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Income Distribution Comparison of Farms With Innovative Activities: A Probabilistic Approach

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Executive Summary

Farmland and agriculture in the northeastern states are facing enormous pressure from urbanization, regulation, and increasingly competitive markets. Conventional farming is becoming more and more unprofitable and inadequate for farm viability. On the other hand, urbanization and high population density of the region have created new opportunities for the farmers to enhance farm income. In response, farmers in the region are adopting new and innovative activities in addition to conventional farming in order to strengthen the farm financial situation.

Farmers in the region are increasingly resorting to direct marketing of farm produce instead of relying on wholesale markets to sell their produce and value-added farm products. In addition to farming, they are diversifying into several directions such as producing organic products, providing farm tours and picnic areas, organizing farm festivals, and offering petting zoos for the children and their families from the surrounding urban areas. Some farmers are moving away from crop production towards more profitable alternatives such as floriculture as a way to enhance farm income.

This study examines the income-generating potential of the non-conventional farm-related activities that have been adopted by New Jersey farmers. Results of the study indicate that direct marketing by the farmer is more profitable than selling farm output through the wholesale market. Farmers in urban and suburban locations have some advantage over those located in rural communities in attaining higher income levels by adopting non-conventional farm activities. Similarly, farmers who are engaged in activities such as providing farm tours, petting zoos, farm festivals, or picnic areas are likely to attain a higher income level compared to those who do not undertake these activities.

The study also indicates that production and marketing of organic products, and direct retailing of value-added products such as jam, jelly, bread, etc., are quite effective in enhancing farm income. Similarly, farmers with greenhouses, garden centers, and other floriculture activities are likely to attain higher income levels compared to those without these facilities.

I. Introduction

Farmland and agriculture are a valuable wealth to the northeastern states in terms of both their contribution to the economy through employment and economic diversity, and through the uniqueness of the rural atmosphere they generate (Adelaja et al., 1994). During the past decade, a number of studies have found that farmers in the region are incurring financial losses and are facing a number of challenges that include but are not limited to high input costs, excessive regulatory burden, increasing competition in the output markets, and rapidly appreciating land values resulting from expansion of the industrial and service sectors (Adelaja, 1995). As more and more farmlands are being transformed from agricultural to suburban and urban uses, farmers are finding it increasingly difficult to compete with non-farming activities as their income continues to lag behind those of other activities. Policy makers in the region are searching for ways to help farmers remain economically viable through farm-related activities that will encourage them to remain in agriculture (Govindasamy and Nayga, 1996), and thereby preserve the unique lifestyle and serene atmosphere for future generations. Farmers are also trying to find ways to increase their farm income and are eager to incorporate those activities into their farm routine that contribute towards higher earnings.

Farm income is generated primarily through the sale of produce to retail and wholesale businesses. Income from retail sales comes primarily from direct marketing of produce to consumers. Several studies have found that farmers are increasingly utilizing direct marketing to consumers as a way to increase their farm income (Beierlien et al., 1986; Cartier, 1994; Govindasamy 1996[a] and 1996[b]; Henderson, 1982; Lindstrom, 1978; Nayga Jr., et al., 1995; and Schooley, et al. 1989). A recent study conducted in New Jersey indicates that average gross sales were roughly $221,000 per operation, and the direct marketing industry is valued at approximately $189 million (Nayga et al., 1994). The direct marketing channels include retail outlets such as temporary farm-stands, wagons, pick-your-own operations, greenhouses, and garden centers.

In recent years, farm operations have diversified into several innovative directions as a part of ongoing efforts to boost farm income. For instance, farmers have been trying to generate supplemental income through popular agrotourism activities. These activities include organizing farm tours, hayrides, festivals, and petting zoos, and providing picnic facilities. Such activities provide people, especially children, with educational and entertaining farm life experiences in the natural rural setting, and offer the urban population a healthy retreat from crowded cities (Adelaja, 1995). These activities utilize existing resources on the farm and do not require large additional investments or expertise on the part of the farmer. Hence, these activities offer farmers the potential to add substantially to their farm income without sizeable additional resources.

