machinery rates are assumed to be a reasonable approximation of the opportunity costs of ownership.

Possible advantages of using custom operations include (Doye, 2006, p.205.4):

- Ownership costs are avoided.
- Capital and labor can be channeled to other uses.
- Machine use can be readily adjusted to changes in crop mix and market conditions.
- Specialized operations may benefit from experienced and skilled operator.
- Jobs may be completed faster using several machines.

Possible disadvantages of using custom operations include (Doye, 2006, p.205.4):

- Service may not be available at the best time.
- Reliability of the custom operator may not be known.
- Rates may be excessive in special situations.

Table 1 General Assumptions made while Preparing Enterprise Budgets for Watermelon, Southern peas, Corn and Tomatoes produced at Lane

1	Average Farmed acres for each crop	1
1	Type of Irrigation system	Drip
3	Efficiency of Irrigation system	75%
4	Energy used for irrigation	Electricity
5	Machinery	Custom Operated
6	Typical wage rate paid for labor	$10/hr
7	Annual Operating Capital Interest Rate	6.50%
8	Property Tax on Irrigation Structure	1%
9	Insurance Rate on Irrigation Structure	1%
10	Interest Rate on Irrigation Structure	5.50%

Source: Oklahoma Farm and Ranch Custom Rates, 2005-2006, CR-205

Table 2 Summary Statistics of Pre-harvest Machinery Custom Rates used in the Budgets for Lane, Oklahoma

No.	Type of operation	Custom Rate $/Acre		
		Minimum	Average	Maximum
3	Chisel Plow	5	7.72	11
4	Spring tooth Harrow	4	5.8	8
5	Field Cultivator	4	6.03	8
6	Row Cultivator	5	6.33	8
7	Stalk Shredder	6	10.5	15
8	Bedding (Listing)	6.5	12.25	15
9	Rotary Hoe	5	6	7
12	Sprayer (Insect and Disease)	2.75	3.86	10

Source: Oklahoma Farm and Ranch Custom Rates, 2005-2006, CR-205

Likewise if the farm is managed by a full-time owner-operator, his salary is considered to be a fixed cost. In that condition it is necessary to reflect the climatic variation in the available working hours of the farm manager depending upon the climatic conditions. Estimates of fixed cost for each item that are included in the budget are presented in Appendices A and B.

Variable costs

Variable costs includes costs of input items such as seed, fertilizer, chemicals, fuel, labor , normal repairs, custom operations and machinery and equipment operating expenses. Variable costs also include labor whether associated with machinery or equipment or as hand labor operations. Vegetable production tends to be labor intensive due to operations like thinning, cultivating, irrigating and harvesting. For this reason labor expenses are much greater for fresh market products. Labor was considered the largest variable cost contributing 42% of total variable expenses on specialized fruit and vegetable farms in 2003 (USDA, 2003).

Variable costs are items that will be used during one year's operation or during one production period and would not be purchased if the enterprise was not produced. Hired labor is assumed to be available in unlimited quantities at a price of 10 dollars per hour. The effects of the enterprise decision when the price of labor increased to 15 dollars will be analyzed. The analysis will be done for both organic and conventional system for both monthly hired labor and labor hired in four months block. The four months in block labor are May, June, July and August. One worker equivalent of block labor provides 160 labor hours in one month. So while using block labor hired workers are assigned integer constraint. Whether or not the total labor hour is utilized the worker/s should be paid at the rate of 160 hours per week for four months.

Grading and marketing costs are also included in variable costs. The grading costs are necessary as most of the vegetables are not marketable in their harvested form. Many vegetables need to be cooled, cleaned, waxed, graded and packaged before they can be sold. Each type of vegetable requires specific pre-marketing processing therefore each has different costs. Variable costs are independent of fixed costs and generally increase as the level of management intensity is increased. Estimates of variable cost for each item that are included in the budget are presented in Appendices A and B.

Table 3 Labor Usage for Six Vegetable Crops Grown at Lane, Oklahoma for the Organic System.

		Labor Required for Different Organic Vegetable Production Activities in Hours/ Acre						
Months	**Activities**	**Sweet Corn**	**Watermelon**	**Tomatoes**	**Southern peas (Determinate)**	**Southern peas (Indeterminate)**	**Bell Pepper**	**Cucumber**
January Labor								
February Labor								
March Labor								
April Labor								
	Manure	2	2	2	2	2	2	2
	All Tillage Labor	2	2	2	2	2	2	2
	Irrigation Set-up	2	2	2	2	2	2	2
May Labor								
	Transplanting/Seeding	2	8	40	2	2	12	2
	Irrigation labor	2	2	2	2	2	2	2
June Labor								
	Cultivating Middles	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	Hand Hoeing	12	6	25	12	12	14	14
	Irrigation Labor	3	3	3	3	3	3	3
July Labor								
	Organic Insect Control	10	5	5	2	2	2	2
	Irrigation Labor	2	2	2	2	2	2	2
	Harvesting	27			50	70	27	27
August Labor								
	Harvesting		15	35				
September Labor								
	Post-Harvest Activities	2.5	2.5	2.5	2.5	2.5	2.5	2.5
October Labor								
November Labor								
December Labor								
Total Labor Requirement		69	52	123	84	104	73	63

Source: Primary data obtained from Lane Oklahoma for the average labor usage for the years 2004, 2005 and 2006.

Table 4 Labor Usage for Six Vegetable Crops Grown at Lane, Oklahoma for the conventional system.

Months	Activities	Sweet Corn	Watermelon	Tomatoes	Southern peas (Determinate)	Southern peas (Indeterminate)	Bell Pepper	Cucumber
		Labor Required for Different Conventional Vegetable Production Activities in Hours/ Acre						
January Labor								
February Labor								
March Labor								
April Labor								
	Fertilizer application	1	1	1	1	1	1	1
	All Tillage Labor	2	2	2	2	2	2	2
	Herbicide application	1	1	1	0	0	1	1
	Irrigation Set-up	2	2	2	2	2	2	2
May Labor								
	Transplanting/Seeding	2	8	40	2	2	12	2
	Irrigation Labor	2	2	2	2	2	2	2
June Labor								
	Cultivating Middles	1	1	1	1	1	1	1
	Hand Hoeing	6	4	9	6	6	6	6
	Irrigation Labor	3	3	3	3	3	3	3
July Labor								
	Insecticide application	10	5	5	5	5	2	2
	Irrigation labor	2	2	2	2	2	2	2
	Harvesting Labor	27			50	70	27	27
Aug Labor								
	Harvesting Labor		15	35				
September Labor								
	Post-Harvest Activities	2.5	2.5	2.5	2.5	2.5	2.5	2.5
October Labor								
November Labor								
December Labor								
Total Labor Requirement		61.5	48.5	105.5	78.5	98.5	63.5	53.5

Source: Primary data obtained from Lane Oklahoma for the average labor usage for the years 2004, 2005 and 2006.

Table 5 Comparison of Labor Usage between Six Organic and Conventional Vegetable Production Systems, Lane Oklahoma.

Crops	Sweet Corn	Watermelon	Tomatoes	Southern Peas (Determinate)	Southern Peas (Indeterminate)	Bell Pepper	Cucumber
	Total Labor Required for Different Vegetable Production Activities in Hours/Acre						
Organic System	69	52	123	84	104	73	63
Conventional System	61.5	48.5	105.5	78.5	98.5	63.5	53.5
Difference	7.5	3.5	17.5	5.5	5.5	9.5	9.5

Source: Primary data obtained from Lane Oklahoma for the average labor usage for the years 2004, 2005 and 2006.

Irrigation Costs

Accurate estimates of the cost of irrigation are important when making irrigation decisions. The annualized cost of an irrigation system is dependent on the design choices made whereas the energy required for irrigation pumping is dependent on both the quantity pumped (acre-inches) and the total head (lift plus pressure) the pump is working against. The type of irrigation system used to prepare our budgets is ‘drip’ irrigation. Energy cost is a major portion of the total cost of pumping irrigation water. Irrigation cost applies to those crops which actually are irrigated. Dry land crops do not have irrigation costs. Irrigation cost used for this study is $12 per acre-inch of irrigation water which is the rate used by Wes Watkins Agriculture Research and Extension Center.

Irrigation labor, fuel, repair and maintenance are considered variable and can be different for different crops. These costs depend on the amount of water applied per acre, and the efficiency of the system. Fixed costs include depreciation, property tax, insurance and annual interest cost. Salvage value is assumed to be zero at the end of the useful life. Purchase price is the actual dollar amount paid and may vary significantly from list price. Annual fixed cost estimates for property taxes, insurance and interest are calculated by multiplying the appropriate percentage by the average value of the asset over its useful life, assuming zero salvage value. In the budgets prepared for this study all these costs are assumed to be included in $12 for per acre-inch of irrigation water.

Price Data

Currently, organic vegetable prices are not consistently reported by the market News Service, with the exception of the San Francisco and Boston/New York markets. Many of the participants of the organic industry believe that price premiums need to decrease if organic foods are to extend their market into the mainstream (Oberholtzer et al., 2005). In the markets where consumers are willing to pay a premium to organic products, the early adopters of organic production methods make high profits. This will attract more producers which consequently may cause a decrease in profitability over time.

In this study models were simulated using the same prices for both organic and conventional produce, meaning profitability was calculated without a price premium in the organic system. When prices were available from the Dallas Terminal Market these were preferred. Producer received prices in Lane, Oklahoma were then extrapolated from the Dallas terminal wholesale price data, assuming transportation and packaging cost margins of 30 percent. The actual margin may vary by an unknown amount depending upon supply and the demand situation in the Dallas Terminal Market (Wathen et al.). Price received in Lane is (P_2) thus taken as price in Dallas terminal market (P_1) minus 30% of that price in Dallas Terminal Market (d) which can be seen in table 6.

Table 6 Price list for selected vegetables for the years 2004, 2005 and 2006, Dallas Terminal Market

Vegetable	Unit	Year	Price in Dallas Terminal Market (P_1)	30% of P_1 (d)	Price in Lane (P_2*)
Sweet Corn	Dozen	2004	3.50	1.05	2.45
		2005	4.00	1.20	2.80
		2006	4.25	1.28	2.98
Pickling Cucumber	55 lb crate	2004	20.00	6.00	14.00
		2005	23.50	7.05	16.45
		2006	18.00	5.40	12.60
Bell Pepper	28 lb crate	2004	15.75	4.73	11.03
		2005	16.00	4.80	11.20
		2006	17.00	5.10	11.90
Tomatoes	25 lb crate	2004	10.00	3.00	7.00
	lb				0.28
		2005	13.00	3.90	9.10
					0.36
		2006	12.00	3.60	8.40
					0.34
Watermelon	lb	2004	0.16	0.05	0.11
		2005	0.18	0.05	0.13
		2006	0.19	0.06	0.13
Southern Peas	lb	2004	2.80	0.84	1.96
		2005	2.70	0.81	1.89
		2006	3.00	0.90	2.10

Source: Dallas Terminal Market Prices for selected vegetables for 2004, 2005 and 2006
Note: * $P_2 = P_1 - d$

Returns

Net returns of a farm enterprise are a function of the prices, quantities of inputs, and outputs and costs. Return above operating costs (net return) is equal to the total revenue (yield multiplied by price) minus total variable cost (summation of operating cost). Comparing returns above operating cost of the different enterprises gives expected profitability of many of the vegetable crops. Fixed costs are the same for all crops when produced by single crop.

The Linear Programming Model

A linear programming model for this study is designed to achieve the second objective of the study which is to determine the profit maximizing vegetable mix for both organic and conventional systems. The model is developed to maximize net returns for given resource restrictions and farm organizations for both organic and conventional methods. A matrix is developed to determine the optimal product mix for using different acreage and labor wage rates. The rows consist of all the inputs that are constrained in the study. Each row is an equation where the combined total of the resource levels used in a farm mix must be either "equal to", "less than" or "greater than" the constraint imposed, depending upon the type of constraint. For example, one of the restrictions imposed is that no more than one third of the land may be of tomato, pepper or the combination of the two. A similar restriction is imposed on watermelon and cucumber. And, another on southern pea and sweet corn.

The columns consist of all of the production activities (organic and conventional tomatoes, sweet corn, bell pepper, etc.), idle land, balance rows for yields of production activities for different years, non-labor cost balance, buying of labor from April to September and Income balance for different years. Each parameter in the columns represents how many units of the row resource are required for the particular column activity.

Twenty four different models were simulated to get the optimal values for different combinations of land acreage, wage rate, and the type of labor used. The different acreages used are: 6, 9 and 15; different wage rates used are: \$10 and \$15 per hour; and the two types of labor used are: labor hired on a hourly basis and labor hired in a four month block. The four months under block labor are: May, June, July, and August and consists of 160 labor hours in one month.

The Target MOTAD Model

The target MOTAD is the modification of the MOTAD model which is computationally efficient and generates a solution by generating a solution that meets a second-degree stochastic dominance (SSD) test. This model is designed to achieve the third objective of the study which is a risk analysis of selected vegetables in both conventional and organic systems. The model is developed to determine the allocation of land and labor among the different vegetables under the study including tomato, determinate southern pea, indeterminate southern pea, sweet corn, watermelon, bell pepper, and pickling cucumber; such that net returns are maximized, given the resource restriction in different farm conditions. Determinate southern peas are harvested at one time, whereas, indeterminate southern peas have multi harvesting. So labor cost involved with the later is higher. The Target MOTAD is constructed under the assumption that the decision maker possesses the utility function $U = c + aR + b\min(R - T, 0)$, where R is income, T is target income level, and a, b are parameters and are assumed to be greater than zero (Tauer, 1983).

The Target MOTAD model was formed by setting a target on income constraint of the simple programming model formed for objective two. Also λ (allowable average deviation below the target income) was varied to trace out a risk return frontier. Since the Target MOTAD model entails a linear objective function and linear constraints; the model was solved with a linear programming algorithm using Excel Solver. The basic objective of the model is to analyze the maximum expected return from the production of organic and conventional vegetables subject to a given minimum level of risk identified with a predetermined target level of return. This model can be useful for decision makers who wish to maximize the expected return, but are concerned about net returns falling below critical target T. The target income is the minimum income necessary to meet the fixed costs of farmers including credit repayment, and to meet his family's living costs each year.

