J. OF THE NORTHEASTERN AGR. ECON. COUNCIL VOL. X, NO. 1, APRIL, 1981

PRODUCTION COSTS AND RELATIVE PROFITABILITY OF ORGANICALLY GROWN VEGETABLES

PRITAM S. DHILLON AND BARBARA PALLADINO

INTRODUCTION

In recent decades modern technology has created phenomenal growth in U.S. agricultural output. Large scale farming systems and the application of scientific techniques have been largely responsible for the increased production of farm products. However, recently there has emerged a growing concern over the social costs of modern agricultural technology. Displacement of labor with little off-farm employment opportunities, concentration of agriculture in fewer hands and extensive usage of manufactured chemicals are viewed by some with alarm. The ensuing debate has drawn attention to organic farming as an alternative to modern farming.

Increased demand for organic food has also contributed to heightened interest in organic farming in recent years. The increased demand is attributed to a growing health consciousness among the public. Due to the high incidence of diet-related diseases, some consumers have become particularly careful about the food they eat. Consumption of organically produced food, especially fresh fruits and vegetables, has become very popular with these consumers. The interest in organic food is not limited to consumers only. With increasing costs of petroleum based agricultural chemicals, some farmers are seeking alternative farming systems such as organic farming that minimize the use of these inputs.

The philosophy of organic farming is to maintain and promote a "living" soil environment for plants so that decaying organic matter and natural predator-prey relationships encourage the productivity of cultivated crops. A recent study by the USDA states that organic farming is productive and efficient even though agricultural chemical use is avoided. It is not, as is often misunderstood, a return to the agriculture of the past. According to this study, there are over 20,000 organic farmers in the U.S.

Although the USDA study indicates that organic farmers produce all types of crops and animal products, in the Northeast, farmers tend to concentrate on organically grown vegetable crops for fresh markets. Conventional vegetable production relies heavily on manufactured fertilizers and pesticides, and health conscious consumers have become wary of the chemical residues left in produce. Price differentials in the produce sold at health food stores and supermarkets indicate that these consumers are willing to pay premium prices for the organic vegetables. An increasing number of small growers around metropolitan areas have realized this fact and have taken up organic production of vegetables.

In essence, rising demand for organic produce, the changing structure of input prices, and a burgeoning interest in environmental protection call for a deeper exploration of the economics of organic vegetable production.

OBJECTIVES

The purpose of this paper is to report the results of a recent study on costs and returns of producing selected vegetable crops by organic methods and compare them with costs and returns under conventional vegetable production. The estimates are expected to shed light on the structure of costs and relative profitability of organic vegetable farming.

METHODOLOGY AND DATA

The study is based on data obtained from vegetable growers in New Jersey. While there are numerous commercial fresh vegetable farms which use conventional methods of production, only 19 commercial growers using organic methods of production could be identified in the state. Typically, organic farms are much smaller in size than the conventional farms. In view of this difference, whole farm comparsions of costs and net income may not be meaningful. The best one can do is estimate and compare costs and returns for important fresh crops on a per acre or per unit basis. The effects of economies of scale may cloud the results, but hopefully, the difficulty will be largely confined to machinery and equipment costs.

A preliminary survey of the 19 organic growers indicated that their farm size ranged from 1/3 to 120 acres and only six of them produced 5 or more acres of organic vegetables. These six growers were interviewed in 1979 to obtain input and output data for the calculation of costs and returns of organically produced crops. The study focused only on the most widely planted crops of tomatoes, eggplant, peppers, cucumbers, snap beans and sweet corn.

For estimating certain cost components, a representative organic farm of 21 acres, growing an acre of each of the six vegetable crops and 15 acres of soybeans, was hypothesized. The cost and returns estimates for the conventional production of the six vegetable crops were obtained from a recent study of six commercial fresh vegetable farms using parallel methodology (Dhillon). The representative conventional farm raised fresh market vegetables on 400 acres of cropland and produced large acreages of lettuce, cabbage, onions and snap beans, and small acreages of

---

Pritam S. Dhillon and Barbara Palladino are Associate Professor and Graduate Assistant at Rutgers - The State University

several vegetable crops analyzed in this paper.