Studies on consumers' attitudes have consistently found that buyers are increasingly demanding better quality fresh fruits and vegetables, and are willing to pay premium prices for higher quality products (Connell et al., 1986; Eastwood et al., 1986; Rhodus et al., 1994). In addition, the growing awareness among consumers of health and environmental hazards associated with syn-

thetic agricultural inputs has created a demand for specialized produce (Govindasamy et al., 1997). Consumers today are demanding a safer food supply and are willing to pay a premium to ensure safety of the food items they purchase. Some farmers have taken advantage of the emerging markets for such products by providing a variety of products, such as organic produce, Integrated Pest Management (IPM) produce, and naturally ripened produce. The incorporation of new, environmentally friendly farming methods has offered farmers the opportunity to pursue high-profit production alternatives in place of conventional farming practices.

Farmers' markets are no longer limited to selling only fresh produce to consumers. Today, farmers sell various farm products, such as homemade jams, pies, bread, flower bouquets, etc., through these markets. These value-adding activities provide farmers the option to earn extra income by catering to consumers' demand (Nayga et al., 1994).

Traditionally, farm income has been modeled as a function of farm size, per acre production, output prices, farm location, and other demographics. However, as a result of the incorporation of various non-traditional profit-generating options into farming operations in recent years, farm income has become a more complex function. Today, farmers have opportunities to implement farm business diversification, product differentiation, and produce promotion to expand their market not only to increase their income but also to reduce the risk associated with the non-diversified single-business of conventional farming. Faced with increasing competitive pressure, it has become all the more important for farmers with limited resources to find and implement some innovative alternative activities that have the potential of yielding higher income, relative to average farm income, per acre of agricultural land.

This paper attempts to quantify the contribution of various innovative activities such as direct marketing, agrotourism activities, and marketing of organic and other farm related products, in addition to other factors, such as the stage of business, location, zoning, and advertising expenditure, to the farm income. A logit model is used to estimate the probability of attaining higher income relative to average farm income for each activity considered. The results of this study should help farmers choose those activities that have greater contributions to the probability of attaining high income. The study also performs a sensitivity analysis on the definition of *high income* to test the robustness of the model predictions.

II. Conceptual Framework

A logit framework is used to estimate the probability of attaining a higher income relative to average farm income by engaging in various innovative activities. The logit method is preferred to other categorical variable estimation techniques (Maddala, 1983), and is a better procedure than probit models (Amemiya, 1983) for capturing the magnitude of the effects of independent variables on qualitative dependent variables. In the logit approach, the likelihood of an activity generating a higher income (i.e., higher than average income) is modeled as a function of a set of predetermined variables. Since the dependent variable is binary in nature, a qualitative choice model is used in the analysis. The model is estimated using the maximum likelihood (ML) procedure because of the large-sample properties of consistency and asymptotic normality.

The model assumes that the probability of a farmer attaining a *high income* (in terms of sales per acre), P_i, depends on a vector of independent variables (X_{ij}'s) associated with the farmer i, and variable j and a vector of unknown parameters, β's. The dependent variable y_i is defined as a dichotomous random variable such that y_i = 1 if the income of the farmer is above some predetermined value (in dollars), and $y_i = 0$ otherwise. For the logit model, the probability of attaining *high income* (i.e., y_i = 1) is given by:

$$P_i = F(Z_i) = F(\alpha + \beta X_{ij}) = 1 / [1 + \exp(-Z_i)] \quad (1)$$

where:

$F(Z_i)$ = the value of the cumulative logistic function associated with each possible value of the underlying index Z_i.

