To Market, To Market, To Sell Some Organic Products:
The Economics of Organic Farming during the Transition Phase

by

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Executive Summary

The objective was to determine the economic and financial feasibility of organic farming during the transition phase (defined as the three-year period during which a conventionally-operated farm must switch to organic practices before it can be certified as organic). The production and yield data are based on an actual farm in North Central West Virginia operated by researchers at West Virginia University that successfully made this transition. There are three components to the farm: (a) a market garden (consisting of a combination of different vegetables that can potentially be marketed to a combination of outlets, including grocery stores, restaurants and/or directly to consumers); (b) field crops (including wheat, soybeans, and potatoes); and (c) livestock-related enterprises (sheep and grassland).

Standard economic and financial tools are employed. Enterprise budgets are used to determine the initial establishment costs and subsequent annual maintenance costs and revenues from each organic farm component. Capital investment (or capital budgeting) analysis is used to evaluate the long-term financial feasibility.

Based on conditions assumed in the budgets, preliminary analysis of the data reveals that, among the three components of the organic farm listed above, only the market garden is profitable during the transition stage. Although the other components are not economically feasible during transition, their profitability in succeeding years needs to be investigated. In addition, the other components are considered to be part of an integrated "system," and important from an ecological perspective. Other highlights of the findings are as follows:

- Preliminary analyses show that, using fairly conservative price and yield assumptions, the market garden is profitable even on a small scale (the 1/2 acre unit investigated in this study) during the transition period. A larger area will be needed if the market garden is to represent the main income source.

- A market garden can be operated profitably as a "stand-alone" activity, or as an "add-on" in conjunction with existing enterprises such as livestock (desirable, both from a diversification standpoint, and as a source of compost).

- Additional study over a longer time period is needed to reinforce these conclusions for other parts of WV (the study area). In addition, this study can be extended to investigate such aspects as the profit-risk tradeoffs of a market garden as a "stand-alone" activity versus an "add-on" activity.

The study has several implications. One implication is that risk (both production risk and market risk) is an important aspect of organic farming at the firm level as it is with all other types of farming operations. We have not factored risk into the analysis, leaving it

for subsequent research as more production data become available. Another implication is that without price premiums, any additional costs associated with organically certified operations are not likely to be offset by additional revenues from such production (in West Virginia or elsewhere) unless organic farming is accompanied by yield increases. This determination will require many more years of data than the three reflected in this study.

At the aggregate level, if adoption of organic farming becomes widespread, there will be economic development implications as well. We provide an illustration for the vegetable sector. According to WV Dept of Agriculture data, vegetable sales across the state amount to approximately $6 million annually (sales at farmers' markets, roadside stands and other forms of direct sales are probably not represented in this total; in addition, the proportion of organic sales in this total is not known). However, vegetable sales do appear to be growing over time. By virtue of its linkages with other sectors of the economy, a $1 million increase in total vegetable production (organic or otherwise), will increase total output in the state by an estimated $1.4 million annually, generate $1.8 million in income and add 36 jobs.

In addition to the economic development ramifications associated with the large scale adoption of vegetable and other organically-farmed products, information from this analysis can overcome an important barrier to entry into organic farm production and provide producers with decision-making information to guide them through the transitional phase of organic farming.

Introduction

As the demand for organic products grows, so is the interest on the part of producers in making a transition to organic farming practices. The economics of organic farming practices during the transition from conventional to organic is not well known, a void addressed by this analysis. Thus, our objective is to determine the economic and financial feasibility of organic farming during the transition phase (defined as the three-year period during which a conventionally-operated farm must switch to organic practices before it can be certified as organic). The production and yield data are based on an actual farm operated by WVU researchers in North Central West Virginia that successfully made this transition. There are three components to the farm: (a) a market garden (consisting of a combination of different vegetables that can potentially be marketed to a combination of outlets, including grocery stores, restaurants and/or directly to consumers); (b) field crops (including wheat, soybeans, and potatoes); and (c) livestock-related enterprises (sheep and grassland).