The calculation of production costs required a combination of accounting and budgeting approaches. Costs of most materials used in production were determined by using typical per acre input quantities and prices paid. Per acre machinery and equipment costs were determined by first estimating the per hour overhead and operating costs of machines on the representative farm, and then budgeting back the costs of individual operations performed on the crops. These costs were based on replacement value of machines. Labor costs were budgeted by using typical coefficients and average wage rates for agricultural workers. To obtain a complete picture of costs, a management fee at the rate of 7 percent of other costs, excluding the costs of land and packing boxes, was added in the costs. Slightly different methodologies were used for the estimation of land costs and allocation of general overhead on the organic and conventional operations. However, because of small magnitudes of these costs, this may not affect the results appreciably.

The conventional growers typically marketed their produce through an auction paying 3 percent of gross receipts as selling charges. Organic growers typically delivered their produce to several health food stores travelling an average distance of 38 miles for each trip. Farm marketing costs based on these assumptions were included in the total production costs. Alternative marketing costs based on hypothetical sales of organic produce through an auction were also estimated and used in the comparisons.

ANALYSIS AND RESULTS

Per Acre and Per Unit Costs

The estimates of per acre and per unit costs of producing the six vegetable crops with organic and conventional methods are shown in Table 1. Costs of raising tomatoes, eggplant, peppers and cucumbers with organic methods were 4 to 30 percent lower than for conventional methods. Organically grown snap beans and sweet corn cost 47 to 83 percent more than conventionally grown produce.

When yields were taken into consideration, costs per unit of output were consistently higher for the organic production. The per pound cost of producing organic vegetables exceeded the costs of conventional produce from 16 percent for eggplant to 83 percent for snap beans. For the six vegetables the mean increase was 52 percent. For most of the organic crops, the higher per pound costs were due to sharp reduction in yields. For snap beans, the higher per pound costs was due to higher per acre costs, there being no reduction in yield. For corn, the higher per pound cost was due to both factors.

Yields of tomatoes, eggplant, peppers and cucumbers were roughly one-half to three-fourths of the conventional yields. For corn, there was only a 12 percent reduction in yield. These figures reflect permanent yield losses for the organic methods of production. Of the six organic farmers, five had been practicing organic farming for 5 or more years. The reduced yields may be attributed to the lack of nutrients, absence of irrigation and greater pest damage on the organic farms. Though it is hard to assess the effect of individual factors, the comparison between snap bean and other crop yields suggests that pest damage may be a key factor. Pest problems tend to be relatively less severe for snap beans as indicated by the low expenditure on pesticides under conventional method. Hence, yield of this crop did not suffer under the organic method where chemical control was absent. On the other hand, tomatoes, eggplant, peppers and cucumbers need a greater use of pesticides as indicated by the larger expenditures under conventional production and hence, their yields declined appreciably when chemical controls were denied under the organic method.

Composition of Costs

For organic tomatoes, eggplant and cucumbers, harvesting and marketing costs were higher than the growing costs, while for the other crops the case was reverse (Table 1). Relatively large yields of the former three crops were responsible for the higher harvesting and marketing costs. This relationship between the two categories of costs of organic crops was no different from the conventionally produced crops.

Growing Costs: With the exception of eggplant and peppers, the per acre costs of growing organic crops were higher than the conventional costs. In most cases, relatively higher costs of organic fertilizer, labor and machinery were responsible for this. There were some cost savings in lime and pesticides, but they were not large enough to match the increased costs of other items. In eggplant and peppers, however, there were additional savings in the use of less expensive blocked seedlings which reduced the total growing costs of these crops below the level of conventional costs. But on a per unit of output basis, growing costs of all organic crops were consistently higher than the conventional costs.