P_i = probability that a farmer will have a high income or not, given the knowledge of various factors X_{ij}'s

exp = base of natural logarithms

Z_i = underlying index number or βX_{ij}

β = a vector of unknown parameters

α = the intercept

The underlying index number, βX_{ij}, is a linear function of the independent variables. Thus:

$$Z_i = \log[P_i/(1-P_i)] = \beta_0 + \beta_1 X_{11} + \beta_2 X_{12} + \ldots + \beta_n X_{1n} + \varepsilon \quad (2)$$

where:

i = 1, 2, …, I denotes the individual farmers

j = 1, 2, …, n represents the independent variables

Z_i = the unobserved index level or the log odds of choice for the ith observation

X_{ij} = the jth explanatory variable for the ith individual

β = the parameters to be estimated

ε = error term or disturbance term

The dependent variable in the above equation is the logarithm of the odds that a randomly chosen farmer belongs to the *high income* category. The parameters themselves do not directly represent the effects of changes in the independent variables on the probability of attaining the *high income*. Such probability changes depend on the original probability and thus on the initial values of all

the independent variables and their coefficients. In the logit model, the change in probability that $y_i = 1$ (i.e., P_i) due to a change in the independent variable, X_{ij}, is given by:

$$(P_i / X_{ij}) = [\beta_j \exp(-\beta X_{ij})] / [1 + \exp(-\beta X_{ij})] \quad (3)$$

However, when the independent variables are qualitative in nature, as is true for most of the explanatory variables included in the analysis, (P_i / X_{ij}) does not exist because the X_{ij}'s are discrete and cannot vary continuously. Hence, probability changes must be obtained by evaluating P_i at alternative values of X_{ij}. Therefore:

$$(P_i / X_{ij}) = [P(Y_i|X_{ij} = 1) - P(Y_i|X_{ij} = 0)] / [1-0] \quad (4)$$

Three different logit models are estimated corresponding to the three different income categories. The models specified are:

$$\begin{aligned} Prob_i = {} & \beta_0 + \beta_1 \text{ Tours} + \beta_2 \text{ Fest} + \beta_3 \text{ StageI} + \\ & \beta_4 \text{ stageII} + \beta_5 \text{ GOP} + \beta_6 \text{ Retail} + \\ & \beta_7 \text{ Urban} + \beta_8 \text{ RP} + \beta_9 \text{ Com} + \\ & \beta_{10} \text{ Temp} + \beta_{11} \text{ Green} + \beta_{12} \text{ Garden} + \\ & \beta_{13} \text{ PYO} + \beta_{14} \text{ C1} \end{aligned} \quad (5)$$

where:

$Prob_i$ = 1 if an individual farmer's income from per acre sales is greater than or equal to I, and 0 otherwise (where I = either $1,200, or $4,166, or $375 corresponding to the three income levels).

Tours = 1 if the farmer is engaged in activities such as organizing farm tours, hayrides, or providing picnic facilities on the farm, and 0 otherwise.

Fest = 1 if the farmer undertakes activities such as farm festivals or petting zoos for customers, and 0 otherwise.

StageI = 1 if the farm business is in the initial stage of development, and 0 otherwise.

StageII = 1 if the farm business is in the mature stage of development, and 0 otherwise.

GOP = 1 if the farmer grows and / or sells organic produce, and 0 otherwise.

Retail = 1 if the farmer sells his/her output primarily through retailing[1], and 0 otherwise.

Urban = 1 if the location of the market used by the farmer is in an urban or suburban area, and 0 otherwise.

RP = 1 if the farmer sells other value-added products such as jams, pies, flower pots etc., and 0 otherwise.

Com = 1 if the market used by the farmer is located in a commercial zone, and 0 otherwise.

Temp = 1 if the farmer retails farm products through temporary facilities such as stands, wagons, tables, etc., and 0 otherwise.

Green = 1 if the farmer retails farm products through greenhouse facilities, and 0 otherwise.

Garden = 1 if the farmer retails farm products through nursery or garden center, and 0 otherwise.

PYO = 1 if the farmer sells farm produce through pick-your-own, U-pick, choose-and-cut, or U-dig, facilities, and 0 otherwise

C1 = Annual advertising expenditure incurred by the direct marketer (a continuous variable).

At the estimation stage, one classification was eliminated from each of the independent variables defined above. The base group of farmers are those satisfying the following description: those who are not engaged in activities such as organizing farm tours, hayrides, farm festivals, or petting zoos, or providing on-farm picnic areas; whose business is in the declining stage of development; who do not grow and/or sell organic produce; who are selling their produce primarily through retail outlets; whose market is located in a rural area; who are not involved in producing and marketing value-added products such as jams, pies, bread etc.; whose market outlet is located in a noncommercial zone; who are not utilizing retail channels such as temporary stands, greenhouses, nurseries, garden centers, or pick-your-own operations; and who are not engaged in advertising.