CHAPTER V

RESULTS AND DISCUSSION

Linear Programming Model

A linear programming model is built from budgets and data sets specifying the objective function, resource constraints, activity limits, and output prices. Excel Solver is used to maximize the objective function. Linear Programming solution obtained by using the Excel Solver is used to determine the profitability of hypothetical vegetable farms assuming three production sizes of 6, 9, and 15 acres; and two wage rates10 and 15 dollars per hour hired labor for both monthly hired labor and block labor. Results of these simulations will be discussed below.

Result for Six acres

Altogether, eight different models were simulated for six acres of land. Four scenarios were formed using $10 per hour labor rate for monthly hired labor, for both organic and conventional production methods. And four scenarios were simulated using $15 per hour labor rate for block labor, for both organic and conventional systems.

Assuming the conventional method using $10 for hourly labor, the optimal mix of vegetables is: 2 acres of tomato, 2 acres of determinate southern peas and 2 acres of sweet corn which can be seen in table 7. The optimal income for this situation is $9,578.22. For the same combination but this time assuming an organic method, the optimal mix of vegetables is: 2 acres of tomato, 2 acres of determinate southern pea and 2 acres of watermelon. The optimal income is $5,678.81.

Assuming $10 for block labor and the conventional system of production the optimal mix of vegetables is: 2 acres of tomato, 2 acres of determinate southern peas and 2 acres of sweet corn, and the optimal income is $7,274.39. For the same condition, but assuming organic production system, the optimal income is $3,011.60 and the optimal mix of vegetables is: 1.93 acres of tomato, 2 acres of determinate southern peas, 0.07 acres of bell pepper, and 2 acres of cucumber.

Likewise; using $15 for hourly labor for conventional system, the optimal mix of vegetables is 2 acres of tomato, 2 acres of determinate southern peas and 2 acres of sweet corn. The optimal income for this case is $7,275.26. For the same combination, in the organic system the optimal income is $3,370.90 and the optimal vegetable mix is: 2 acres of tomato, 2 acres of determinate southern peas, and 2 acres of idle land. Two acres is left idle because water-melon and cucumber are not profitable at $15/hour labor.

Whereas; using $15 for block labor for conventional system, the optimal vegetable mix is: 2 acres of tomato, 2 acres of determinate southern peas, and 2 acres of sweet corn. The optimal income is $4,518.39. For the same combination in organic, the optimal income is $247.60 and the optimal vegetable mix is: 1.93 acres of tomato, 2 acres of determinate southern peas, 0.07 acres of bell pepper, and 2 acres of cucumber.

The required monthly hired labor, the number of workers hired in the case of block labor and the idle labor when labor is hired in block are presented in table 8. One worker hired in block labor system provides 160 labor hours in one month. Idle labor is the labor left idle in block labor. Since workers are hired in whole number, all the labor hours they can provide may not be utilized, therefore some labor hours are left idle.

Table 7 Optimum mix of Vegetables for Six Acres of Land in Both Conventional and Organic Production Systems

	Conventional System				Organic System			
	$10 /Hr		$15/Hr		$10 /Hr		$15/Hr	
Crops	Hourly labor	Block Labor	Hourly labor	Block Labor	Hourly labor	Block Labor	Hourly labor	Block Labor
Tomato	2.00	2.00	2.00	2.00	2.00	1.93	2.00	1.93
Southern peas indeterminate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Southern peas determinate	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Watermelon	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00
Sweet Corn	2.00	2.00	2.00	2.00	0.00	0.00	0.00	0.00
Bell Pepper	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.07
Pickling Cucumber	0.00	0.00	0.00	0.00	0.00	2.00	0.00	2.00
Idle land	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00

Table 8 Income and Labor for Six Acres of Land in Both Conventional and Organic Production Systems

	Conventional System				Organic System			
	$10 /Hr		$15/Hr		$10 /Hr		$15/Hr	
	Monthly Labor	Block Labor	Monthly Labor	Block Labor	Monthly Labor	Block Labor	Monthly Labor	Block Labor
Income	$9,578.22	$7,274.39	$7,275.26	$4,518.39	$5,678.81	$3,011.60	$3,370.90	$247.60
Hourly Labor Hired								
April	34.00	34.00	34.00	34.00	36.00	36.00	24.00	36.00
May	100.00	0.00	100.00	0.00	112.00	0.00	92.00	0.00
June	66.00	0.00	66.00	0.00	119.00	0.00	96.00	0.00
July	85.24	0.00	85.24	0.00	57.70	0.00	43.70	0.00
August	160.35	0.00	160.35	0.00	225.70	0.00	166.13	0.00
September	15.00	15.00	15.00	15.00	15.00	15.00	10.00	15.00
Block Labor Hired*	-	1.00	-	1.00	-	1.00	-	1.00
Idle Labor Hours								
May	-	60.12	-	60.12	-	62.07	-	62.07
June	-	94.01	-	94.01	-	25.81	-	25.81
July	-	74.74	-	74.74	-	97.55	-	97.55
August	-	0.00	-	0.00	-	0.00	-	0.00

* 1 hired worker provides 160 hours per month on the months of May, June, July and August.

Result for Nine acres

Altogether, eight different models were simulated for nine acres of land. Four scenarios were formed using $10 per hour labor rate for monthly hired labor, for both organic and conventional production methods. And four scenarios were simulated using $15 per hour labor rate for block labor, for both organic and conventional systems. The results can be seen in tables 9 and 10. Assuming conventional methods using $10 for hourly labor, the optimal mix of vegetables is: 3 acres of tomato, 3 acres of determinate southern peas, and 3 acres of sweet corn. The optimal income for this situation is $14,367.33. For the same combination but assuming organic method, the optimal mix of vegetable is: 3 acres of tomato, 2 acres of determinate southern pea and 2 acres of watermelon and the optimal income is $8,518.22.

Assuming 10 dollars for block labor and the conventional system of production the optimal mix of vegetables is: 2 acres of tomato, 3 acres of determinate southern peas, 3 acres of sweet corn, and 1 acre of bell pepper, and the optimal income is $9,596.89. For the same combination but assuming organic production system, the optimal income is $3,927.68 and the optimal mix is: 1.93 acres tomato, 3 acres determinate southern peas, 1.07 acres bell pepper, 1.43 acres cucumber, and 1.57 acres idle land.

Likewise; using $15 for hourly labor for conventional system, the optimal mix of vegetables is 3 acres of tomato, 3 acres of determinate southern peas, and 3 acres of sweet corn. The optimal income for this case is $10,912.88. For the same combination in organic the optimal income is $5,056.35 and the optimal vegetable mix is: 3 acres of tomato, 3 acres of determinate southern peas, and 3 acres of idle land.

Whereas; using $15 for block labor for conventional system, the optimal vegetable mix is: 2 acres of tomato, 3 acres of determinate southern peas, 3 acres of sweet corn, and 1 acre of bell pepper. The optimal income is $6,029.39. For the same combination in organic, the optimal income is $412.07 and the optimal vegetable mix is 1.93 acres of tomato, 3 acres of determinate southern peas, 1.07 acres of bell pepper, 1.43 acres of cucumber, and 1.57 acres of idle land.

The required monthly hired labor, number of workers hired in the case of block labor and idle labor when labor is hired in block is presented in table 10.

Table 9 Optimum Mix of Vegetables for Nine Acres of Land for Both Conventional and Organic Production Systems

	Conventional System				Organic System			
	$10 /Hr		$15/Hr		$10 /Hr		$15/Hr	
Crops	Hourly labor	Block Labor	Hourly labor	Block Labor	Hourly labor	Block Labor	Hourly labor	Block Labor
Tomato	3.00	2.00	3.00	2.00	3.00	1.93	3.00	1.93
Southern peas indeterminate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Southern peas determinate	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Watermelon	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00
Sweet Corn	3.00	3.00	3.00	3.00	0.00	0.00	0.00	0.00
Bell Pepper	0.00	1.00	0.00	1.00	0.00	1.07	0.00	1.07
Cucumber	0.00	0.00	0.00	0.00	0.00	1.43	0.00	1.43
Idle land	0.00	0.00	0.00	0.00	0.00	1.57	3.00	1.57

Table 10 Income and Labor for Nine Acres of Land for Both Conventional and Organic Production Systems

	Conventional System				Organic System			
	$10 /Hr		$15/Hr		$10 /Hr		$15/Hr	
	Monthly Labor	Block Labor	Monthly Labor	Block Labor	Monthly Labor	Block Labor	Monthly Labor	Block Labor
Income	14,367.33	8,561.05	10,912.88	6,029.39	8,518.22	3,927.68	5,056.35	412.07
Hourly Labor Hired								
April	51.00	51.00	51.00	51.00	54.00	44.56	36.00	44.56
May	150.00	0.00	150.00	0.00	168.00	0.00	138.00	0.00
June	99.00	0.00	99.00	0.00	178.50	0.00	144.00	0.00
July	127.86	0.00	127.86	0.00	86.54	0.00	65.54	0.00
August	240.53	0.00	240.52	0.00	338.54	0.00	249.20	0.00
September	22.50	22.50	22.50	22.50	22.50	18.57	15.00	18.57
Block Labor Hired*	-	1.00	-	1.00	-	1.00	-	1.00
Idle Labor Hours								
May	-	30.98	-	38.12	-	46.36	-	46.36
June	-	63.25	-	64.01	-	0.00	-	0.00
July	-	29.29	-	28.32	-	74.02	-	74.02
August	-	0.00	-	0.00	-	0.00	-	0.00

*1 hired worker provides 160 hours per month on the months of May, June, July and August.

Results for Fifteen acres

Altogether, eight different models were simulated for fifteen acres of land. Four scenarios were formed using $10 per hour labor rate for monthly hired labor, for both organic and conventional production methods. And four scenarios were simulated using $15 per hour labor rate for block labor, for both organic and conventional systems. The results can be seen in tables 11 and 12. Assuming the conventional method and using $10 for hourly labor the optimal mix of vegetables is: 5 acres of tomato, 5 acres of determinate southern pea, and 5 acres of sweet corn. The optimal income for this situation is $23,945.55. For the same combination but this time assuming an organic method, the optimal mix of vegetables is: 5 acres of tomato, 5 acres of determinate southern pea, and 5 acres of watermelon and the optimal income is $14,197.03.

Assuming $10 for wage rate of block labor and the conventional system of production the optimal mix of vegetables is: 3.99 acres of tomato, 5 acres of determinate southern peas, 5 acres of sweet corn, and 1.01 acre of bell pepper, the optimal income is $16,871.28. For the same combination, but assuming organic production system, the optimal income is $7,060.19 and the optimal mix is: 3.85 acres tomato, 5 acres determinate southern pea, 1.15 acres bell pepper, 4.75 acres cucumber and 0.25 acres idle land.

Likewise; using $15 for hourly labor for conventional system, the optimal mix of vegetables is: 5 acres of tomato, 5 acres of determinate southern pea, and 5 acres sweet corn. The optimal income for this case is $18,188.14. For the same combination, in organic the optimal income is $8,427.24 and the optimal vegetable mix is 5 acres of tomato, 5 acres of determinate southern peas and 5 acres of idle land

Whereas; using $15 for block labor for conventional system the optimal vegetable mix is: 3.99 acres of tomato, 5 acres of determinate southern pea, 5 acres of sweet corn, and 1.01 acre of bell pepper. The optimal income is $9,858.78. For the same combination, in organic the optimal income is $1,071.78 and the optimal vegetable mix is: 1.93 acres of tomato, 5 acres of determinate southern pea, 0.71 acres of bell pepper, 1.43 acres of cucumber, and 7.37 acres of idle land.

The information regarding required monthly hired labor, number of workers hired in the case of block labor and idle labor when labor is hired in block is presented in table 12.

Table 11 Optimum Mix of Vegetables for Fifteen Acres of Land for Both Conventional and Organic Production Systems

	Conventional System				Organic System			
	$10 /Hr		$15/Hr		$10 /Hr		$15/Hr	
Crops	Hourly labor	Block Labor	Hourly labor	Block Labor	Hourly labor	Block Labor	Hourly labor	Block Labor
Tomato	5.00	3.99	5.00	3.99	5.00	3.85	5.00	1.93
Southern peas indeterminate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Southern peas determinate	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Watermelon	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00
Sweet Corn	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.00
Bell Pepper	0.00	1.01	0.00	1.01	0.00	1.15	0.00	0.71
Cucumber	0.00	0.00	0.00	0.00	0.00	4.75	0.00	0.00
Idle land	0.00	0.00	0.00	0.00	0.00	0.25	5.00	7.37

Table 12 Income and Labor Requirement for Fifteen Acres of Land for Both Conventional and Organic Production Systems

	Conventional System				Organic System			
	$10 /Hr		$15/Hr		$10 /Hr		$15/Hr	
	Monthly Labor	Block Labor	Monthly Labor	Block Labor	Monthly Labor	Block Labor	Monthly Labor	Block Labor
Income	23,945.55	16,871.28	18,188.14	9,858.78	14,197.03	7,060.19	8,427.24	1,071.78
Hourly Labor Hired								
April	85.00	85.00	85.00	85.00	90.00	88.50	60.00	45.79
May	250.00	0.00	250.00	0.00	280.00	0.00	230.00	0.00
June	165.00	0.00	165.00	0.00	297.50	0.00	240.00	0.00
July	213.11	0.00	213.11	0.00	144.24	0.00	109.24	0.00
August	400.88	0.00	400.88	0.00	564.24	0.00	415.32	0.00
September	37.50	37.50	37.50	37.50	37.50	36.87	25.00	19.08
Block Labor Hired*	-	2.00	-	2.00	-	2.00	-	1.00
Idle Labor Hours								
May	-	98.24	-	98.24	-	103.13	-	49.23
June	-	158.03	-	158.03	-	0.00	-	0.00
July	-	103.06	-	103.06	-	159.49	-	62.47
August	-	0.00	-	0.00	-	0.00	-	0.00

*1 hired worker provides 160 hours per month on the months of May, June, July and August.

Vegetables are labor intensive crops so labor is considered as one important factor in this study. Consequently, various scenarios are considered with varying assumptions about wage rates applied to monthly hired labor and block labor. In scenarios including block labor, one of the column restraints is the number of hired workers. Here this is constrained to be an integer. So in the scenarios having block labor at least one worker has to be hired for the four months block. The four months considered in the block are May, June, July and August. The results show that hiring hourly labor is more profitable than hiring block labor for the same acreage, since labor hours may remain idle when labor is hired in blocks causing a decrease in income. As illustrated by tables 8, 10, and 12 the idle labor hours decreases with an increase in acreage. This shows that if the farm were of sufficient size the block labor tends to give more income as less labor is left as idle.