A look at the important components of growing costs reveals that the cost of fertilizer was about two to four times higher for the organic method than the conventional method, even though the manure used in organic production was obtained without cost. The difference in fertilizer cost is mainly due to the very high cost of organic fertilizer used by the organic growers.

In conventional production, pesticides and herbicides costs ranged from 6 to 11 percent of the total costs. In organic production, no pesticides were used on peppers, snap beans and corn while only low rates of organic pesticides were applied to tomatoes, eggplant and cucumbers.

Table 1. Costs of Producing Selected Vegetables by Organic and Conventional Methods, 1979

	Tomatoes		Eggplant		Peppers		Cucumbers		Snap Beans		Sweet Corn	
	Org.	Conv.	Org.	Conv.	Org.	Conv.	Org.	Conv.	Org.	Conv.	Org.	Conv.
	Dollars Per Acre											
Growing Costs												
Lime	9	17	9	17	9	17	9	17	9	17	9	17
Fertilizer[a]	217	104	217	104	217	104	217	104	217	53	217	84
Plants/seed	450	375	51	375	119	500	11	9	85	71	26	22
Herbicides & pesticides	13	84	20	104	0	100	3	95	0	21	0	34
Cover crop seed	28	10	28	10	28	10	28	10	28	10	28	0
Labor	293	145	328	177	248	138	181	154	156	32	141	36
Machinery & equipment	180	126	157	165	172	116	201	170	179	67	178	80
Land	48	50	48	50	48	50	48	50	48	50	48	50
General overhead	25	35	25	38	25	27	25	24	25	8	25	8
Total	1,263	946	883	1,040	866	1,062	723	633	747	329	672	331
Harvesting & Mktg. Costs												
Picking and packing boxes	112	725	170	670	100	340	100	449	25	93	20	153
Labor	1,024	929	765	1,024	606	617	724	677	291	74	156	126
Machinery & equipment	230	179	316	237	153	118	344	142	70	107	107	34
Selling charges	0	117	0	110	0	72	0	97	0	24	0	18
Total	1,366	1,950	1,251	2,041	859	1,147	1,168	1,365	386	298	283	331
Management Fee	181	142	146	160	117	124	129	101	76	32	63	31
Total cost per acre, dollars	2,810	3,038	2,280	3,241	1,842	2,333	2,020	2,099	1,209	659	1,018	693
Yield per acre, pounds	14,000	25,000	20,000	33,000	9,000	15,000	22,000	28,800	4,000	4,000	6,250	7,137
Cost per pound, dollars	0.201	0.122	0.114	0.098	0.205	0.156	0.092	0.073	0.302	0.165	0.164	0.097

[a]Organic producers used 8 tons of manure free of cost and 1 ton of Fertrell Super (an organic fertilizer) costing $200/tons. For details of other cost items see Barbara A. Palladino, Commercial Organic Vegetable Farming in New Jersey: A Profile and Study of Costs and Returns, Unpublished M.S. Thesis, Rutgers - The State University, 1979; and Pritam S. Dhillon, Cost of Producing Selected Fresh Market Vegetables in South Jersey, Bulletin B-853, New Jersey Agricultural Experiment Station, 1979.

Labor costs for growing organic crops were 18 percent to fivefold greater than the conventional costs. This was due to smaller equipment and more manual operations used in organic production. Machinery costs for growing most of the organic crops were also considerably higher than the conventional costs. Partly, this was due to the special production practices followed in organic production such as hauling of manure, and partly this was due to low performence rates and generally higher per hour costs of smaller machines. The higher machinery costs resulting from the latter factor reflect diseconomies of smaller scale in organic farming.

Differences in seed and plant costs were due to different number of plants used or different types and rates of seed used or different prices paid. The differences in other growing cost items were small and were partly due to the differences in the estimating procedures used.