We employ standard economic and financial tools in the analysis. Enterprise budgets are used to determine the initial establishment costs and subsequent annual maintenance costs and revenues from each organic farm component. Capital investment (or capital budgeting) analysis is used to evaluate the long-term financial feasibility using measures such as net present value (NPV) and internal rate of return (IRR). Analyses such as these are important in breaking down barriers to entry into organic farm production by providing information relative to the costs of making the transition to organic methods. We begin with a brief discussion of the background and trends.

Background

Following World War I, major advances in the field of agriculture were made. Synthetic fertilizers reached the markets as a much smaller alternative to the previously utilized manures and composts (Lotter, 2003). This was followed by the onset of mechanization in agriculture, greatly increasing operational efficiencies, specifically labor efficiency. The idea of primarily using inputs to achieve higher outputs was a trend that agriculture followed religiously to achieve yields much higher than before. With this method of production have come several problems relating to sustainability in production. First and foremost, is the potential loss of viability in the soils. It is the soils that act as the single most facilitating factor in crop production. This is related to environmental problems such as excess nutrients in the soil and runoff of fertilizers into water systems. Erosion of topsoil is also contributing to a reduced level of viability in conventional systems of production. Nutrient imbalances in the soil caused by chemical fertilizers result in plants losing their ability to produce a nutritional value (Wolf, 1977). These nutrient imbalances do not foster an environment where nutrients can build up in a soil. Without this buildup, we are simply putting more and more in to get more and more out, creating artificial systems instead of interacting with the present biological systems (Zimmer, 2000).

Organic production practices are a possible solution to the soil degradation problems. Organic agriculture presents a way to work within existing ecological systems to advance

soil organic matter and long term productivity. To understand organic production, it is important to first identify what exactly "Organic Agriculture" is. Lotter (2003) defines it as:

> "*An ecological production management system that promotes and enhances biodiversity, biological cycles, and soil biological activity. It is based on minimum use of off-farm inputs and on management practices that restore, maintain, and enhance ecological harmony*" (p. 62).

By minimizing the use of off-farm inputs and enhancing the biological activity in the soil, higher operational efficiency is potentially achievable by reducing the inputs rather than by increasing them. This contradicts the conventional methodology for production by reducing the variable costs associated with higher amounts of input use (synthetic fertilizers). This improves efficiency in the exact opposite way. Whereas the conventional method seeks to expand yields above the costs of the additional inputs, the organic method reduces the need for these inputs by less than the reduction in yields, garnering additional efficiency by the difference between these two factors. This helps to alleviate the constraints to production from lack of effective allowable inputs and cost of allowable inputs as are illustrated later in this paper (Table 2) (Lotter, 2003).

Trends

In the last several years, there has been a movement toward increased adoption of organic farming practices among smaller farming operation (USDA, 1998). The small farm has been caught in a "cost-price squeeze" by larger farms due to economies of scale that allow larger farms to produce at lower costs due to the size of their operations (Kohls and Uhl, 2002). Thus, to ensure continued existence of small farms, they must differentiate between their products and those produced on large-scale production units. While there are several different value-adding processes, organic production is seen as a very popular way to add more value to the producer's goods. This popularity can be illustrated by the growth in certified organic sales by around 20% per year since at least 1992 (Lotter, 2003, p. 65). The growth is not uniform across products, as shown in Table 1.