Tables 7, 9 and 11 show that for hourly labor, the optimal mix of vegetables were the same for different acreage in conventional as well as organic but the number of acres for each crop increased proportionately with the increase in total acreage. The most profitable mix of vegetables for hourly labor in the conventional system are tomato, determinate southern pea and sweet corn and that in organic system are tomato, determinate southern pea and watermelon. The optimal mix for both conventional and organic system for block labor is different with a change in acreage. In some cases when labor cost is $15, the organic system couldn't pay the labor cost and the results show that some acres of land are left idle.

In the above scenarios, the same prices are used for both the organic and conventional system. However, the results obtained may not be the same as in real life, because in most cases organic products get some price premium over the conventional products. The simulation results obtained for 6, 9, and 15 acres prove our hypothesis that organic production system provides less return over the conventional production system when the same prices are considered for both organic and conventional products. The organic system may begin providing higher returns in future. This can be seen in some of the budgets where yields in long-term production in organic systems is greater than that in conventional after many years.

Target MOTAD Model

The typical Target MOTAD model of vegetable farms under conventional and Organic systems is constructed. The model offers two advantages, first, it incorporates risk into a linear programming approach and secondly, the solution of a Target MOTAD model contains production plans which are second degree stochastic dominance efficient (Tauer, 1983). Stochastic dominance is a term used in decision theory to refer to situations where one farm plan can be ranked as superior to another. It is based upon preferences regarding outcomes. For example if each outcome is expressed as a number, a higher value is preferred but requires only limited knowledge of preferences with regard to distribution of outcomes, which depend on risk aversion. Farm plan A has first-order stochastic dominance over farm plan B if for any outcome ‘x’, A gives higher probability of receiving an outcome equal to or better than ‘x’ than B. Second order stochastic dominance adds risk aversion to the assumption made by first-order stochastic dominance.

Altogether four scenarios were applied to the Target MOTAD models to perform the risk assessment for a vegetable farm. Two scenarios were developed for a 10 acre conventional farm using block labor and monthly hired labor with labor rate of $10 per hour. On the other hand, two additional scenarios assumed exactly the same combination of wage rate and acreage in an organic system.

The objective function of the model is set to maximize expected net returns. The first set of constraints imposes the resource restrictions. The second set of constraints defines deviations below the target income in each time period. The third constraint sums the negative income deviations times their probability of occurrence. This sum is represented by parameter λ and it is interpreted as the expected deviation below target income. The models are solved by varying λ from zero to a large number. When λ is sufficiently large, the optimal solution results in a linear programming solution. However, when λ is equal to zero, no negative income deviations are allowed in any time period.

Risk Analysis Results for Conventional 9 Acres of Land

Assuming a conventional 9 acre farm and using block labor at the rate of $10 per hour, the chosen target income is $8,200 dollars. Different farm plans were obtained by using the Target MOTAD model changing the parameter λ which controlled the expected deviation below target income. The λ values that were chosen are 0, 25, 50, 100 and 2,000. The expected incomes for these λ values are $8296, $8420, $8492, $8635 and $9597 dollars. When the expected λ value is equal to 2,000 it generates a solution which is equivalent to a linear programming solution. The variation between higher and lower income has decreased with the decrease in λ and the change in expected income is basically due to changes in acreage between tomato and bell pepper which can be seen in table 13.

Whereas, assuming exactly the same farm scenario but using hourly labor at the rate of $10 per hour, the chosen target income is $11,800. Also in this case, different farm plans were obtained using target MOTAD model changing the parameter λ. The λ values in this case are also 0, 25, 50, 100 and 2,000. The expected incomes for these λ values are $12,786, $13,532, $14,264, $14,367 and $14,367. The expected value for λ equal to 100 and beyond is equivalent to a linear programming solution in this case. The variation between higher and lower income has decreased with the decrease in λ. The change in expected income is basically due to changes in acreage between determinate southern pea and watermelon. These results are presented in table 14.

Table 13 Risk Analysis For Conventional 9 Acres of Land Using Block Labor for $10 an Hour

Target Income	Average deviation	Expected Income	High Income	Low Income	Tomato	SP-Det	Sweet Corn	Bell pepper
$8,200	0	$8,296	$8,646	$8,200	2.29	3.00	3.00	0.71
$8,200	25	$8,420	$8,936	$8,125	2.28	3.00	3.00	0.72
$8,200	50	$8,492	$9,226	$8,050	2.26	3.00	3.00	0.74
$8,200	100	$8,635	$9,805	$7,900	2.23	3.00	3.00	0.77
$8,200	2,000	$9,597	$13,312	$6,842	2.00	3.00	3.00	1.00

Table 14 Risk Analysis for Conventional 9 Acres of Land Using Hourly Labor for $10 an Hour

Target Income	Average deviation	Expected Income	High Income	Low Income	Tomato	SP-Det	Sweet Corn	Watermelon	SP-Indet
$11,800	0	$12,786	$14,759	$11,800	3.00	2.83	3.00	0.17	0.00
$11,800	25	$13,532	$17,070	$11,725	3.00	2.86	3.00	0.14	0.00
$11,800	50	$14,264	$19,343	$11,650	3.00	2.89	3.00	0.05	0.06
$11,800	100	$14,367	$19,455	$11,629	3.00	3.00	3.00	0.00	0.00
$11,800	2,000	$14,367	$19,455	$11,629	3.00	3.00	3.00	0.00	0.00

Risk Analysis Results for Organic 9 Acres of Land

Assuming an organic 9 acre farm, and using hourly labor at the rate of $10 per hour the chosen target income is $3,500. Different farm plans were obtained using the target MOTAD model and changing the parameter λ which controlled the expected deviation below target income. The λ values chosen for the organic system are 0, 25, 50, 100 and 2,000 which are same as that for conventional system. The expected incomes for these λ values are $8235, $ 8303, $ 8320, $ 8353 and $ 8518. When the expected value of λ is equal to 2000 the solution is equivalent to a linear programming solution in this case.

The variation between higher and lower income has decreased slightly with the decrease in λ but there is no major difference as in the conventional system. This may be due to the fact that organic system is labor intensive, the farm income could not pay the cost involved when all the available land resource was used. Thus, in most cases some of the land was left idle. The higher variability between higher and lower incomes can also be explained by a very low income in one of the years in the organic system. The existing variation in expected income is basically due to changes in acreage between determinate southern pea, watermelon and idle land. We can see significant changes in the acreage of idle land with the change in λ values. These results are presented in table 15.

Whereas, assuming exactly the same scenario but using four months block labor at the rate of $10 per hour the chosen target income is $900. Different farm plans were developed using the Target MOTAD model and changing the parameter λ which controlled the expected deviation below target income. The λ values chosen are also 0, 25, 50, 100 and 2,000. The expected incomes for these λ values are \$2,539, \$ 2,700, \$ 2,861, \$ 3,162 and \$ 3,928 dollars.

When λ is set equal to 2,000 the expected value is equivalent to a linear programming solution. Likewise, in this case the variation between higher and lower income has decreased slightly with the decrease in λ, but there is no major difference as in the conventional system. This may be due to the fact that organic system is labor intensive, the farm income could not pay the cost involved when all the land resource was used. Thus, in most cases some of the land was left idle. In this case acres for idle land are lower than that for the models ran with block labor. It is one of the reasons for lower expected income as compared to results from model with hourly labor.

The higher variability between higher and lower incomes can also be explained by very low returns in one of the years in the organic system. The existing variation in expected income is essentially due to changes in acreage among bell pepper, cucumber and idle land. We can see significant changes in the acreage of idle land with the change in λ values. These results can be seen in table 16.

The above solutions in all four cases are second-degree stochastic efficient as proved by Tauer. In each table 13, 14, 15, and 16, five different farm plans can be seen. Some farm plans have higher incomes, but higher variability between lower and higher incomes- whereas other farm plans have lower incomes and lower variability between lower and higher incomes. It is up to the farmers to choose the farm plan. The perception of the level of risk associated with an outcome differs among decision makers. Furthermore, different farmers may have different attitudes towards risk and therefore risk impacts can’t be assessed without accounting for the attitude of the decision maker.

But one important thing to be considered in decision making is the variability between lower and higher incomes. The higher the variability, more risky is a farm plan.

Table 15 Risk Analysis for Organic 9 Acres of Land Using Hourly Labor for $10 an Hour

Target Income	Average deviation	Expected Income	High Income	Low Income	Tomato	SP-Det	Watermelon	Idle Land
$3,500	0	$8,235	$12,494	$3,500	3.00	2.88	0	3.12
$3,500	25	$8,303	$12,536	$3,425	3.00	3.00	0.10	2.90
$3,500	50	$8,320	$12,537	$3,350	3.00	3.00	0.33	2.67
$3,500	100	$8,353	$12,540	$3,200	3.00	3.00	0.78	2.22
$3,500	2,000	$8,518	$12,552	$2,462	3.00	3.00	3.00	0.00

Table 16 Risk Analysis for Organic 9 Acres of Land Using Block Labor for $10 an Hour

Target Income	Average deviation	Expected Income	High Income	Low Income	Tomato	SP-Det	Bell Pepper	Cucumber	Idle land
$900	0	$2,539	$5,818	$900	2.19	3.00	0.81	1.28	1.72
$900	25	$2,700	$6,376	$825	2.16	3.00	0.84	1.29	1.71
$900	50	$2,861	$6,934	$750	2.13	3.00	0.87	1.31	1.69
$900	100	$3,162	$6,997	$600	2.08	3.00	0.92	1.34	1.66
$900	2,000	$3,928	$6,133	$209	1.93	3.00	1.07	1.43	1.57

Required Price Premium to Grow Organic Vegetables

The results for objectives two and three are based upon using the same price for both organic and conventional products. To determine the price premium necessary for the organic products to breakeven with conventional production many simple programming models were simulated for all the scenarios developed for organic system. The results can be seen in table 17. The break even price premium ranges between 15% to 19%.

Table 17 Break Even Price Premium in Organic System to Obtain Same Level of Optimal Solution as in Conventional.

	Hourly labor				Block Labor			
	$10 /Hr		$15/Hr		$10 /Hr		$15/Hr	
	Income	Price Premium	Income	Price Premium	Income	Price Premium	Income	Price Premium
6 Acres	9,816.90	15%	7,324.90	17%	7,310.54	17%	4,546.54	17%
9 Acres	14,725.35	15%	10,987.34	17%	9,618.99	19%	6,103.37	19%
15 Acres	24,542.25	15%	18,312.24	17%	17,300.43	18%	10,172.03	18%

CHAPTER VI

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary and Conclusions

Southeastern Oklahoma has small crop acreages suitable for fresh vegetable production due to its fertile soil and availability of water in an adequate quantity and quality for vegetable production. The vegetable industry can increase farm incomes by intensifying existing enterprises, adding enterprises, reducing cost or by changing the production system from conventional to organic. Conversion from conventional to organic may take some years, but some of the organic yield data obtained from WWAREC, Lane Oklahoma has shown that organic systems may produce higher as compared to conventional systems in the long term. This study compares the profitability and risk related to conventional and organic vegetable production systems.

For this study seven different vegetable types were selected, namely determinate and indeterminate southern pea, tomato, sweet corn, watermelon, pickling cucumber and bell pepper. Enterprise budgets were prepared for each of these seven vegetables for both organic and conventional systems for three years 2004, 2005 and 2006. Input requirements were determined based upon production data from Wes Watkins Agriculture Research and Extension Center (WWAREC) and with the help of enterprise budgets prepared by different universities; including University of Alabama at Malta, Mississippi State University, Florida State University, Penn State University, University of Arkansas and University of Missouri at Columbia. Inputs from scientists, technicians, extension specialists from WWAREC and Oklahoma State University were also used. Output prices were determined from the Dallas terminal market. The selected crops represent the crops that are adaptable to the climatic and soil conditions of Southeastern Oklahoma.

All of the selected vegetable budgets were incorporated into a programming model and an optimal farm mix was determined for both Organic and Conventional systems. Based upon the results, the mix of tomato, determinate southern peas and sweet corn is most profitable for the conventional system and the mix of tomato, determinate southern pea and watermelon is most profitable for the organic system. Block labor is more restrictive and less profitable compared to the hourly labor.

The simple programming model formed was modified to a target MOATD model for risk analysis. The risk analysis results show that higher variability existed in most of the cases in the organic production system as compared to the conventional production system. In some cases, in the organic system some acres of land were left idle due to higher production cost and higher risk involved; whereas, all the acres were used in all cases in conventional production system.

Some simple programming models were also simulated to determine the break even price premium in the organic system to get a similar optimum solution as in the conventional system. The break even price premium ranged between 15-19%. Currently the price premium for organic produce over the conventional ones still exists in most of the markets where consumers are willing to pay higher prices for organic for various reasons. Therefore, in that case profitability of organic production method can be seen as the function of price premium.

For increased production of specialty crops, like organic vegetables, potential producers will need information on the latest production and management practices. Therefore, this study is an effort to produce information regarding commercial production of both organic and conventional vegetables and profits and risk related to both of them. This study is different and important in the sense that it has tried to analyze profitability and risk related to select vegetable crops in Southeastern Oklahoma and has provided recommendations regarding the most profitable vegetable crop mix in for that area of the state.

Recommendations

The objective of this study is to compare the profitability and risk related to organic versus conventional production systems. The study was accomplished with limited data for small farm size from Southeastern Oklahoma. Therefore, the results may not be applicable to other locations. The results may vary with a change in farm size. Thus, different variables exogenous to this study may need additional research.

This study is based on several assumptions that may vary largely depending upon farm size, available resources and weather conditions causing significant differences in actual results. This study does not address various irrigation technologies, different crop varieties, different planting dates, different harvesting dates etc. Those factors can have a high influence in the total revenue and profitability of an industry, however due to the unavailability of sufficient time series data this study is limited to three years of data, limiting consideration of those factors. Sensitivity analysis dealing with changes in yield and price variability related to different factors such as type of irrigation, varieties, planting date, harvesting date, change in input costs, fluctuating prices and change in production methods between organic or conventional production would yield useful information to producers in the future.