Harvesting and Marketing Costs: With the exception of snap beans, the per acre harvesting and marketing costs of organic crops were lower than the conventional costs. This was mainly due to savings in packing boxes and selling charges realized under the organic system. With the generally lower yields of organic crops, one may expect savings in labor and machinery costs also, but this was not true across the board. With some exceptions, the per acre labor and machinery costs were in fact higher than the conventional costs. These higher costs are a reflection of the different marketing system employed for organic produce where unpackaged produce was delivered piecemeal to several health food stores. However, this system resulted in major savings in packing boxes and sales charges which reduced the overall harvesting and marketing costs. The only exception was the organic snap beans where due to manual harvesting of beans, the per acre harvesting and marketing costs were relatively higher.

Perhaps more important than the per acre costs are the harvesting and marketing costs for per unit of output sold. On this basis, costs of organic crops were generally higher than the conventional costs. This shows that efficiency in marketing organic produce is lower than in conventional produce. To what extent the lower efficiency was due to the small scale of the organic operation and to what extent it was due to the different marketing system is not clear.

The above comparison of harvesting and marketing costs is based on the existing practices of organic growers which are quite different from the marketing system used by conventional growers. Cost comparisons based on similar marketing systems may be more meaningful. For this reason, costs for hypothetical sales of organic produce through a conventional channel, i.e., auction, were next estimated.

Harvesting and Marketing Costs with Sales Through Auction

To sell through an auction, an organic grower will have to wash his produce, package it in standard containers, haul it to the auction and pay selling charges. By using conventional growers' coefficients adjusted for a small volume, harvesting and marketing costs for the six organic crops were budgeted. The results are summarized in Table 2.

Comparison of these harvesting and marketing costs with the existing costs show that for all organic crops the per acre costs will be relatively higher when sold through an auction. The composition of these costs shows that in changing to an auction sale, though there will be a definite savings in the labor and machinery costs, the increased cost of packing boxes and sales charges would outweigh them and result in higher overall costs. The existing marketing system for organic produce does not use packaging, thus avoiding a significant expense of packing boxes. Since costs are lower under the existing marketing channel, one can conclude that for small organic growers delivering unpackaged produce to retailers is more efficient than selling it though auctions.

Comparisons between the auction based costs of organic and conventional produce show that for tomatoes, eggplant, peppers and cucumbers per acre harvesting and marketing costs are lower and for snap beans and corn, higher than the conventional costs. However, the per pound harvesting and marketing costs of all organic crops are higher than the corresponding costs of conventional produce. This difference reflects the diseconomies of scale in marketing small volumes of organic vegetables through auctions.

Net Returns Per Acre

A survey of organic growers showed that, depending upon the crop, organic growers received 47 to 102 percent higher average prices in 1978 and 1979 than conventional growers. Using the two-year average prices of organic produce as one extreme and state average prices of conventional produce as another extreme, the per acre gross revenues of organic crops were estimated. By subtracting appropriate production costs, net returns per acre under different marketing arrangements were estimated (Table 3).

With premium prices and costs based on the existing marketing system, all organic crops, except sweet corn, showed net profits which ranged from $191 to $3,520 per acre. Organic sweet corn produced a loss of $150 per acre. In comparison to conventional crops, organic tomatoes and sweet forn showed lower net returns while eggplant, peppers and cucumbers produced higher net returns. Net returns from snap beans were about equal for the two methods of production.

With the assumption of conventional prices received for organic produce and costs based on

Table 2. Estimated Costs of Producing Organic Vegetables with Hypothetical Auction Sales

Item	Tomatoes	Eggplant	Peppers	Cucumbers	Snap Beans	Sweet Corn
	----------Dollars Per Acre----------					
Growing Costs[a]	1,263	883	866	723	747	672
Harvesting & Mktg. Costs						
Picking & packing boxes	417	422	214	351	118	134
Labor	688	753	468	674	266	170
Machinery & equipment	139	179	99	154	43	33
Selling charges[b]	147	174	92	145	42	26
Total	1,391	1,528	873	1,324	469	363
Management Fee	181	146	117	129	76	63
Total Cost Per Acre	2,835	2,557	1,856	2,176	1,292	1,098

[a]See Table 1 for details.

