Organic and Conventional Vegetable Production in Oklahoma

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Abstract:

This study compares he profitability and risk related to conventional and organic vegetable production systems A linear programming model was used to find the optimal mix of vegetables in both production systems. And a target MOTAD (minimization of total absolute deviation) model was used to perform risk analysis in both organic and conventional production systems

ORGANIC AND CONVENTIONAL VEGETABLE PRODUCTION IN OKLAHOMA

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). As shown in figures 1 and 2 the total organic acreage as well as acreage of organic vegetables in the United States have been increasing since the early 90's.

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. On the demand side consumers are encouraged to increase their intake of fruits and vegetables. Despite the increasing demand and potential profitability in this sector, studies related to economic feasibility of fruits and vegetable production in Oklahoma have been limited to research conducted during the 1980's and early 90's.

Studies by Schatzer, Wickwire, and Tilley (1986) 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 waterIn this aspect Russo and Taylor (2006) have stated that due to changes in demographics and economic hardships faced by people, there is a growing interest in converting land to crops that are not traditional in the southern plains of the U.S. and one such option in the southern plains is vegetable production. Their study also states that in the southern plains like Oklahoma, land needs to be taken out of row crops or cow-calf operations and make land available for the production of vegetables.

Vegetables can be produced by both organic and conventional methods. The general concept of organically grown produce refers to food that has not been treated with preservatives, hormones or antibiotics and that has been grown without pesticides or artificial fertilizers in soil whose humus content is increased by the addition of organic matter and whose mineral content is increased by the application of natural mineral fertilizers. 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. An evaluation of the feasibility of the production of organic crops in Oklahoma would assist the producers in choosing between organic productions versus 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. Given their perishability, the level of risk associated with the production and marketing of fresh vegetables is one of the major obstacles faced by Oklahoma growers. Thus, risk analysis related to price and production issues is important for increasing the number of growers in Oklahoma. More specifically; this study has focused 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.

Comparative Studies of Organic Versus Conventional Food

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. Regarding the economic profitability of the U.S. organic crops, price premium is a key factor in giving the organic farming systems comparable or higher whole farm profits. 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

The way risk is incorporated into production analysis varies among studies. 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.

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).

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 using Target MOTAD model.

PROCEDURES

Budgeting

To accomplish the first objective, enterprise budgets for selected vegetable enterprises are developed for both organic and conventional systems. Budgets for watermelon, tomato, sweet corn, determinate and indeterminate southern peas, pickling cucumber and bell pepper 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. 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. All the budgets are standardized so as to fix some exceptions and extremities. For example in one of the three 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 cost estimates are representative of average costs for farms in Southeastern Oklahoma. Larger and smaller farms may have lower or higher costs per acre.

Price Data

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 thus taken as price in Dallas terminal market minus 30% of that price in Dallas Terminal Market.

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 separately. 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, and 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. Only the results for 9 acres are included in this paper. 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 model includes risk in a multi period approach and it fixes a static target over several years. 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. 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).

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 includes 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. The target income is the minimum income necessary to cover the fixed costs of farmers including credit repayment, and to meet his family's living costs each year.

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 for 9 acres are included in this paper.

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 1 and 2. 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.

Exactly similar types of models were run for six and fifteen acres, the results for which are not included in this paper.

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.

Results 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.

Target MOTAD Model

The typical Target MOTAD model of vegetable farms under conventional and Organic systems is constructed. 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.

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 3.

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. These results are presented in table 4.

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 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. Results are presented in table 5.

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 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 6.

The above solutions in all four cases are second-degree stochastic efficient as proved by Tauer. In each table 3, 4, 5, and 6, 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.

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 7. The break even price premium ranges between 15% to 19%.

SUMMARY AND CONCLUSIONS

For this study seven different vegetable types were selected, namely determinate and indeterminate southern pea, tomato, sweet corn, watermelon, pickling cucumber and bell pepper. 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.