Besides information on production and management skills related to vegetables, marketing is an important factor to determine profitability and risk related to the vegetable industry. Effective marketing is a crucial factor for the sustainable vegetable industry. Further research should address marketing issues including potential markets for the desired crops. Harvesting and packaging are important marketing traits therefore some studies and analysis are needed in the future related to the interaction of farmer's groups producing vegetables and vegetable marketing cooperatives or packing plants.

Linear programming models can generate good results only if good data are used to develop the model. The budgets used for the model were developed with the best information available at Wes Watkins Agricultural Research and Extension Center and was verified by different experts and scientists. However; limitations may exist in the data because until more actual farm production research is done the best information may not become available and the expected requirement of the inputs may be different than the actual. The biggest limitation of this study is the unavailability of long-term time series data. And, the most important constraint for this study is the rotation constraint. The simple programming model and Target MOTAD model for risk programming were formed with three years of data, the results would have been more practical with more years of data.

Southeastern Oklahoma may not be considered a major vegetable producing area in the U.S. but there exists a big potential for production of some selected vegetable crops sufficient to feed the state of Oklahoma. There always exists an opportunity to develop markets in the established specialty crop states such as Texas, California and Florida. Studies have shown that the climatic and agronomic factors are good enough to support the production possibilities of some selected vegetable crops in Oklahoma. Depending upon the availability of adequate labor and sufficient irrigation capability, Southeastern Oklahoma can be a producer of high quality organic and conventional vegetables. In this context some farmers can slowly move from conventional to organic production systems in order to be growers of the organic produce consumed in the local cities of Tulsa and Oklahoma City and the bigger markets in Dallas and other major cities in the Midwest.

BIBLIOGRAPHY

Anderson, J.R., J.L. Dillon, and J.B. Hardaker.1977. *Agricultural Decision Analysis* Ames: The Iowa State University Press

Antle, J.M. 1983. "Incorporating Risk in Production Analysis." *American Journal of Agricultural Economics* 65: 5, 1099-1106.

Armah, P.W. 2002. "Setting Eco-label Standards in the Fresh Organic Vegetable Markets of Northeast Arkansas." *Journal of Food Distribution* Research 33(1): 35-45.

Asami, D., Y-J. Hong, D. Barrett, and A. Mitchell. 2003. "Comparison of the Total Phenolic and Ascorbic acid Content of Freeze-Dried and Air-Dried Marionberry, Strawberry, and Corn Grown Using Conventional, Organic, and Sustainable Agricultural Practices". *Journal of Agriculture and Food Chemistry* 51:1237-41.

Authur, Tom.1988. "Breaking into Vegetables." *American Vegetable Grower,* pp. 10-11

Babb, E. M., and B.F. Long.1987. "The Role of Alternative Agricultural Enterprises in Changing Agricultural Economy." *Southern Journal of Agricultural Economics,* 19.1:7-15

Binici,T., A.A. Koc, C.R. Zulauf, and A. Bayaner. 2003. "Risk Attitudes of Farmers in Terms of Risk Aversion: A Case Study of Lower Seyhan Plain Farmers in Adana Province, Turkey." *Truk Journal of Agric* 27: 305-312.

Bolin, P., and L. Brandenberger ed. "Cucurbit Integrated Crop Management." Oklahoma Cooperative Extension Service E-853, Oklahoma State University.

Bourn, D., and J. Prescott. 2002. "A comparison of nutritional value, sensory qualities, and food safety of organically and conventionally produced foods". *Crit Rev Food Science*: 42: 1-34.

Brandenberger, L., and L. Wells. 2006. "2005 Vegetable Trial Report". Department of Horticulture and Landscape Architecture Division of Agricultural Sciences and Natural Resources, Oklahoma State University.

Brandenberger, L., and L. Wells. 2007. "2006 Vegetable Trial Report". Department of Horticulture and Landscape Architecture Division of Agricultural Sciences and Natural Resources, Oklahoma State University.

Brandt, K., and J. P. Molgaard .2001. "Organic Agriculture: Does It Enhance or Reduce the Nutritional Value of Plant Foods?" *Journal of the Science of Food and Agriculture* 81:924-31.

Burros, M. 2002. "Study Finds Far Less Pesticide Residue on Organic Produce." *New York Times,* May 8.

Burton, M.D., D.Rigby, and T.Young. 2003. "Modelling the Adoption of Organic Horticultural Technology in the UK Using Duration Analysis." *Australian Journal of Agricultural and Resource Economics* 47(1):29-54.

Byrum, A. 2003. "Organically Grown Foods Higher in Cancer-Fighting Chemicals than Conventionally Grown foods." *American Chemical Society public release,* March.

Campbell, H. and R. Liepins. 2001. "Naming organics: Understanding organic standards in New Zealand as a discursive field." *Sociologia Ruralis* 41(1):21-39.

CAPRI. 2002. "Common Agricultural Policy Regional Impact Analysis." Institute for Food and Resource Economics. http://www.agp.uni-bonn.de/agpo/rsrch/capri/capri_e.htm

Casey, J. E., R., Jobes, and O. Walker. 1977. "Enterprise Budgets A Farm Planning Tool." Stillwater, Oklahoma State University, Agriculture Economics Paper 7707, July

Connor, D., and R. Christy. 2002. "Consumer preferences for Organic Standards: Guiding Demand- Expansion Strategies for Organic Food." *Journal of Food Distribution Research*, 46-51.

Connor, D., and R. Christy. 2004. "The Organic Label: How to Reconcile its meaning with Consumer Preferences." *Journal of Food Distribution Research* 35:40-43.

Curl, C. L., R.A., Fenske, and K.Elgethun. 2003. "Orgonophosphorus Pesticide Exposure of Urban and Suburban Preschool Children with Organic and Conventional Diets." *Environmental Health Perspectives* 111(3):377-82.

Darby, M., and E. Karni. 1973. "Free Competition and the Optimal Amount of Fraud." *Journal of Law and Economics* 16(1):67-88.

Devkota, S. 2006. "Economically Feasible Crop Production Alternatives to Peanuts in Southwestern Oklahoma." MS thesis, Oklahoma State University.

Dimitri, C., and C. Greene. 2002. "Recent Growth Patterns in the U.S. Organic Foods Market." Economic Research Service, U.S Department of Agriculture AIB-777:1-21.

Dimitri, C., and N. J. Richman. 2002. "Organic Food Markets in Transition. Henry A. Wallace Centre for Agricultural and Environmental Policy." *Policy Studies report* 14. Greenbelt MD: Winrock International.

Doye, D., R. Sahs, and D. Kletke. 2003-2004 "Oklahoma Farm and Ranch Custom Rates." Oklahoma Cooperative Extension Service, CR-205.

Doye, D., R. Sahs, and D. Kletke. 2005-2006. "Oklahoma Farm and Ranch Custom Rates." Oklahoma Cooperative Extension Service, CR-205.

Doye, D., R. Sahs, D. Kletke, and M. Hardin. 2004. "OSU Enterprise Budget Software Advanced User's Guide." Oklahoma Cooperative Extension Service, Oklahoma State University.

Duram, L.A. 2005. *Good Growing: Why Organic Farming Works,* vol.17.University of Nebraska Press, Lincoln and London.

El-Beheisi, Y.1991. The Economic Potential of Expanding Oklahoma's Fresh Fruit and Vegetable Industry. Ph.D. Thesis, Oklahoma State University.

Fields,D., M. Runge, J. Diehl, J. Kemble and E. Sikora. 2005. "Vegetable Planning Budgets Alabama." Department of Agricultural Economics and Rural Sociology, Auburn University, AEC-BUD 2-2, January.

Firth, Chris. 2002. "Organic Vegetable Update." HDRA/Soil Association Project Report.

Foster, C. and N. Lampkin.1999. *European Organic Production Statistics, 1993-1996. Organic Farming in Europe: Economics and Policy*. Vol 3. Stuttgart; University of Hohenheim.

Gaskell, M., B. Fouche, S. Koike, T. Lanini, J. Mitchell, and R. Smith. 2000. "Organic Vegetable production in California-Science and Practice." *Hort Technology* 10(4):699-713.

Gil, J.M., A. Gracia, and M. Sanchez. 2002. "Market Segmentation and Willingness to Pay for Organic Products in Spain." *International Food and Agribusiness Management Review* 3:207-226.

Goldberg, A. 2002. Consumers Union Research Team Shows: Organic Foods Really Do Have Less Pesticide. May 8.

Greene, C and T. Dobbs. 2001. *Organic Wheat Production in the United States: Expanding Markets and Supplies*. Economic Research Service. U.S. Department of Agriculture.

Greene, C., and A. Kremen. 2003.*U.S. Organic farming in 2000-2002: Adoption of Certified Systems*. U.S. Department of Agriculture, Economic Research Service, Agriculture Information Bulletin no. 780.

Greene, C. 2001.U.S. *Organic Farming Emerges in the 1990s: Adoption of Certified Systems.* USDA, Economic Research Service, Resource Economics Division. Agriculture Information Bulletin no.770.

Grinder-Pedersen, L., S. Rasmussen, S. Bugel, .Jorgensen, L.Dragsted, V.Gundersen, and B. Sandstorm. 2003. "Effect of Diets Based on Foods from Conventional versus Organic Production on Intake and Excretion of Flavonoids and Markers of Defense in Humans." *Journal of agricultural and Food Chemistry* 51(19):5671-76.

Hadar, J., and W.R. Russell.1969. "Rules for Ordering Uncertain Prospects." *American Economic Review* 59: 25-34.

Hadar, J., and W.R. Russell.1969. "Rules for Ordering Unvertain Prospects." *American Economic Review* 59: 25-34.

Hardaker J. B. and G. Lien. 2003. "Stochastic Efficiency Analysis with Risk Aversion Bounds: A Simplified Approach." University of New England, Graduate School of Agricultural and Resource Economics, Working Paper Series No. 2003-1.

Hardaker, J.B. 2000. "Some Issues in Dealing with Risk in Agriculture." Working Paper Series No. 2000-3 in Agricultural and Resource Economics, University of New England.

Hardaker, J.B., J.W. Richardson, G. Lien, and K.D. Schumann. 2004. "Stochastic Efficiency Analysis with Risk Aversion Bounds: A Simplified Approach." *The Australian Journal of Agricultural and Resource Economics* 48:253-270.

Hazell, P. B. R., and R. D. Norton.1986. *Mathematical Programming for Economical Analysis in Agriculture.* New York: MacMillan Publishing Co. pp.101-102.

Heaton, S.2001. Organic Farming, Food Quality, and Human Health Report. Briefing Sheet. UK Soil Association.

Henneberry, S.R and W. Armbruster.2003. "Emerging Roles for Food Labels: Inform, Protect, Persuade." *Journal of Food Distribution Research* XXXIV, No 3, pp 62-69.

Henneberry, S.R. and C. Barron, 1990. “Problem Identification of the Oklahoma Produce Industry: The Marketing Challenge.” Research Bulletin B-790. Oklahoma Agricultural Experiment Station, October.

Hogh-Jensen, H. 1998. “Systems Theory as a Scientific Approach towards Organic Farming.” *Biological agriculture and Horticulture* 16(1):37-52. International Trade Centre.1999. “Organic Food and Beverages: World Supply and Major European Markets.” Geneva: International Trade Centre/ UNCTAD/WTO.

J.K. Hammitt. 1986. “Estimating Consumer Willingness to Pay to Reduce Food-Borne Risk”. Santa Monica, the RAND Corporation.

James, S.C., and P.R. Eberle. 2000. “Economics and Business Principles in Farm Planning and Production” Iowa State University Press/Ames.

Jobes, R.A. 1984. “Use of Budgets in Farm Management.” Stillwater, Oklahoma State University Cooperative Extension Service. OSU Extension Facts Sheet No. 139, April. pp 139.2

Jolly D. A, Schutz H. G., Diaz-Knauf K. V. and Johal J. 1989. Organic foods: consumers attitudes and use, Food Technology 43:60-66.

Kizer, M. 2007. “Personal Communication.” Extension Irrigation Specialist, Department of Biosystems and Agricultural Engineering, Oklahoma State University.

Klonsky, K. 2000. “Forces Impacting the Production of Organic Foods.” *Agriculture and Human Values* 17(3):233-43.

Klonsky, K., and C.Greene. 2005. “Widespread Adoption of Organic Agriculture in the US: Are Market Driven Policies Enough?” Paper Presented at AAEA Annual Meeting, Providence, Rhode Island, 24-27 July.

Kuchler, F., R. Chandran, and K. Ralston.1996. “The Linkage between Pesticide Use and Pesticide Residues.” *American Journal of Alternative Agriculture* 11(4):161-67.

Kumbhakar, S.C. 2002. “Risk Preferences and Technology: a Joint Analysis”. *Marine Resource Economics,* 17:77-89.

Kuoba, Maryline. 2003. “Quality of Organic Animal Products.” *Livestock Production Science* 80:33-40.

Lampkin, N., and S. Padel, eds.1999. *The Economics of Organic farming: an International Perspective.*Wallingford: CAB International.

Lampkin, N.1992. *Organic Farming*. Ipswich: Farming Press.

Leon, W., and C. S. DeWaal. 2002. *Is Our Food Safe? A Consumer's Guide to Protecting Your Health and Environment.* New York: Three River Press.

Lohr, L., and B.Krissoff.2001. "Consumer Effects of Harmonizing International Standards for Trade in Organic Foods." Department of Agriculture and Applied Economics, University of Georgia.

Lohr, L.1999. "Welfare Effects of Eco-Label Proliferation: Too Much of a Good Thing?" Paper presented at the FAMC conference on New Approaches to Consumer Welfare, Alexandria, VA.

Lucier, G., S. Pollack, M. Ali, and A. Perez. 2006. U.S. Department of Agriculture, Economic Research Service, April. http://www.ers.usda.gov/publications/VGS/apr06/vgs31301/vgs31301.pdf

Lundegardh,B., and A. Martensson .2003."Organically Produced Plant Foods: Evidence of Health Benefits." *Acta agriculture Scandinavica, Section B: Soil and Plant sciences* 53(1): 3-15.

Makatouni, A.2002. "What motives consumers to buy organic food in the UK? Results from a quantitative study." *Br Food Journal* 104:345-352.