[b]Based on gross revenue estimated with premium prices.

Table 3. Per Acre Net Returns From Organic and Conventional Produce

Crop	Price Per Pound		NET RETURNS		
			Organic Produce		Conventional Produce
	Organic	Conventional	Sold to health food store at organic prices	Sold at auction at conventional prices[a]	Sold at auction at conventional prices
			----------Dollars----------		
Tomatoes	0.350	0.236	2,090	517	2,862
Eggplant	0.290	0.170	3,520	915	2,369
Peppers	0.340	0.168	1,218	(-297)	187
Cucumbers	0.220	0.134	2,820	829	1,760
Snap Beans	0.350	0.213	191	(-424)	193
Sweet Corn	0.139	0.094	(-150)	(-502)	(-20)

[a]In estimating net returns, selling charges were adjusted for the decreased revenue at conventional prices.

hypothetical sales through an auction, only tomatoes, eggplant and cucumbers showed profits while other crops showed losses. Because of the relatively higher marketing costs and lower prices, per acre net returns were much lower than with the existing marketing pattern. Net returns were also much lower than those of conventionally produced crops.

It seems the existing price premium was adequate for the relative profitability of eggplant, peppers and cucumbers produced on small organic farms. However, for organic tomatoes and sweet corn the premium was not enough to assure their profitability over conventionally grown crops.

CONCLUSIONS

Commercial organic vegetable farms in New Jersey are typically small sized operations. In 1979, the per acre costs of producing organic tomatoes, eggplant, peppers and cucumbers on these farms were lower than the costs of conventionally grown crops. For organically grown snap beans and sweet corn, the per acre costs were relatively higher. With the exception of snap beans, yields of organic crops were less than the conventional yields. As a result, costs per unit of output for organic crops were 16 to 83 percent greater than the conventional costs.

Per acre and per unit growing costs of most organic crops exceeded the conventional growing costs. In most cases relatively higher costs of organic fertilizer, labor and machinery were responsible for the higher growing costs. On the other hand, the per acre harvesting and marketing costs of organic crops were generally less than the corresponding conventional costs. This was due to savings in the cost of packing boxes and selling charges realized under the existing marketing system where mostly unpackaged organic produce was sold to the stores. However, organic snap beans were an exception where, due to manual picking, the per acre harvesting and marketing costs were relatively higher. On the basis of per unit of output though, harvesting and marketing costs of almost all organic crops were greater than the conventional costs.

Organic growers received premium prices from the health food stores where most of the organic produce was marketed. With these prices eggplant, peppers and cucumbers produced higher per acre net returns than the conventional crops. For organic snap beans, the net returns were about the same as in the conventional case and for organic tomatoes and sweet corn, the net returns were lower than those of conventional crops. However, at the premium prices, most organic crops were profitable to produce. The only exception was corn which incurred losses. The use of an auction for selling organic produce resulted in higher marketing costs and a significant drop in the net returns. With this system, the net returns of all organic crops fell below the level of conventional net returns and about half of the crops incurred large losses. Thus, premium prices are essential not only for the relative profitability of organic crops but also for avoiding losses on several of them.

REFERENCES

Dhillon, P.S. Cost of Producing Selected Fresh Vegetables in South Jersey. Bulletin B-853, New Jersey Agricultural Experiment Station, 1979.

Palladino, Barbara A. Commercial Organic Vegetable Farming in New Jersey: A Profile and Study of Costs and Returns, Unpublished M.S. Thesis, Rutgers - The State University. 1979.

U.S.D.A., Report and Recommendations on Organic Farming, United States Department of Agriculture, 1980.