[1] The variable is defined as 1 if more than 50 percent of the dollar value of products are marketed through retailing—indicating that the farmer is primarily a retailer and 0 otherwise.

III. Data Description

In 1992, a survey of New Jersey Direct Market farmers was conducted to collect information on characteristics of direct markets. The questionnaire was developed by Rutgers Cooperative Extension, in consultation with research personnel at the New Jersey Agricultural Experiment Station, the New Jersey Department of Agriculture, the New Jersey Farm Bureau, and the New Jersey Farmers' Direct Marketing Association. Questionnaires were mailed to 1,055 direct marketing operations in the state. Of all the questionnaires, 557 were returned. One hundred of the returned questionnaires were from businesses that were no longer in operation due to various reasons, and two were returned at a later date after compilation. However, only 370 of these questionnaires were completed properly and consistently. Hence, a total of 370 properly completed questionnaires were used in the present study.

Table 1 provides the descriptive statistics of the variables used in logit analysis. With respect to the dependent variable, Table 1 shows that about 50 percent of the responding farmers belonged to the high-income category[2]. About 43 percent of the farmers reported to have engaged in activities such as organizing farm tours, hayrides, and providing picnic areas on their farms. About 22 percent of the respondents provided activities such as farm festivals and petting zoos. Regarding the stage of development of the direct market business, about 7 percent reported to be in the initial stage, 77 percent reported to be in the growth or mature stage, and about 10 percent in the declining stage. About 42 percent of the farmers surveyed were found to be engaged in the sale of value-added products like jams, pies, etc., about 12 percent indicated that they sell organic produce, and about 79 percent of the farmers sell more than half of the dollar value of retail sales directly to consumers. About 45 percent of the respondents have their direct marketing outlets located in urban or suburban areas and about 58 percent have their sales outlets in commercial zones. About 35 percent of the respondents retail farm products through temporary facilities like farm stands, wagons, and tables. About 22 percent have greenhouses, about 13 percent have nursery or garden center facilities, and about 13 percent of the farmers have pick-your-own, U-dig, or choose-and-cut operations. The average amount spent by the participating direct marketers on advertising was $2,170 per year.

[2] A farmer is in the high income category if the income, defined as the gross sales per acre, is at least equal to $1,200.

Table 1. Descriptive Statistics of the Variables Used in Analysis

Variable			Mean	Standard Deviation
Dependent Variable				
Income (gross sales/acre) $1200			0.5081	0.5006
Income (gross sales/acre) $4166			0.2567	0.4374
Income (gross sales/acre) $375			0.7594	0.4279
Independent Variables				
Provide activities like farm tours, picnic areas, hayride (Tours)	Yes		0.43	0.4957
	No[a]		0.57	0.4957
Provide activities like festivals and petting zoo (Fest)	Yes		0.22	0.4177
	No[a]		0.78	0.4177
Stage of market business development	Initial	StageI	0.07	0.2691
	Mature	StageII	0.77	0.4159
	Decline[a]	StageIII	0.10	0.3109
Grow or sell organic produce (GOP)	Yes		0.12	0.3241
	No[a]		0.88	0.3241
Products marketed primarily through retailing (Retail)	Yes		0.79	0.4025
	No[a]		0.21	0.4025
Markets located in urban or suburban are (Urban)	Yes		0.45	0.4985
	No[a]		0.55	0.4985
Sell farm related products (RP)	Yes		0.42	0.4957
	No[a]		0.57	0.4957
Zoning of the farm market is commercial (Com)	Yes		0.58	0.4944
	No[a]		0.42	0.4944
Retail farm products through temporary facilities like stands, wagons, tables, etc. (Temp)	Yes		0.35	0.4788
	No[a]		0.65	0.4788
Retail farm products through greenhouses (Green)	Yes		0.22	0.4140
	No[a]		0.78	0.4140
Retail farm products through nursery/garden (Garden)	Yes		0.13	0.3364
	No[a]		0.87	0.3364
Retail farm products through pick-your-own, u-pick, choose-and-cut, u-dig, etc. (PYO)	Yes		0.33	0.4707
	No[a]		0.67	0.4707
Annual advertising expenditure (C1)			2170.22	5195.73

[a] Refers to omitted category in the analysis.