Markle, S. 1997. "Consumer Demand Growing for Organic, Local Foods." *Community Nutrition Institute Newsletter*, 4-6 February.

Markowitz, H.M.1959. *Portfolio Selection; Efficient Diversification of Investments*, New York, Wiley.

McCamley,F. and R.K.Rudel.-1999. "Target MOTAD for Risk Lovers" Paper presented at Western Agricultural Economics Association Meeting, Fargo,ND,11-14 July

McCarl, B.A. "Preference among Risky Prospects under Constant Risk Aversion." *Southern Journal of Agricultural Economics* 20 (1988): 25-33.

McCluskey, J.J. 2000. "A Game Theoretic Approach to Organic Foods: An Analysis of Asymmetric Information and Policy." *Agricultural and Resource Economics Review* 29(1):1-9.

McEnery, Mary Anne.1996. "Organic Farming Takes Root." *The Record*, 3 April.

Michelsen, J. (2001). "Organic farming in a regulatory perspective. The Danish case." *Sociologia Ruralis* 41(1):62-83.

Musser, W.N., Wetzstein, M.E., Reece, S.Y., Musser, L.M., Varca, P.E., and Chou, C.C.J.1984. "Classification of Risk Preferences with Elicited Utility Data: Does the Functional Form Matter?" *Western Journal of Agricultural Economics* 9 :322-328.

National Agricultural Statistics Service, United States Department of Agriculture.

Natural Foods Merchandiser, various issues.

Nutrition Business Journal (NBJ), 2004. "The NBJ/SPINS Organic Foods Report 2004, Penton Media,Inc.

Oberholtzer L., C. Dimitri, and C. Greene.2005. " Price Premiums Hold on as U.S. Organic Produce market Expands.", U.S. Department of Agriculture, Economic Research Service (USDA,ERS). Outlook Report No. (VGS30801) 22p www.ers.usda.gov/Publications/vgs/may05/VGS30801/

Organic Trade association (OTA).2004. "The OTA 2004 Manufacturer Survey Overview, with input from the *Nutrition Business Journal* .

Organic Trade Association. 2004. *Organic Trade Association's Manufacture Survey*. OTA, Maine, May.

Qiu, Z., T. Prato, and F. McCamley. 2001. "Evaluating Environmental Risks Using Safety-First Constraints" *Americal Journal of Agricultural Economics* 83(2):402-413.

Ramaswami, B. 1992. "Production Risk and Optimal Input Decisions" *American Journal of Agricultural Economics*, Vol. 74, No. 4. pp. 860-869.

Rathwell, P. James. 1987. "Evaluation Criteria for Alternative Enterprises." Proceeding of Alternative Farming Opportunities for the South, Starkville, Mississippi. January

Richardson, J.W., K. Schumann, and P. Feldman. 2005. "Simulation for Applied Risk Management with an Introduction to the Software Package SIMETAR: Simulation for Excel to Analyze Risk." Department of Agricultural Economics, Texas A&M University, January 2001.

Rigby. D, T. Young, and M. Burton. 2001. "The Development of and Prospects for Organic Farming in the UK." *Food Policy* 26(6):599-613.

Rosetto, L. 2002. "Marketing Strategies for Organic Wine Growers in the Veneto Region." Prepared for the 8th Joint Conference on Food, Agriculture and the Environment, Red Cedar Lake, Wisconsin, 25-28 August.

Russo, V.M., and M.Taylor .2006. "Soil Amendments in Transition to Organic Vegetable Production with Comparison to Conventional Methods: Yields and Economics." *HortScience* 41(7):1576-1583.

Schatzer, R.J., M.Wickwire, and D. Tilley.1986. "Supplemental Vegetable Enterprise for Cow-Calf and Grain Farmers in Southeastern Oklahoma.'' Res. Re. No. T-874, Agr.Exp.Sta, Department of Agriculture Economics, Oklahoma State University.

Sok, E., and L. Glaser. 2001. "Tracking Wholesale Prices for Organic Produce," *Agricultural Outlook,* U.S. Department of Agriculture, Economic Research Service, October, available at www.ers.usda.gov/publications/agoutlook/oct2001/ao285d.pdf

Sylvander, B. and A. Le Floc'h Wadel. 2000. "Consumer Demand and Production of Organics in the EU." *AgBio Forum* 3(2-3):97-106.

Tauer, Loren W. 1983. " Target MOTAD." *American Journal of Agricultural Economics* 65 :606-610.

Taylor, M.J. 2003.Oklahoma Agricultural Experiment Station Oklahoma State University, Hatch Project Proposal.

Taylor, M. J., J. R.C. Robinson.2004. "Risk Management for Investment in Vegetables", Proceedings of Oklahoma-Arkansas Horticulture Industry Show, Tulsa, OK., January.

Taylor, M.J.2006. "Personal Communication". Professor and Director, Wes Watkins Research and Extension Centre, Lane, OK.

Taylor, M.J., W. Roberts, J.Edelson, V. Russo, S. Pair, A. Davis, C. Webber.2006. "Economic Evaluation of a Four (4) Crop Organic Vegetable Rotation", Proceedings of the Bi-State Horticulture Industry Show, Tulsa, OK. January.

Tilley, D. S., C. Falk, and R. J. Schatzer.1986. Wholesalers' Interest in Oklahoma Produce. *Current Farm Economics*, Vol. 59, No. 2,pp. 17-25.

U. S. Department of Agriculture, Economic Research Service (USDA, ERS). 2002. Briefing Room-Organic Farming and Marketing: Questions and answers, June. www.usda.gov/nass

U.S. Department of Agriculture, 2004. "Wholesale Market Prices at Dallas Texas." Washington, Agriculture Marketing Board. Federal-State Market News Service.

U.S. Department of Agriculture, 2005. "Wholesale Market Prices at Dallas Texas." Washington, Agriculture Marketing Board. Federal-State Market News Service.

U.S. Department of Agriculture, 2006. "Wholesale Market Prices at Dallas Texas." Washington, Agriculture Marketing Board. Federal-State Market News Service.

U.S. Department of Agriculture, Economic Research Service (USDA, ERS). 2003. Agricultural Resource Management Survey.

U.S. Department of Agriculture, Economic Research Service (USDA, ERS). 2005. U.S. Market Profile for Organic Food Products, February. Washington DC.

U.S. Department of Agriculture, Economic research Service (USDA, ERS). 2006, "Farm Income Data Files: Cash Receipts." Farm Income and Costs Briefing Room. www.ers.usda.gov/briefing/farmincome

U.S. Department of Agriculture, Economic Research Service (USDA, ERS). 2007. www.ers.usda.gov/publications/vgs/VGSTables.htm

U.S. Department of Agriculture, Economic Research Service (USDA, ERS). 2006. "U.S. Certified Farm Acreage 1992-2005".

Wathen, B.L., M.J. Taylor, J.V. Edelson, B.W. Roberts, R.B. Holcomb. 2005. "Melon marketing and Price Volatility: Applied Study of the Southern Oklahoma Region." Manuscript for Publication in the Journal of Agricultural and Applied Economics, February.

Wickwire, M.C., 1981. "Supplemental Vegetable Crop Mixes for a Cow-Calf and Grain Producer in Bryan and Atoka Counties in Oklahoma." MS thesis, Oklahoma State University.

World Health Organization (WHO). 2003. "Fruit, Vegetables and NCD Disease Prevention" www.who.int/dietphysicalactivity/media/en/gsfs_fv.pdf

Yassour, J., D. Zilberman, and G.C. Rausser.1981. "Optimal Choices among Alternative Technologies with Stochastic Yield." *American Journal of Agricultural Economics*, 63: 718-723.

Zuhair, S.M.M., D.B. Taylor, and R.A. Kramer.1992. "Choice of Utility Function Form: It's Effect on Classification of Risk Preferences and the Prediction of Farmer decisions." *Agricultural Economics* 6: 333-344.

APPENDIX A

Organic Budgets

Table 18 Organic Bell Pepper Budget, 2004

Production	Units	Price	Quantity	Total ($/Acre)
Organic Bell Pepper 2004	28 Lb box	11.03	310	$3,419.30
Total Revenue				$3,419.30
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Transplants	Plants	0.1	6000	$600.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides		0	0	0.00
Disease Control		0	0	0.00
Cultivation	Application	10	2.5	25.00
Growing Season Labor				
Transplanting	Hours	10	12	120.00
Hand Hoeing	Hours	10	14	140.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	0	0	0.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$1,309.00
Harvesting Costs				
Harvesting labor	28 Lb box	0.42	310	$130.20
Grade and Packaging Cost	28 Lb box	2	310	620.00
Total Harvesting, Grading and Packaging Costs	28 Lb box			$750.20
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$2,402.20
Revenue Above Costs	Acre			$1,017.10
Break-Even Price	Per Box			$7.75

Table 19 Organic Bell Pepper Budget, 2005

Production	Units	Price	Quantity	Total ($/Acre)
Organic Bell Pepper 2005	28 Lb box	11.2	153	$1,713.60
Total Revenue				$1,713.60
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Transplants	Plants	0.1	6000	$600.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides		0	0	0.00
Disease Control		0	0	0.00
Cultivation	Application	10	2.5	25.00
Growing Season Labor				
Transplanting	Hours	10	12	120.00
Hand Hoeing	Hours	10	14	140.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	0	0	0.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$1,309.00
Harvesting Costs				
Harvesting labor	28 Lb box	0.42	153	$64.26
Grade and Packaging Cost	28 Lb box	2	153	306.00
Total Harvesting, Grading and Packaging Costs	28 Lb box			$370.26
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$2,022.26
Revenue Above Costs	Acre			-$308.66
Break-Even Price	Per Box			$13.22

Table 20 Organic Bell Pepper Budget, 2006

Production	Units	Price	Quantity	Total ($/Acre)
Organic Bell Pepper 2006	28 Lb box	11.9	245	$2,915.50
Total Revenue				$2,915.50
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Transplants	Plants	0.1	6000	$600.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides		0	0	0.00
Disease Control		0	0	0.00
Cultivation	Application	10	2.5	25.00
Growing Season Labor				
Transplanting	Hours	12	10	120.00
Hand Hoeing	Hours	10	14	140.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	0	0	0.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$1,309.00
Harvesting Costs				
Harvesting labor	28 Lb box	0.42	245	$102.90
Grade and Packaging Cost	28 Lb box	2	245	490.00
Total Harvesting, Grading and Packaging Costs	28 Lb box			$592.90
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$2,244.90
Revenue Above Costs	Acre			$670.60
Break-Even Price	Acre			$9.16

Table 21 Organic Pickling Cucumber Budget, 2004

Production	Units	Price	Quantity	Total ($/Acre)
Organic Cucumber-2004	55 lb box	$14.00	109	$1,526.00
Total Revenue				$1,526.00
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Seed	Lbs	25	2.5	$62.50
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	0	0	0.00
Disease Control	Application	0	0	0.00
Cultivation	Application	10	2.5	25.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	14	140.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	0	0	0.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$671.50
Harvesting Costs				
Harvesting labor	55 Lb box	0.42	109	$45.78
Grading, Packaging and Marketing Cost	55 Lb box	4	109	436.00
Total Harvesting, Grading and Packaging Costs	55 Lb box			$481.78
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,496.28
Revenue Above Costs	Acre			$29.72
Break-Even Price	55 Lb Box			$13.73

Table 22 Organic Pickling Cucumber Budget, 2005

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Cucumber-2005	55 lb box	$16.45	113	$1,858.85
Total Revenue				$1,858.85
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Seed	Lbs	25	2.5	$62.50
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	0	0	0.00
Disease Control	Application	0	0	0.00
Cultivation	Application	10	2.5	25.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	14	140.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	0	0	0.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$671.50
Harvesting Costs				
Harvesting labor	55 Lb box	0.42	113	$47.46
Grading, Packaging and Marketing Cost	55 Lb box	4	113	452.00
Total Harvesting, Grading and Packaging Costs	55 Lb box			$499.46
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,513.96
Revenue Above Costs	Acre			$344.89
Break-Even Price	55 Lb Box			$13.40

Table 23 Organic Pickling Cucumber Budget, 2006

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Cucumber-2006	55 lb box	$12.60	144	$1,814.40
Total Revenue				$1,814.40
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Seed	Lbs	25	2.5	$62.50
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	0	0	0.00
Disease Control	Application	0	0	0.00
Cultivation	Application	10	2.5	25.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	14	140.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	0	0	0.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$671.50
Harvesting Costs				
Harvesting labor	55 Lb box	0.42	144	$60.48
Grading, Packaging and Marketing Cost	55 Lb box	4	144	576.00
Total Harvesting, Grading and Packaging Costs	55 Lb box			$636.48
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,650.98
Revenue Above Costs	Acre			$163.42
Break-Even Price	55 Lb Box			$11.47

Table 24 Organic Determinate Southern Pea Budget, 2004

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Southern Pea 2004(Determinate)	Pound	$1.96	926	$1,814.96
Total Revenue				$1,814.96
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Seed	Lbs	5.7	37.5	$213.75
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	0	0	0.00
Disease Control	Application	0	0	0.00
Cultivation	Application	10	3	30.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	12	120.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	0	0	0.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$807.75
Harvesting Costs				
Harvesting	Lbs	0.60	926	$555.60
Grade and Packaging Cost	Lbs	0.25	926	231.50
Total Harvesting, Grading and Packaging Costs				$787.10
Post Harvest Clean-Up Costs	Acre	100	1	$100.00
Total Costs	Acre			$1,937.85
Revenue Above Costs	Acre			-$122.89
Break-Even Price	Lb			$2.09

Table 25 Organic Determinate Southern Pea Budget, 2005

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Southern Pea 2005(Determinate)	Pound	$1.89	1873	$3,539.97
Total Revenue				$3,539.97
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Seed	Lbs	5.7	37.5	$213.75
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	0	0	0.00
Disease Control	Application	0	0	0.00
Cultivation	Application	10	3	30.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	12	120.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	0	0	0.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$807.75
Harvesting Costs				
Harvesting	Lbs	0.60	1873	$1,123.80
Grade and Packaging Cost	Lbs	0.25	1873	468.25
Total Harvesting, Grading and Packaging Costs				$1,592.05
Post Harvest Clean-Up Costs	Acre	100	1	$100.00
Total Costs	Acre			$2,742.80
Revenue Above Costs	Acre			$797.17
Break-Even Price	Lb			$1.46