Table 1. Organic commodity growth rates and shares of organic market for 1998 and projections for 2003

Commodity Group	Market Value ($1,000)			Share of Organic Market (%)	
	1998	2003	Avg. Annual Growth (%)	1998	2003
Produce	34486	5210	8.4	64.5	39.6
Frozen foods	400	2101	39.3	7.4	15.9
Dairy	424	2015	36.6	7.9	15.3
Bakery & cereals	201	970	36.9	3.7	7.4
Ready meals	145	758	39.2	2.7	5.8
Chilled foods	274	635	18.3	5.1	4.8
Meat and Meat Product	168	617	29.8	3.1	4.7
Baby foods	84	417	37.7	1.6	3.2
Other	112	219	14.4	2.1	1.7

Soft Drinks	60	153	20.4	1.1	1.2
Beer & Wine	46	77	10.9	0.9	0.6
Overall	**5401**	**13172**	**19.5**	**100**	**100** `

Source: Lotter (2003).

There is a differentiation between organic products and their conventionally produced counterparts from the market to the grocery store. This is in the form of higher prices and seals of certification by the USDA, state agriculture agencies, or private organic certification groups. The differentiation brings about a higher price for the greater perceived value of organic products due to the reduction in of the use of off-farm inputs, a natural approach to production, and a presumably healthier form of food. The organic labeling usually includes a seal of organic certification such as the USDA certified organic seal (Figure 1) and the Pennsylvania certified organic seal (Figure 2) shown below:

From USDA Agricultural Marketing Service
(Figure 1)

From PA Certified Organic
(Figure 2)

These goods are offered for sale through several different outlets or forums, usually involving direct marketing. Farmers' markets are one such forum. According to the USDA (2003), organic farmers represent approximately 33% of the regular attendees at farmers; markets during the 2002 season. This presence provides an outlet for new producers to market their goods without a significant level of entry fees. Farmers' markets also allow the farmer to assume marketing functions normally carried out by others and to be compensated for these activities.

It is important to identify how these practices can be used in an effective and efficient manner of production to create a product superior to conventionally produced alternatives. This is especially important in production, for if the product of an enterprise is not superior, there is no reason to produce when others hold a comparative advantage in that market. This is where organic products have a niche. Organic demand is highly attributed to consumer distrust of conventional products, i.e., a perception of higher quality attributed to organic products (Lotter, p. 69). Consumer distrust is also easily transferable to the emergence of public knowledge of the existence of genetically modified crops (GMOs) (Lotter, p. 69) and adverse publicity associated with outbreaks of bovine somatotropic encephalopathy (BSE) or "mad cow" disease. Stewardship practices employed by organic producers have also given organic agriculture a much higher value in consumer perception. The image of environmentally friendly activities can provide a way for higher prices to become acceptable to consumers.

In regards to supply of organic products, this production style does have some barriers to entry (Table 2). The largest of these is related to the allowed inputs for organic use. These

are often found in areas remote to the operations, and, in many cases, hard to find at all. The inputs are often ineffective, which presents a problem. An example of this would be the presence of only fourteen organic feed grain producers and handlers in the surrounding states of Pennsylvania, Ohio, Virginia, and North Carolina (National Organic Program, 2004). Information is the other obstacle that presents a barrier. There have not been nearly as many experiments into organic production and ways to maximize products compared to conventional research (USDA, p. 4).

Table 2. Nationally surveyed organic farmers rankings of constraints to production (adapted from Lotter, 2003)

Constraints to production	
1	Cost of allowable inputs
2	Uncooperative or uninformed extension agents
3	Distance or transport of organically allowable inputs
4	Sourcing or finding organically allowable inputs
5	Achieving desired yields
6	Information on organic practices unavailable or hard to find
7	Effectiveness of organically allowable inputs
8	Personal lack of knowledge about organic practices
9	Social pressure from other farmers or community to farm conventionally
10	Pressure from lenders to farm conventionally

In West Virginia, there are less than twenty organic farming operations and farmlands (Figure 3) (USDA, p. 4).

Methods

We employ standard economic and financial tools in the analysis (described in D'Souza, 2002, for example). Enterprise budgets are used to determine the initial establishment costs and subsequent annual maintenance costs and revenues from each organic farm component. Capital investment (or capital budgeting) analysis is used to evaluate the long-term financial feasibility using measures such as net present value and internal rate of return.