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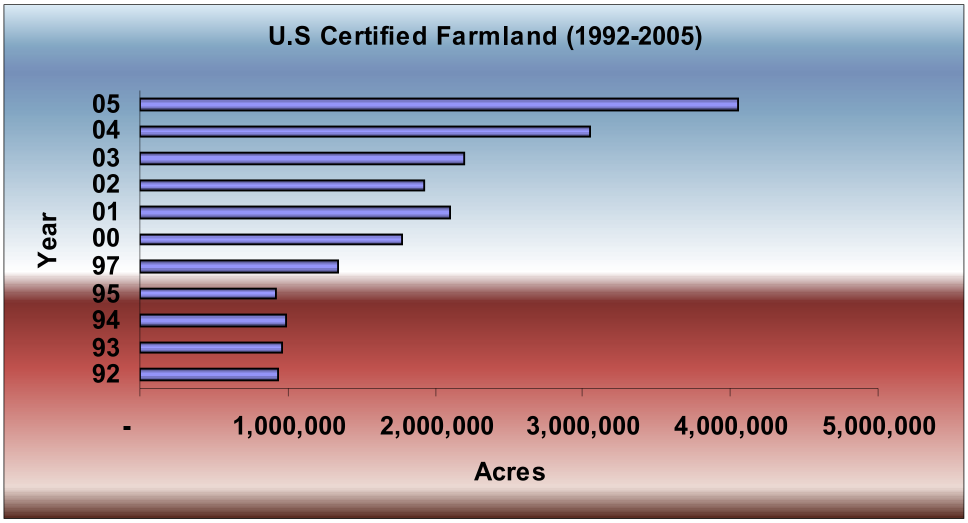
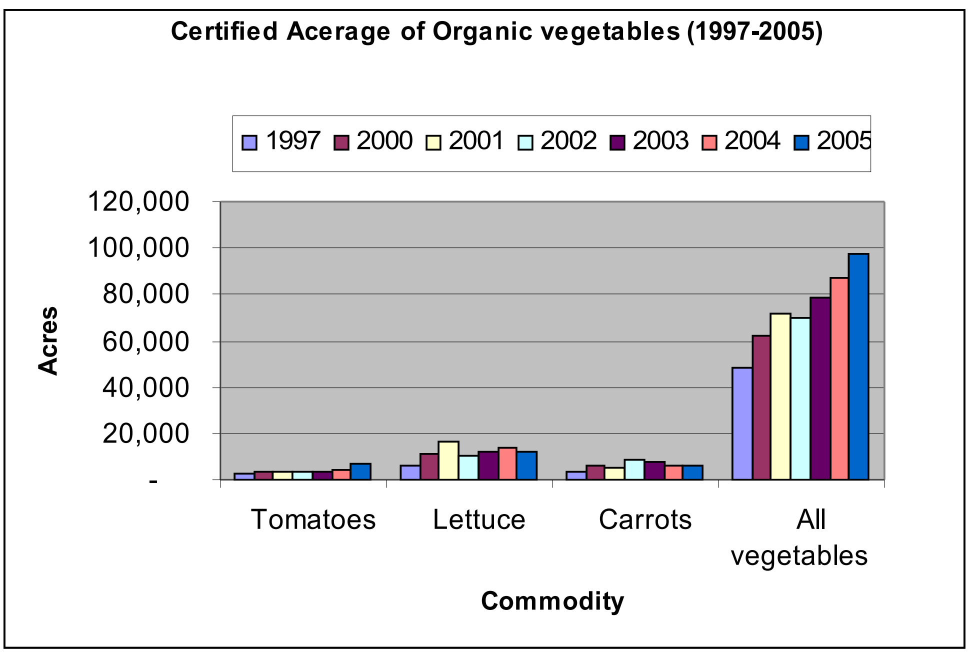
Figures

Figure 1 U.S. Certified Organic Farm Acreage (1992-2005)



Source: USDA, Economic Research Service, 2006.

Figure 2 U.S. Certified Organic Vegetables Acreage (1997-2005)



Source: National Agricultural Statistics Service, USDA

Tables

Table 1 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 2 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.

Table 3 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 4 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

Table 5 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 6 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

Table 7 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%