Table 26 Organic Determinate Southern Pea Budget, 2006

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Southern Peas 2006(Determinate)	Lbs	$2.10	2625	$5,512.50
Total Revenue				$5,512.50
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Seed	Lbs	5.7	37.5	$213.75
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	0	0	0.00
Disease Control	Application	0	0	0.00
Cultivation	Application	10	3	30.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	12	120.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	0	0	0.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$807.75
Harvesting Costs				
Harvesting	Lbs	0.60	2625	$1,575.00
Grade and Packaging Cost	Lbs	0.25	2625	656.25
Total Harvesting, Grading and Packaging Costs				$2,231.25
Post Harvest Clean-Up Costs	Acre	100	1	$100.00
Total Costs	Acre			$3,382.00
Revenue Above Costs	Acre			$2,130.50
Break-Even Price	Lb			$1.29

Table 27 Organic Indeterminate Southern Pea Budget, 2004

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Southern Peas 2004 (Indeterminate)	Pound	1.96	968.00	$1,897.28
Total Revenue				$1,897.28
Over Winter Cost	Application	25.00	1.00	$25.00
Pre-Planting Costs				
Disk	Application	10.00	2.00	$20.00
Bed	Application	4.00	1.00	4.00
Final Seed Bed Preparation	Application	4.00	1.00	4.00
Poultry Litter	Tons	40.00	4.00	160.00
Pre-Planting Labor	Hours	10.00	3.00	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Seed	Lbs	5.70	37.50	$213.75
Drip Irrigation Tape	Feet	0.03	6,400.00	160.00
Irrigation	Inches	12.00	7.00	84.00
Organic Chemicals				
Insecticides	Application	0.00	0.00	0.00
Disease Control	Application	0.00	0.00	0.00
Cultivation	Application	10.00	3.00	30.00
Growing Season Labor				
Seeding	Hours	10.00	2.00	20.00
Hand Hoeing	Hours	10.00	12.00	120.00
Irrigation Set-Up Labor	Hours	10.00	2.00	20.00
Irrigation Labor	Hours	10.00	6.00	60.00
Organic Chemical application	Hours	0.00	0.00	0.00
Land Charge	Acre	100.00	1.00	100.00
Total Growing Season Costs				$807.75
Harvesting Costs				
Harvesting	Lb	0.65	968.00	$629.20
Grade and Packaging Cost	Lb	0.25	968.00	242.00
Total Harvesting, Grading and Packaging Costs				$871.20
Post Harvest Clean-Up Costs	Acre	100.00	1.00	$100.00
Total Costs	Acre			$2,021.95
Revenue Above Costs	Acre			-$124.67
Break-Even Price	Lb			$2.09

Table 28 Organic Indeterminate Southern Pea Budget, 2005

Production	Units	Price	Quantity	Total ($/Acre)
Organic Southern Peas 2005 (Indeterminate)	Pound	1.89	1,102.00	$2,082.78
Total Revenue				$2,082.78
Over Winter Cost	Application	25.00	1.00	$25.00
Pre-Planting Costs				
Disk	Application	10.00	2.00	$20.00
Bed	Application	4.00	1.00	4.00
Final Seed Bed Preparation	Application	4.00	1.00	4.00
Poultry Litter	Tons	40.00	4.00	160.00
Pre-Planting Labor	Hours	10.00	3.00	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Seed	Lbs	5.70	37.50	$213.75
Drip Irrigation Tape	Feet	0.03	6,400.00	160.00
Irrigation	Inches	12.00	7.00	84.00
Organic Chemicals				
Insecticides	Application	0.00	0.00	0.00
Disease Control	Application	0.00	0.00	0.00
Cultivation	Application	10.00	3.00	30.00
Growing Season Labor				
Seeding	Hours	10.00	2.00	20.00
Hand Hoeing	Hours	10.00	12.00	120.00
Irrigation Set-Up Labor	Hours	10.00	2.00	20.00
Irrigation Labor	Hours	10.00	6.00	60.00
Organic Chemical application	Hours	0.00	0.00	0.00
Land Charge	Acre	100.00	1.00	100.00
Total Growing Season Costs				$807.75
Harvesting Costs				
Harvesting	Lb	0.65	1,102.00	$716.30
Grade and Packaging Cost	Lb	0.25	1,102.00	275.50
Total Harvesting, Grading and Packaging Costs				$991.80
Post Harvest Clean-Up Costs	Acre	100.00	1.00	$100.00
Total Costs	Acre			$2,142.55
Revenue Above Costs	Acre			-$59.77
Break-Even Price	Lb			$1.94

Table 29 Organic Indeterminate Southern Pea Budget, 2006

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Southern Peas 2006 (Indeterminate)	Pound	$2.10	2,062.00	$4,330.20
Total Revenue				$4,330.20
Over Winter Cost	Application	25.00	1.00	$25.00
Pre-Planting Costs				
Disk	Application	10.00	2.00	$20.00
Bed	Application	4.00	1.00	4.00
Final Seed Bed Preparation	Application	4.00	1.00	4.00
Poultry Litter	Tons	40.00	4.00	160.00
Pre-Planting Labor	Hours	10.00	3.00	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Seed	Pound	5.70	37.50	$213.75
Drip Irrigation Tape	Feet	0.03	6,400.00	160.00
Irrigation	Inches	12.00	7.00	84.00
Organic Chemicals				
Insecticides	Application	0.00	0.00	0.00
Disease Control	Application	0.00	0.00	0.00
Cultivation	Application	10.00	3.00	30.00
Growing Season Labor				
Seeding	Hours	10.00	2.00	20.00
Hand Hoeing	Hours	10.00	12.00	120.00
Irrigation Set-Up Labor	Hours	10.00	2.00	20.00
Irrigation Labor	Hours	10.00	6.00	60.00
Organic Chemical application	Hours	0.00	0.00	0.00
Land Charge	Acre	100.00	1.00	100.00
Total Growing Season Costs				$807.75
Harvesting Costs				
Harvesting	Lb	0.65	2,062.00	$1,340.30
Grade and Packaging Cost	Lb	0.25	2,062.00	515.50
Total Harvesting, Grading and Packaging Costs				$1,855.80
Post Harvest Clean-Up Costs	Acre	100.00	1.00	$100.00
Total Costs	Acre			$3,006.55
Revenue Above Costs	Acre			$1,323.65
Break-Even Price	Lb			$1.46

Table 30 Organic Sweet Corn Budget, 2004

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Sweet Corn 2004	Dozen	$2.45	576	$1,411.20
Total Revenue				$1,411.20
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Seed	Lbs	9	20	$180.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	18	4	72.00
Disease Control		0	0	0.00
Cultivation	Application	10	3	30.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	12	120.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	10	10	100.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$946.00
Harvesting Costs				
Harvesting labor	Lb	0.10	576	$57.60
Grade and Packaging Cost	Lb	0.10	576	57.60
Total Harvesting, Grading and Packaging Costs				$115.20
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,404.20
Revenue Above Costs	Acre			$7.00
Break-Even Price	Lb			$2.44

Table 31 Organic Sweet Corn Budget, 2005

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Sweet Corn 2005	Dozen	$2.80	1471	$4,118.80
Total Revenue				$4,118.80
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Seed	Lbs	9	20	$180.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	18	4	72.00
Disease Control		0	0	0.00
Cultivation	Application	10	3	30.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	12	120.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	10	10	100.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$946.00
Harvesting Costs				
Harvesting labor	Lb	0.10	1471	$147.10
Grade and Packaging Cost	Lb	0.10	1471	147.10
Total Harvesting, Grading and Packaging Costs				$294.20
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,583.20
Revenue Above Costs	Acre			$2,535.60
Break-Even Price	Lb			$1.08

Table 32 Organic Sweet Corn Budget, 2006

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Sweet Corn 2006	Dozen	$2.98	643	$1,916.14
Total Revenue				$1,916.14
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Seed	Lbs	9	20	$180.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	18	4	72.00
Disease Control		0	0	0.00
Cultivation	Application	10	3	30.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	12	120.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	10	10	100.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$946.00
Harvesting Costs				
Harvesting labor	Lb	0.10	643	$64.30
Grade and Packaging Cost	Lb	0.10	643	64.30
Total Harvesting, Grading and Packaging Costs				$128.60
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,417.60
Revenue Above Costs	Acre			$498.54
Break-Even Price	Lb			$2.20

Table 33 Organic Tomato Budget, 2004

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Tomatoes 2004	Pound	$0.28	30000	$8,400.00
Total Revenue				$8,400.00
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Transplants	Plants	0.21	3630	$762.30
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	10	2	20.00
Disease Control	Application	18	2	36.00
Cultivation	Application	10	2.5	25.00
Stakes	Thousand	105	3.6	378.00
Growing Season Labor				
Transplanting	Hours	10	40	400.00
Hand Hoeing	Hours	10	25	250.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	10	5	50.00
Staking Labor	Hours	10	50	500.00
Suckering Labor	Hours	10	54	540.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$3,385.30
Harvesting Costs				
Harvesting labor	Lb	0.03	30000	$900.00
Grade and Packaging Cost	Lb	0.02	30000	600.00
Total Harvesting, Grading and Packaging Costs				$1,500.00
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$5,228.30
Revenue Above Costs	Acre			$3,171.70
Break-Even Price	Lb			$0.17

Table 34 Organic Tomato Budget, 2005

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Tomatoes 2005	Pound	$0.36	29800	$10,728.00
Total Revenue				$10,728.00
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Transplants	Plants	0.21	3630	$762.30
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	10	2	20.00
Disease Control	Application	18	2	36.00
Cultivation	Application	10	2.5	25.00
Stakes	Thousand	105	3.6	378.00
Growing Season Labor				
Transplanting	Hours	10	40	400.00
Hand Hoeing	Hours	10	25	250.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	10	5	50.00
Staking Labor	Hours	10	50	500.00
Suckering Labor	Hours	10	54	540.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$3,385.30
Harvesting Costs				
Harvesting labor	Lb	0.03	29800	$894.00
Grade and Packaging Cost	Lb	0.02	29800	596.00
Total Harvesting, Grading and Packaging Costs				$1,490.00
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$5,218.30
Revenue Above Costs	Acre			$5,509.70
Break-Even Price	Lb			$0.18

Table 35 Organic Tomato Budget, 2006

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Tomatoes 2006	Pound	$0.34	23265	$7,910.10
Total Revenue				$7,910.10
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$218.00
Growing Season Costs				
Transplants	Plants	0.21	3630	$762.30
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	10	2	20.00
Disease Control	Application	18	2	36.00
Cultivation	Application	10	2.5	25.00
Stakes	Thousand	105	3.6	378.00
Growing Season Labor				
Transplanting	Hours	10	40	400.00
Hand Hoeing	Hours	10	25	250.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	10	5	50.00
Staking Labor	Hours	10	50	500.00
Suckering Labor	Hours	10	54	540.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$3,385.30
Harvesting Costs				
Harvesting labor	Lb	0.03	23265	$697.95
Grade and Packaging Cost	Lb	0.02	23265	465.30
Total Harvesting, Grading and Packaging Costs				$1,163.25
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$4,891.55
Revenue Above Costs	Acre			$3,018.55
Break-Even Price	Lb			0.21

Table 36 Organic Watermelon Budget, 2004

Production	Units	Price	Quantity	Total ($/Acre)
Organic Watermelon 2004	Pound	$0.11	17872	$1,965.92
Total Revenue				$1,965.92
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Plastic Mulch	Acre	90	1	90.00
Pre-Planting Labor	Hours	10	4	40.00
Total Pre-Planting Cost				$318.00
Growing Season Costs				
Transplants	Plants	0.28	1000	$280.00
Drip Irrigation Tape	Feet	0.025	2,133	53.33
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	18	2	36.00
Disease Control	Application	15	2	30.00
Cultivation	Application	10	2.5	25.00
Growing Season Labor				
Transplanting	Hours	10	8	80.00
Hand Hoeing	Hours	10	6	60.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	10	5	50.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$878.33
Harvesting Costs				
Harvesting labor	Lb	0.015	17872	$268.08
Grade and Packaging Cost	Lb	0.015	17872	268.08
Total Harvesting, Grading and Packaging Costs				$536.16
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,857.49
Revenue Above Costs	Acre			$108.43
Break-Even Price	Lb			$0.10

Table 37 Organic Watermelon Budget, 2005

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Watermelon 2005	Pound	$0.13	17643	$2,293.59
Total Revenue				$2,293.59
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Plastic Mulch	Acre	90	1	90.00
Pre-Planting Labor	Hours	10	4	40.00
Total Pre-Planting Cost				$318.00
Growing Season Costs				
Seed	Plants	0.28	1000	$280.00
Drip Irrigation Tape	Feet	0.025	2,133	53.33
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	18	2	36.00
Disease Control	Application	15	2	30.00
Cultivation	Application	10	2.5	25.00
Growing Season Labor				
Seeding	Hours	10	8	80.00
Hand Hoeing	Hours	10	6	60.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	10	5	50.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$878.33
Harvesting Costs				
Harvesting labor	Lb	0.015	17643	$264.65
Grade and Packaging Cost	Lb	0.015	17643	264.65
Total Harvesting, Grading and Packaging Costs				$529.29
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,850.62
Revenue Above Costs	Acre			$442.97
Break-Even Price	Lb			$0.10

Table 38 Organic Watermelon Budget, 2006

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Organic Watermelon 2006	Pound	$0.13	24051	$3,126.63
Total Revenue				$3,126.63
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Poultry Litter	Tons	40	4	160.00
Plastic Mulch	Acre	90	1	90.00
Pre-Planting Labor	Hours	10	4	40.00
Total Pre-Planting Cost				$318.00
Growing Season Costs				
Transplants	Plants	0.28	1000	$280.00
Drip Irrigation Tape	Feet	0.025	2,133	53.33
Irrigation	Inches	12	7	84.00
Organic Chemicals				
Insecticides	Application	18	2	36.00
Disease Control	Application	15	2	30.00
Cultivation	Application	10	2.5	25.00
Growing Season Labor				
Transplanting	Hours	10	8	80.00
Hand Hoeing	Hours	10	6	60.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Organic Chemical application	Hours	10	5	50.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$878.33
Harvesting Costs				
Harvesting labor	Lb	0.015	24051	$360.77
Grade and Packaging Cost	Lb	0.015	24051	360.77
Total Harvesting, Grading and Packaging Costs				$721.53
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$2,042.86
Revenue Above Costs	Acre			$1,083.77
Break-Even Price	Lb			$0.08