Net present value (NPV) *is defined as the discounted value of a project's net annual cash flows less the initial investment cost. Simply put, it gives the difference between returns and costs when compared in today's dollars; thus, if the NPV is zero, then the investment will exactly break even. A higher NPV indicates a more profitable investment.*

Internal rate of return (IRR) *is basically the compound interest rate of the investment. If the IRR equals the borrowing rate, then the investment will exactly break even. Like the NPV, the higher the IRR, the more desirable the investment.*

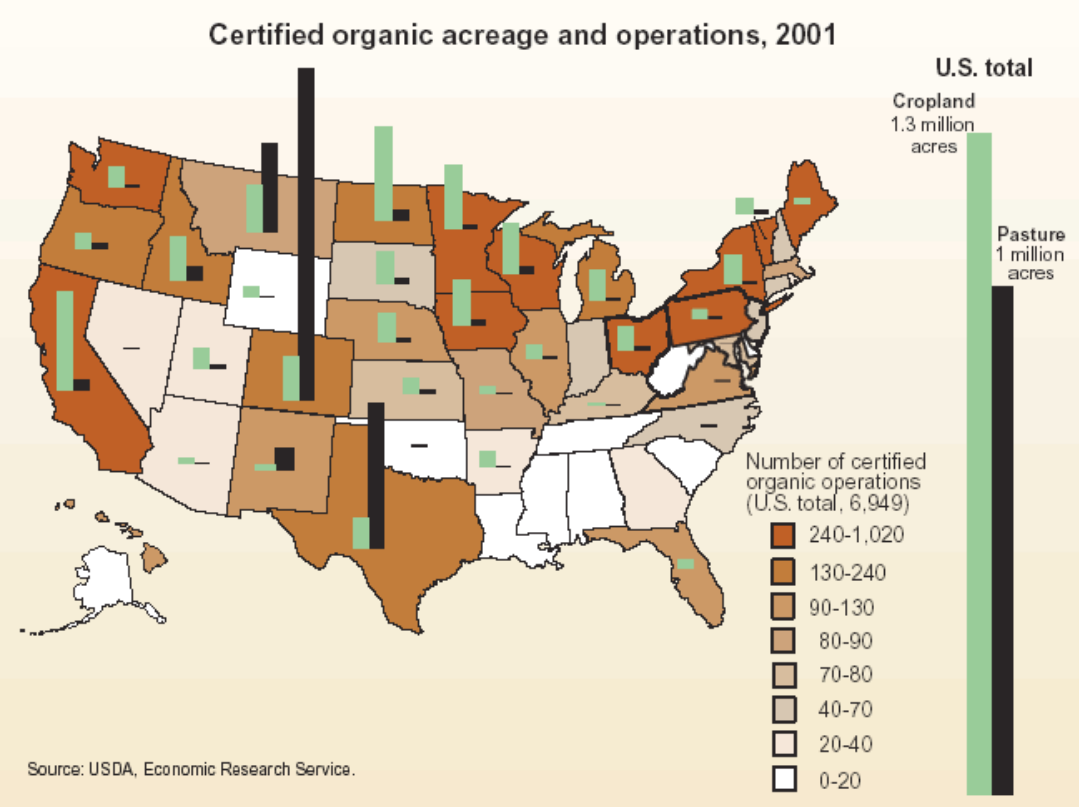

Figure 3. Prevalence of Organic Farms Across the US

A detailed description of the assumptions and procedures used in compiling the two types of enterprise budgets (an initial "establishment budget," and an annual "maintenance budget") is provided in Baer (2004).

Results

(a) Market Garden:

The establishment cost for a ½ acre unit was estimated as $10,494 (APPENDIX Table 1). Annual net returns to land and management (for this same ½ acre unit) during the transition are estimated to be $2,603 per year (APPENDIX Table 2). Based on conditions assumed in the budgets, preliminary analysis of the data reveals that the market garden is financially feasible. If we are to assume that this garden will be operated over 10 years, for example, we find that the net present value is a positive (Table 3), and the internal rate of return is fairly high (20%), both of which are desirable characteristics of an investment.