APPENDIX B

Conventional Budgets

Table 39 Conventional Bell Pepper Budget, 2004

Production	Units	Price	Quantity	Total ($/Acre)
Conventional Bell Pepper 2004	28 Lb box	$11.03	199	$2,194.97
Total Revenue				$2,194.97
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final seed bed preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Lbs	0.35	36	12.60
Phosphorus	Lbs	0.25	92	23.00
Potassium	Lbs	0.16	120	19.20
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$112.80
Growing Season Costs				
Transplants	Plants	0.08	6000	$480.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	5	1	5.00
Disease Control	Application	0	0	0.00
Weed Control	Application	4	1.5	6.00
Cultivation	Application	10	1	10.00
Growing Season Labor				
Transplanting	Hours	10	12	120.00
Hand Hoeing	Hours	10	6	60.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	3	30.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$1,135.00
Harvesting Costs				
Harvesting labor	28 Lb box	0.42	199	$83.58
Grade and Packaging Cost	28 Lb box	2	199	398.00
Total Harvesting, Grading and Packaging Costs				$481.58
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,854.38
Revenue Above Costs	Acre			$340.59
Break-Even Price	28 Lb Box			$9.32

Table 40 Conventional Bell Pepper Budget, 2005

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Bell Pepper 2005	28 Lb box	$11.20	140	$1,568.00
Total Revenue				$1,568.00
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final seed bed preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Lbs	0.35	36	12.60
Phosphorus	Lbs	0.25	92	23.00
Potassium	Lbs	0.16	120	19.20
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$112.80
Growing Season Costs				
Transplants	Plants	0.08	6000	$480.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	5	1	5.00
Disease Control	Application	0	0	0.00
Weed Control	Application	4	1.5	6.00
Cultivation	Application	10	1	10.00
Growing Season Labor				
Transplanting	Hours	10	12	120.00
Hand Hoeing	Hours	10	6	60.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	3	30.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$1,135.00
Harvesting Costs				
Harvesting labor	28 Lb box	0.42	140	$58.80
Grade and Packaging Cost	28 Lb box	2	140	280.00
Total Harvesting, Grading and Packaging Costs				$338.80
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,711.60
Revenue Above Costs	Acre			-$143.60
Break-Even Price	28 Lb Box			$12.23

Table 41 Conventional Bell Pepper Budget, 2006

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Bell Pepper 2006	28 Lb box	$11.90	147	$1,749.30
Total Revenue				$1,749.30
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final seed bed preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Lbs	0.35	36	12.60
Phosphorus	Lbs	0.25	92	23.00
Potassium	Lbs	0.16	120	19.20
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$112.80
Growing Season Costs				
Transplants	Plants	0.08	6000	$480.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	5	1	5.00
Disease Control	Application	0	0	0.00
Weed Control	Application	4	1.5	6.00
Cultivation	Application	10	1	10.00
Growing Season Labor				
Transplanting	Hours	10	12	120.00
Hand Hoeing	Hours	10	6	60.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	3	30.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$1,135.00
Harvesting Costs				
Harvesting labor	28 Lb box	0.42	147	$61.74
Grade and Packaging Cost	28 Lb box	2	147	294.00
Total Harvesting, Grading and Packaging Costs				$355.74
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,728.54
Revenue Above Costs	Acre			$20.76
Break-Even Price	28 Lb Box			$11.76

Table 42 Conventional Pickling Cucumber Budget, 2004

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Cucumber-2004	55 lb box	$14.00	124	$1,736.00
Total Revenue				$1,736.00
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Lbs	0.35	36	12.60
Phosphorus	Lbs	0.25	92	23.00
Potash	Lbs	0.16	120	19.20
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$112.80
Growing Season Costs				
Seed	Lbs	22	2.5	$55.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	5	1	5.00
Disease Control	Application	0	0	0.00
Weed Control	Application	4	1.5	6.00
Cultivation	Application	10	1	10.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	6	60.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	3	30.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$610.00
Harvesting Costs				
Harvesting labor	55 lb box	0.42	124	$52.08
Grading, Packaging and Marketing Cost	55 lb box	4	124	496.00
Total Harvesting, Grading and Packaging Costs				$548.08
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,395.88
Revenue Above Costs	Acre			$340.12
Break-Even Price	55 Lb Box			$11.26

Table 43 Conventional Pickling Cucumber Budget, 2005

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Cucumber-2005	55 lb box	$16.45	67	$1,102.15
Total Revenue				$1,102.15
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Lbs	0.35	36	12.60
Phosphorus	Lbs	0.25	92	23.00
Potash	Lbs	0.16	120	19.20
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$112.80
Growing Season Costs				
Seed	Lbs	22	2.5	$55.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	5	1	5.00
Disease Control	Application	0	0	0.00
Weed Control	Application	4	1.5	6.00
Cultivation	Application	10	1	10.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	6	60.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	3	30.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$610.00
Harvesting Costs				
Harvesting labor	55 lb box	0.42	67	$28.14
Grading, Packaging and Marketing Cost	55 lb box	4	67	268.00
Total Harvesting, Grading and Packaging Costs				$296.14
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,143.94
Revenue Above Costs	Acre			-$41.79
Break-Even Price	55 Lb Box			$17.07

Table 44 Conventional Pickling Cucumber Budget, 2006

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Cucumber-2006	55 lb box	$12.60	73	$919.80
Total Revenue				$919.80
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Lbs	0.35	36	12.60
Phosphorus	Lbs	0.25	92	23.00
Potash	Lbs	0.16	120	19.20
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$112.80
Growing Season Costs				
Seed	Lbs	22	2.5	$55.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	5	1	5.00
Disease Control	Application	0	0	0.00
Weed Control	Application	4	1.5	6.00
Cultivation	Application	10	1	10.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	6	60.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	3	30.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$610.00
Harvesting Costs				
Harvesting labor	55 lb box	0.42	73	$30.66
Grading, Packaging and Marketing Cost	55 lb box	4	73	292.00
Total Harvesting, Grading and Packaging Costs				$322.66
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,170.46
Revenue Above Costs	Acre			-$250.66
Break-Even Price	55 Lb Box			$16.03

Table 45 Conventional Determinate Southern Pea Budget, 2004

Production	Units	Price	Quantity	Total ($/Acre)
Conventional Southern Peas 2004(Determinate)	Pound	$1.96	1,181.00	$2,314.76
Total Revenue				$2,314.76
Over Winter Cost	Application	25.00	1.00	$25.00
Pre-Planting Costs				
Disk	Application	10.00	2.00	$20.00
Bed	Application	4.00	1.00	4.00
Final seed bed preparation	Application	4.00	1.00	4.00
Fertilizers				
Nitrogen	Pounds	0.35	25.00	8.75
Phosphate	Pounds	0.25	50.00	12.50
Potash	Pounds	0.16	120.00	19.20
Pre-Planting Labor	Hours	10.00	3.00	30.00
Total Pre-Planting Cost				$98.45
Growing Season Costs				
Seed	Lbs	5.00	37.50	$187.50
Drip Irrigation Tape	Feet	0.03	6,400.00	160.00
Irrigation	Inches	12.00	7.00	84.00
Agro Chemicals				
Insecticides	Application	5.00	2.00	10.00
Disease Control	Application	0.00	0.00	0.00
Herbicides	Application	20.65	1.00	20.65
Cultivation	Application	10.00	1.00	10.00
Growing Season Labor				
Seeding	Hours	10.00	2.00	20.00
Hand Hoeing	Hours	10.00	6.00	60.00
Irrigation Set-Up Labor	Hours	10.00	2.00	20.00
Irrigation Labor	Hours	10.00	6.00	60.00
Chemical application	Hours	10.00	5.00	50.00
Land Charge	Acre	100.00	1.00	100.00
Total Growing Season Costs				$782.15
Harvesting Costs				
Harvesting	Lb	0.60	1,181.00	$708.60
Grade and Packaging Cost	Lb	0.25	1,181.00	295.25
Total Harvesting, Grading and Packaging Costs				$1,003.85
Post Harvest Clean-Up Costs	Acre	100.00	1.00	$100.00
Total Costs	Ace			$2,009.45
Revenue Above Costs	Acre			$305.31
Break-Even Price	Lb			$1.70

Table 46 Conventional Determinate Southern Pea Budget, 2005

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Southern Peas2005 (Determinate)	Pound	$1.89	1,474.00	$2,785.86
Total Revenue				$2,785.86
Over Winter Cost	Application	25.00	1.00	$25.00
Pre-Planting Costs				
Disk	Application	10.00	2.00	$20.00
Bed	Application	4.00	1.00	4.00
Final seed bed preparation	Application	4.00	1.00	4.00
Fertilizers				
Nitrogen	Pounds	0.35	25.00	8.75
Phosphate	Pounds	0.25	50.00	12.50
Potash	Pounds	0.16	120.00	19.20
Pre-Planting Labor	Hours	10.00	3.00	30.00
Total Pre-Planting Cost				$98.45
Growing Season Costs				
Seed	Lbs	5.00	37.50	$187.50
Drip Irrigation Tape	Feet	0.03	6,400.00	160.00
Irrigation	Inches	12.00	7.00	84.00
Agro Chemicals				
Insecticides	Application	5.00	2.00	10.00
Disease Control	Application	0.00	0.00	0.00
Herbicide	Application	20.65	1.00	20.65
Cultivation	Application	10.00	1.00	10.00
Growing Season Labor				
Seeding	Hours	10.00	2.00	20.00
Hand Hoeing	Hours	10.00	6.00	60.00
Irrigation Set-Up Labor	Hours	10.00	2.00	20.00
Irrigation Labor	Hours	10.00	6.00	60.00
Chemical application	Hours	10.00	5.00	50.00
Land Charge	Acre	100.00	1.00	100.00
Total Growing Season Costs				$782.15
Harvesting Costs				
Harvesting	Lb	0.60	1,474.00	$884.40
Grade and Packaging Cost	Lb	0.25	1,474.00	368.50
Total Harvesting, Grading and Packaging Costs				$1,252.90
Post Harvest Clean-Up Costs	Acre	100.00	1.00	$100.00
Total Costs	Ace			$2,258.50
Revenue Above Costs	Acre			$527.36
Break-Even Price	Lb			$1.53

Table 47 Conventional Determinate Southern Pea Budget, 2006

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Southern Peas 2006(Determinate)	Pound	$2.10	1,014.00	$2,129.40
Total Revenue				$2,129.40
Over Winter Cost	Application	25.00	1.00	$25.00
Pre-Planting Costs				
Disk	Application	10.00	2.00	$20.00
Bed	Application	4.00	1.00	4.00
Final Seed Bed Preparation	Application	4.00	1.00	4.00
Fertilizers				
Nitrogen	Pounds	0.35	25.00	8.75
Phosphate	Pounds	0.25	50.00	12.50
Potash	Pounds	0.16	120.00	19.20
Pre-Planting Labor	Hours	10.00	3.00	30.00
Total Pre-Planting Cost				$98.45
Growing Season Costs				
Seed	Lbs	5.00	37.50	$187.50
Drip Irrigation Tape	Feet	0.03	6,400.00	160.00
Irrigation	Inches	12.00	7.00	84.00
Agro Chemicals				
Insecticides	Application	5.00	2.00	10.00
Disease Control	Application	0.00	0.00	0.00
Herbicide	Application	20.65	1.00	20.65
Cultivation	Application	10.00	1.00	10.00
Growing Season Labor				
Seeding	Hours	10.00	2.00	20.00
Hand Hoeing	Hours	10.00	6.00	60.00
Irrigation Set-Up Labor	Hours	10.00	2.00	20.00
Irrigation Labor	Hours	10.00	6.00	60.00
Chemical application	Hours	10.00	5.00	50.00
Land Charge	Acre	100.00	1.00	100.00
Total Growing Season Costs				$782.15
Harvesting Costs				
Harvesting	Lb	0.60	1,014.00	$608.40
Grade and Packaging Cost	Lb	0.25	1,014.00	253.50
Total Harvesting, Grading and Packaging Costs				$861.90
Post Harvest Clean-Up Costs	Acre	100.00	1.00	$100.00
Total Costs	Ace			$1,867.50
Revenue Above Costs	Acre			$261.90
Break-Even Price	Lb			$1.84

Table 48 Conventional Indeterminate Southern Pea Budget, 2004

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Southern Peas 2004(Indeterminate)	Pound	$1.96	1285	$2,518.60
Total Revenue				$2,518.60
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Pounds	0.35	25	8.75
Phosphate	Pounds	0.25	50	12.50
Potash	Pounds	0.16	120	19.20
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$98.45
Growing Season Costs				
Seed	Lbs	5	37.5	$187.50
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	5	2	10.00
Disease Control	Application	0	0	0.00
Herbicide	Application	20.65	1	20.65
Cultivation	Application	10	1	10.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	6	60.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	5	50.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$782.15
Harvesting Costs				
Harvesting	Lb	0.65	1285	$835.25
Grade and Packaging Cost	Lb	0.25	1285	321.25
Total Harvesting, Grading and Packaging Costs				$1,156.50
Post Harvest Clean-Up Costs	Acre	100	1	$100.00
Total Costs	Acre			$2,162.10
Revenue Above Costs	Acre			$356.50
Break-Even Price	Lb			$1.68

Table 49 Conventional Indeterminate Southern Pea Budget, 2005

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Southern Peas2005 (Indeterminate)	Pound	$1.89	1324	$2,502.36
Total Revenue				$2,502.36
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Pounds	0.35	25	8.75
Phosphate	Pounds	0.25	50	12.50
Potash	Pounds	0.16	120	19.20
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$98.45
Growing Season Costs				
Seed	Lbs	5	37.5	$187.50
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	5	2	10.00
Disease Control	Application	0	0	0.00
Herbicide	Application	20.65	1	20.65
Cultivation	Application	10	1	10.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	6	60.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	5	50.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$782.15
Harvesting Costs				
Harvesting	Lb	0.65	1324	$860.60
Grade and Packaging Cost	Lb	0.25	1324	331.00
Total Harvesting, Grading and Packaging Costs				$1,191.60
Post Harvest Clean-Up Costs	Acre	100	1	$100.00
Total Costs	Acre			$2,197.20
Revenue Above Costs	Acre			$305.16
Break-Even Price	Lb			$1.66