Table 3. Net Present Values for the Organic Market Garden for Different Interest Rates, ½ Acre Production Unit, 10-year Planning Horizon

Cost of Capital	Net Present Value
8%	$6,972
10%	$5,500
12%	$4,213

In addition, we investigated whether it pays to use compost in the market garden. Based on this analysis and given the crops included in the market garden trial, it appears that from an economic standpoint, it only pays to use compost for lettuce, pepper and tomatoes (APPENDIX Table 3).

(b) Field Crops :

None of the field crops (soybeans, wheat, and potatoes) is found to be profitable under either the 'low input' or the 'high input' systems (Table 4). For purposes of this analysis, low input involves the use of cover cropping while high input involves compost application. Results show that losses under the high input method are higher except for potatoes. Interestingly, potatoes presented a mixed portrait in regards to production. The high input system produced a large quantity of potatoes in the first two years of operation. Consequently, the first two years yielded a positive net return of $1,205 and $253, respectively, and a NPV of over $500 at costs of capital up to 10%. The IRR for the first two years is 69%. However, the third year of this system lead to an unusual, predominantly weather-related low production level, and, consequently, a negative net present value even at low costs of capital. Incidentally, the low-input production system for potatoes recorded a large negative NPV, indicating that low-input production is not feasible, even over the two-year production horizon during which production conditions were relatively favorable.

Table 4. Initial Establishment Costs and Annual Returns to Land and Management for Field Crops, 2000-03 (values are averaged for the 3-year transition period)

Crop	**Establishment Cost per Acre**	**Annual Per Acre Returns to Land and management**	
		(a) *Low Input* [1/]	(b) *High Input* [1/]
Wheat	$1,558	-$472	-$1,194
Soybeans	$1,558	-$273	-$783
Potatoes	$800	-$615	-$260 [2/]

[1/] the difference between low input and high input is that while the former method involves the use of cover cropping with legumes (red clover) and grasses, the latter involves the addition of composted manure.

[2/] the average for the first two years for high-input potatoes is +$729.

An implication of the results is that risk (both production risk and market risk) is an important aspect of organic farming as it is with all other types of farming operations. We have not factored risk into the analysis, leaving it for subsequent research as more production data become available. Another implication is that without price premiums, any additional costs associated with organically certified operations are not likely to be offset by additional revenues from such production (in West Virginia or elsewhere) unless organic farming is accompanied by yield increases. This determination will require many more years of data than the three reflected in this study.

Since none of the field crops yielded positive net returns when averaged over the three-year transitional period, it is not meaningful to calculate the NPVs and IRRs.

(c) Livestock Enterprises:

These include sheep (20 ewes) accompanied by 8 acres of rotationally-grazed pasture. While pasture establishment costs are relatively low (Table 5), sheep establishment costs are high. Thus, although annual per acre returns to operators' land and management for sheep production are positive ($2,500 – $2,800 depending on the type of system), the annual net returns are not sufficient to make this enterprise profitable even over a 20-year planning horizon (the NPVs for the low-input and high-input systems over a 20-year horizon were estimated at -$4,000 and -$7,000, respectively, at an 8% cost of capital; the respective IRRs are 6% and 5%). Based on the results of our analysis, for sheep production to become profitable, either price premiums need to be substantially higher and/or long-term meat+wool yields need to increase.

Table 5. Initial Establishment Costs and Annual Returns to Land and Management for Livestock Enterprises, 2003

Crop	**Establishment Cost per Acre**	**Annual Per Acre Returns to Land and management**	
		(a) *Low Input*	(b) *High Input*
Grassland (8 acres)	$802	-$272	-$58
Sheep (20 ewes)	$31,290	$2,771	$2,516

The individual enterprise budgets for establishment and maintenance corresponding to each field crop and livestock enterprise for each of the three transitional years are presented in Baer (2004).

Conclusions

Based on the conditions assumed, preliminary analysis of the data reveals that, among the three components of the organic farm listed above, only the market garden is profitable during the transition stage. Although the other components are not economically feasible during the transition to organic certification, their profitability in succeeding years (together with the associated risk level) needs to be investigated. In addition, the other

components are considered to be part of an integrated "system," and important from an ecological perspective. Other highlights of the findings are as follows:

- Preliminary analyses show that, using fairly conservative price and yield assumptions, the market garden is profitable even on a small scale (the 1/2 acre unit investigated in this study) during the transition period. A larger area will be needed if the market garden is to represent the main income source.

- A market garden can be operated profitably as a "stand-alone" activity, or as an "add-on" in conjunction with existing enterprises such as livestock (desirable, both from a diversification standpoint, and as a source of compost).

- Additional study over a longer time period is needed to reinforce these conclusions for areas other than North Central WV where the experiments were conducted. In addition, this study can be extended to investigate such aspects as the profit-risk tradeoffs of a market garden as a "stand-alone" activity versus an "add-on" activity.

One implication of the study is that risk (both production risk and market risk) is an important aspect of organic farming at the firm level as it is with all other types of farming operations. We have not factored risk into the analysis, leaving it for subsequent research as more production data become available. Another implication is that without price premiums, any additional costs associated with organically certified operations are not likely to be offset by additional revenues from such production (in West Virginia or elsewhere) unless organic farming is accompanied by yield increases. This determination will require many more years of data than the three reflected in this study.

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APPENDIX

Table 1. Estimated Establishment Costs for the Market Garden, 2000

Area: ***0.5 acres***

Crops: ***Tomatoes, Snow Peas, Bell Peppers, Green Beans, Pumpkins, Lettuce, Zucchinni, Spinach***

ITEM	UNIT	QTY	PRICE	AMOUNT	Your farm
Site Preparation (varies with site):			(S/unit)		
(a) Disking & ploughing	tract hrs	40	$12.80	$512	
(b) Bull-dozing	bull-dozing hrs	5	$58.40	$292	
(c) Compost application	tract hrs	1	$27.00	$27	
(d) Cover crop	acres	0.5	$11.30	$6	
Irrigation system (incl. pipes, labor)*				$1,766	
Tool shed (10X10) *				$750	
Tools*				$2,500	
Fencing (incl. wire, posts, gate, labor)*				$2,000	
Plastic, straw, other supplies				$454	
Cover crop (seed, machinery, labor)*				$250	
Compost	tons	5	$40.00	$200	
Labor:					
(a) Surveying & Mapping	hrs	40	$6.00	$240	
(b) Preplanting insect monitoring	hrs	26	$6.00	$156	
(c) Tree removal & hauling	hrs	58	$6.00	$348	
(d) Disking & ploughing	hrs	65	$6.00	$390	
(e) Red clover seeding	hrs	0.5	$6.00	$3	
Farm planning time*	hrs	40	$15.00	$600	
TOTAL ESTABLISHMENT COST (excluding land)				$10,494	

Assumptions:

1. Total costs are rounded off to the nearest $
2. A combination of WVU - AES experimental data, expert opinion, and informal telephone surveys (for selected input prices) is used.