Table 50 Conventional Indeterminate Southern Pea Budget, 2006

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Southern Peas 2006(Indeterminate)	Pound	$2.10	1231	$2,585.10
Total Revenue				$2,585.10
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Pounds	0.35	25	8.75
Phosphate	Pounds	0.25	50	12.50
Potash	Pounds	0.16	120	19.20
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$98.45
Growing Season Costs				
Seed	Lbs	5	37.5	$187.50
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	5	2	10.00
Disease Control	Application	0	0	0.00
Herbicide	Application	20.65	1	20.65
Cultivation	Application	10	1	10.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	6	60.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	5	50.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$782.15
Harvesting Costs				
Harvesting	Lb	0.65	1231	$800.15
Grade and Packaging Cost	Lb	0.25	1231	307.75
Total Harvesting, Grading and Packaging Costs				$1,107.90
Post Harvest Clean-Up Costs	Acre	100	1	$100.00
Total Costs	Acre			$2,113.50
Revenue Above Costs	Acre			$471.60
Break-Even Price	Lb			$1.72

Table 51 Conventional Sweet Corn Budget, 2004

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Sweet Corn 2004	Dozen	$2.45	655	$1,604.75
Total Revenue				$1,604.75
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Fert 17-17-17	Cwt	18.2	3.5	63.70
Nitrogen	Pounds	0.35	70	24.50
Pre-Planting Labor	Hour	10	3	30.00
Total Pre-Planting Cost				$146.20
Growing Season Costs				
Seed	Lbs	9	20	$180.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	25	5	125.00
Disease Control	Application	0	0	0.00
Weed Control	Application	3	2	6.00
Cultivation	Application	10	1	10.00
Growing Season Labor				
Seeding	Hours	10	2	20.00
Hand Hoeing	Hours	10	6	60.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	10	100.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$925.00
Harvesting Costs				
Harvesting labor	Lb	0.10	655	$65.50
Grade and Packaging Cost	Lb	0.10	655	65.50
Total Harvesting, Grading and Packaging Costs				$131.00
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,327.20
Revenue Above Costs	Acre			$277.55
Break-Even Price	Lb			$2.03

Table 52 Conventional Sweet Corn Budget, 2005

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Sweet Corn 2005	Dozen	$2.80	1345	$3,766.00
Total Revenue				$3,766.00
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Do All	Application	4	1	4.00
Fertilizers				
Fert 17-17-17	Cwt	18.2	3.5	63.70
Nitrogen	Pounds	0.35	70	24.50
Pre-Planting Labor	Hour	10	3	30.00
Total Pre-Planting Cost				$146.20
Growing Season Costs				
Seed	Lbs	9	20	$180.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	25	5	125.00
Disease Control	Application	0	0	0.00
Weed Control	Application	3	2	6.00
Cultivation	Application	10	1	10.00
Growing Season Labor				
Seeding	Hour	10	2	20.00
Hand Hoeing	Hour	10	6	60.00
Irrigation Set-Up Labor	Hour	10	2	20.00
Irrigation Labor	Hour	10	6	60.00
Chemical application	Hour	10	10	100.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$925.00
Harvesting Costs				
Harvesting labor	Lb	0.10	1345	$134.50
Grade and Packaging Cost	Lb	0.10	1345	134.50
Total Harvesting, Grading and Packaging Costs				$269.00
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,465.20
Revenue Above Costs	Acre			$2,300.80
Break-Even Price	Lb			$1.09

Table 53 Conventional Sweet Corn Budget, 2006

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Sweet Corn 2006	Dozen	$2.98	785	$2,339.30
Total Revenue				$2,339.30
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Fert 17-17-17	Cwt	18.2	3.5	63.70
Nitrogen	Pounds	0.35	70	24.50
Pre-Planting Labor	Hour	10	3	30.00
Total Pre-Planting Cost				$146.20
Growing Season Costs				
Seed	Lbs	9	20	$180.00
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	25	5	125.00
Disease Control	Application	0	0	0.00
Weed Control	Application	3	2	6.00
Cultivation	Application	10	1	10.00
Growing Season Labor				
Seeding	Hour	10	2	20.00
Hand Hoeing	Hour	10	6	60.00
Irrigation Set-Up Labor	Hour	10	2	20.00
Irrigation Labor	Hour	10	6	60.00
Chemical application	Hour	10	10	100.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$925.00
Harvesting Costs				
Harvesting labor	Lb	0.10	785	$78.50
Grade and Packaging Cost	Lb	0.10	785	78.50
Total Harvesting, Grading and Packaging Costs				$157.00
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,353.20
Revenue Above Costs	Acre			$986.10
Break-Even Price	Lb			$1.72

Table 54 Conventional Tomato Budget, 2004

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Tomatoes 2004	Pound	$0.28	27000	$7,560.00
Total Revenue				$7,560.00
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Pounds	0.35	117	40.95
Phosphate	Pounds	0.25	260	65.00
Potash	Pounds	0.16	200	32.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$195.95
Growing Season Costs				
Transplants	Plants	0.18	3630	$653.40
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	21	3	63.00
Disease Control	Application	3.15	8	25.20
Weed Control	Application	3.2	1	3.20
Cultivation	Application	10	1	10.00
Stakes	Thousand	105	3.6	378.00
Growing Season Labor				
Transplanting	Hours	10	40	400.00
Hand Hoeing	Hours	10	9	90.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	6	60.00
Staking Labor	Hours	10	50	500.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$2,606.80
Harvesting Costs				
Harvesting labor	Lb	0.03	27000	$810.00
Grade and Packaging Cost	Lb	0.02	27000	540.00
Total Harvesting, Grading and Packaging Costs				$1,350.00
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$4,277.75
Revenue Above Costs	Acre			$3,282.25
Break-Even Price	Lb			$0.16

Table 55 Conventional Tomato Budget, 2005

Production	Units	Price	Quantity	Total ($/Acre)
Conventional Tomatoes 2005	Pound	$0.36	27400	$9,864.00
Total Revenue				$9,864.00
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Pounds	0.35	117	40.95
Phosphate	Pounds	0.25	260	65.00
Potash	Pounds	0.16	200	32.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$195.95
Growing Season Costs				
Transplants	Plants	0.18	3630	$653.40
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	21	3	63.00
Disease Control	Application	3.15	8	25.20
Weed Control	Application	3.2	1	3.20
Cultivation	Application	10	1	10.00
Stakes	Thousand	105	3.6	378.00
Growing Season Labor				
Transplanting	Hours	10	40	400.00
Hand Hoeing	Hours	10	9	90.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	6	60.00
Staking Labor	Hours	10	50	500.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$2,606.80
Harvesting Costs				
Harvesting labor	Lb	0.03	27400	$822.00
Grade and Packaging Cost	Lb	0.02	27400	548.00
Total Harvesting, Grading and Packaging Costs				$1,370.00
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$4,297.75
Revenue Above Costs	Acre			$5,566.25
Break-Even Price	Lb			$0.16

Table 56 Conventional Tomato Budget, 2006

Production	Units	Price	Quantity	Total ($/Acre)
Conventional Tomatoes 2006	Pound	$0.34	25775	$8,763.50
Total Revenue				$8,763.50
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Pounds	0.35	117	40.95
Phosphate	Pounds	0.25	260	65.00
Potash	Pounds	0.16	200	32.00
Pre-Planting Labor	Hours	10	3	30.00
Total Pre-Planting Cost				$195.95
Growing Season Costs				
Transplants	Plants	0.18	3630	$653.40
Drip Irrigation Tape	Feet	0.025	6,400	160.00
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	21	3	63.00
Disease Control	Application	3.15	8	25.20
Weed Control	Application	3.2	1	3.20
Cultivation	Application	10	1	10.00
Stakes	Thousand	105	3.6	378.00
Growing Season Labor				
Transplanting	Hours	10	40	400.00
Hand Hoeing	Hours	10	9	90.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	6	60.00
Staking Labor	Hours	10	50	500.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$2,606.80
Harvesting Costs				
Harvesting labor	Lb	0.03	25775	$773.25
Grade and Packaging Cost	Lb	0.02	25775	515.50
Total Harvesting, Grading and Packaging Costs				$1,288.75
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$4,216.50
Revenue Above Costs	Acre			$4,547.00
Break-Even Price	Lb			$0.16

Table 57 Conventional Watermelon Budget, 2004

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Watermelon	Pound	$0.11	19454	$2,139.94
Total Revenue				$2,139.94
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Pounds	0.35	150	52.50
Phosphate	Pounds	0.25	100	25.00
Potash	Pounds	0.16	100	16.00
Plastic Mulch	Acre	90	1	90.00
Pre-Planting Labor	Hours	10	4	40.00
Total Pre-Planting Cost				$251.50
Growing Season Costs				
Transplants/ Seed	Plants	0.24	1000	$240.00
Drip Irrigation Tape	Feet	0.025	2,133	53.33
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	15	1	15.00
Disease Control	Application	45	1	45.00
Weed Control	Application	4.5	2	9.00
Cultivation	Application	10	1	10.00
Growing Season Labor				
Transplanting/Seeding	Hours	10	8	80.00
Hand Hoeing	Hours	10	4	40.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	6	60.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$816.33
Harvesting Costs				
Harvesting labor	Lb	0.015	19454	$291.81
Grade and Packaging Cost	Lb	0.015	19454	291.81
Total Harvesting, Grading and Packaging Costs				$583.62
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,776.45
Revenue Above Costs	Acre			$363.49
Break-Even Price	Lb			$0.09

Table 58 Conventional Watermelon Budget, 2005

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Watermelon 2005	Pound	$0.13	17333	$2,253.29
Total Revenue				$2,253.29
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Pounds	0.35	150	52.50
Phosphate	Pounds	0.25	100	25.00
Potash	Pounds	0.16	100	16.00
Plastic Mulch	Acre	90	1	90.00
Pre-Planting Labor	Hours	10	4	40.00
Total Pre-Planting Cost				$251.50
Growing Season Costs				
Transplants/ Seed	Plants	0.24	1000	$240.00
Drip Irrigation Tape	Feet	0.025	2,133	53.33
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	15	1	15.00
Disease Control	Application	45	1	45.00
Weed Control	Application	4.5	2	9.00
Cultivation	Application	10	1	10.00
Growing Season Labor				
Transplanting/Seeding	Hours	10	8	80.00
Hand Hoeing	Hours	10	4	40.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	6	60.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$816.33
Harvesting Costs				
Harvesting labor	Lb	0.015	17333	$260.00
Grade and Packaging Cost	Lb	0.015	17333	260.00
Total Harvesting, Grading and Packaging Costs				$519.99
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,712.82
Revenue Above Costs	Acre			$540.47
Break-Even Price	Lb			$0.10

Table 59 Conventional Watermelon Budget, 2006

Production	**Units**	**Price**	**Quantity**	**Total ($/Acre)**
Conventional Watermelon 2006	Pound	$0.13	17927	$2,330.51
Total Revenue				$2,330.51
Over Winter Cost	Application	25	1	$25.00
Pre-Planting Costs				
Disk	Application	10	2	$20.00
Bed	Application	4	1	4.00
Final Seed Bed Preparation	Application	4	1	4.00
Fertilizers				
Nitrogen	Pounds	0.35	150	52.50
Phosphate	Pounds	0.25	100	25.00
Potash	Pounds	0.16	100	16.00
Plastic Mulch	Acre	90	1	90.00
Pre-Planting Labor	Hours	10	4	40.00
Total Pre-Planting Cost				$251.50
Growing Season Costs				
Transplants	Plants	0.24	1000	$240.00
Drip Irrigation Tape	Feet	0.025	2,133	53.33
Irrigation	Inches	12	7	84.00
Agro Chemicals				
Insecticides	Application	15	1	15.00
Disease Control	Application	45	1	45.00
Weed Control	Application	4.5	2	9.00
Cultivation	Application	10	1	10.00
Growing Season Labor				
Transplanting	Hours	10	8	80.00
Hand Hoeing	Hours	10	4	40.00
Irrigation Set-Up Labor	Hours	10	2	20.00
Irrigation Labor	Hours	10	6	60.00
Chemical application	Hours	10	6	60.00
Land Charge	Acre	100	1	100.00
Total Growing Season Costs				$816.33
Harvesting Costs				
Harvesting labor	Lb	0.015	17927	$268.91
Grade and Packaging Cost	Lb	0.015	17927	268.91
Total Harvesting, Grading and Packaging Costs				$537.81
Post Harvest Clean-Up Costs	Acre			$100.00
Total Costs	Acre			$1,730.64
Revenue Above Costs	Acre			$599.87
Break-Even Price	Lb			$0.10

VITA

KALPANA KHANAL

Candidate for the Degree of

Master of Science

Thesis: ORGANIC AND CONVENTIONAL VEGETABLE PRODUCTION IN OKLAHOMA

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Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of the Study: ORGANIC AND CONVENTIONAL VEGETABLE PRODUCTION IN OKLAHOMA

Pages in Study: 124 Candidate of the Degree of Master of Science

Major Field: Agricultural Economics

Scope and Method of Study: Growing vegetables as an alternative to traditional crops can potentially enhance Oklahoma farmers' incomes. Conversion from conventional to organic method of production may take some years, but some of the organic yield data obtained from WWAREC, Lane Oklahoma has shown that organic systems may give more yields as compared to conventional systems in the long term. A linear programming model was used to find the optimal mix of vegetables in both production systems. Additionally a target MOTAD (Minimization of Total Absolute Deviation) model was used to perform risk analysis in both organic and conventional production systems.

Findings and Conclusions: The results of this study show that a combination of tomato, determinate southern pea and sweet corn is most profitable for the conventional system and a combination of tomato, determinate southern pea and watermelon is most profitable for the organic system. Block labor is more restrictive and less profitable compared to the hourly labor. In addition to that the risk analysis results show that higher variability existed in most of the cases in the organic production system as compared to the conventional production system. In some cases, in the organic system, some acres of land should be left idle due to higher production cost and higher risk involved; whereas, all the acres should be used in all cases in the conventional production system. This study is intended to provide information to the potential producers considering increasing their production of specialty crops including conventional and organic vegetables.

ADVISOR'S APPROVAL: Dr. Shida Henneberry