* Costs are estimated where actual costs are not available

Table 2. Estimated Annual Maintenance Costs & Returns for the Market Garden, 2000

area: **0.5 acres (total)**

crops **Tomatoes, Snow Peas, Bell Peppers, Green Beans, Pumpkins, Lettuce, Zucchinni, Spinach**

ITEM	UNIT	QTY	PRICE	AMOUNT	Your Farm
ANNUAL SALES			($/unit)		
(a) tomatoes	lbs	1089	$1.25	$1,361	
(b) snow peas	lbs	116	$1.00	$116	
(c) bell peppers	lbs	151	$1.00	$151	
(d) green beans	lbs	654	$1.25	$818	
(e) pumpkins	lbs	1133	$0.27	$309	
(f) Romaine lettuce	lbs	593	$1.58	$937	
(g) iceberg lettuce	lbs	96	$1.74	$167	
(h) zucchini	lbs	3068	$1.00	$3,068	
(i) spinach	lbs	21	$2.00	$42	
Total Annual Production		6921		$6,969	
Less deer damage and spoilage (estimated)		15%		$1,045	
Total Revenue				$5,923	
OPERATING COSTS					
Seed				$100	
Straw, plastics, other supplies				$455	
Water (estmd.)				$100	
Electricity & Gasoline (estmd.)				$200	
Labor:					
(a) Planting and transplanting	hrs	18	$6.00	$108	
(b) Watering and seed preparation	hrs	9	$6.00	$54	
(c) Weeding, raking & thinig,pruning	hrs	44	$6.00	$264	
(d) Pest scouting time	hrs	10	$6.00	$60	
(e) Applying compost	hrs	30	$6.00	$180	
(f) Tilling	hrs	79	$6.00	$474	
(g) Harvesting (estmd.)	hrs	60	$6.00	$360	
Total Operating Cost				$1,500	
Interest on operating capital	%	10		$150	
Returns above operating cost				$1,350	
FIXED COSTS					
Property tax (estmd.)	acre	0.5		$300	
Interest on avg annual investment (excl. land)	%	10	$5,246.83	$525	
Repairs and depreciation	%	5	$7,920.00	$396	
Record keeping time (estmd.)	hrs	40	$15.00	$600	
Total Fixed Cost				$1,821	
TOTAL COST				$3,321	
PRE-TAX RETURNS TO LAND & OPERATORS MANAGEMENT (total revenue - total cost)				$2,603	
Break-Even Price (at current production level)				$0.48	

ASSUMPTIONS for Table 2

Average weight of	**X weight**				Total Pounds
Romaine lettuce	0.633	lb	938	#	593.4726
Iceberg lettuce	0.72	lb	133	#	95.76
Pumpkins	11	lb	103	#	1133

	cost/lb	**price unit**
Romaine lettuce	$1.58	1
Iceberg lettuce	$1.74	1.25
Pumpkins	$0.27	3

Table 3. WVU Organic Farm – Economic Comparison of Low Input vs. High Input Market Garden Treatments, 2001

(Total area: approximately 0.2 ha. or 0.5 acres)

	Low Input (Kg/plot)	High Input (Kg/plot)	Additional Cost	Additional Return	Net Return
Romaine Lettuce	53.4	73.3	$60.44	$69.17	$8.73
Iceberg Lettuce	56.6	91.2	$60.44	$132.45	$72.01
Spinach	0.9	6.8	$60.44	$25.96	($34.48)
Fall Romaine	20.9	17.9	$60.44	($10.43)	($70.87)
Peas	21.4	26.6	$60.44	$11.44	($49.00)
Green Beans	50.2	65.2	$60.44	$41.25	($19.19)
Zucchini	79.9	91.7	$60.44	$25.96	($34.48)
Pumpkins	43.7	72.4	$60.44	$17.05	($44.39)
Peppers	140.6	205	$60.44	$141.68	$81.24
Tomatoes	256.7	359	$60.44	$281.33	$220.89

Source of production data: WVU Organic Farm production records (yield data for summer/fall 2001).

Assumptions:

1. The total area of 0.2 ha. was split evenly among the 10 vegetable crops analyzed.
2. The main difference between the low input treatment and high input treatment was compost application @ 25 tons/ha. for the high input treatment.
3. Additional labor for the high input treatment was 64 hours.
4. The cost of compost assumed for this analysis is $40/ton, and the assumed cost of labor is $6/hr.