IV. Empirical Results

4.1. Income Distribution Analysis

In order to analyze and compare the income distribution patterns among those adopting innovative income-generating activities with those relying only on conventional farm activities, a frequency analysis is performed. The farms are divided into two groups: one group comprises of those farms that are involved in activities such as farm tours and festivals, producing and marketing organic products, marketing through temporary facilities, garden centers, greenhouses, pick-you-own facilities, etc.; the other group includes farmers not undertaking these activities. The comparison of the income distribution pattern of the two groups will help understand which of the activities yield higher returns per acre.

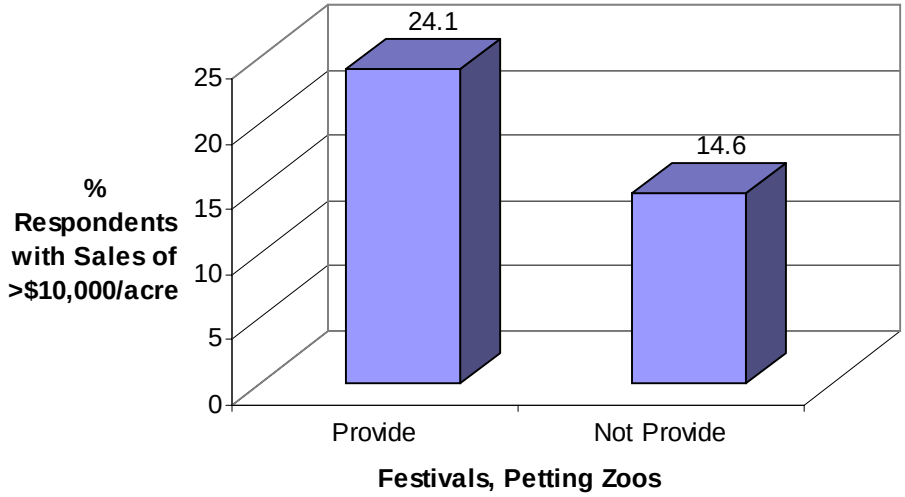
4.1.1. Comparison of Farms With and Without Festival or Petting Zoo Activities

Among the 370 farmers surveyed, only 83 farmers (20 percent) reported having festival activity on their farm, and the remaining 287 farmers (80 percent) did not undertake these activities. Among the 83 farmers who

Table 2. Income Comparison of Farms Providing Festivals and Petting Zoos

	Festivals and Petting Zoos					
	YES			NO		
Per-Acre Sales Range	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Less than $500	17	20.5	20.5	97	33.8	33.8
$500–$1000	13	15.7	36.1	46	16.0	49.8
$1001– $1500	5	6.0	42.2	29	10.1	59.9
$1501–$2000	5	6.0	48.2	17	5.9	65.9
$2001–$2500	7	8.4	56.6	18	6.3	72.1
$2501–$3000	2	2.4	59.0	1	0.3	72.5
$3001–$3500	4	4.8	63.9	9	3.1	75.6
$3501–$4000	1	1.2	65.1	4	1.4	77.0
$4001–$5000	4	4.8	69.9	14	4.9	81.9
$5001–$6000	0	0.0	69.9	2	0.7	82.6
$6001–$7000	2	2.4	72.3	2	0.7	83.3
$7001–$8000	0	0.0	72.3	3	1.0	84.3
$8001–$9000	1	1.2	73.5	2	0.7	85.0
$9001–$10,000	2	2.4	75.9	1	0.3	85.4
$10,001 or More	20	24.1	100.0	42	14.6	100.0

Figure 1. Income Distribution of Farms Providing Festivals and Petting Zoos



reported having festival activity, 36 percent had per-acre income less than $1,000. Almost 64 percent of these farmers had per-acre income below $3,500, and more than 24 percent had per-acre income of at least $10,000 (Table 2). Among the 287 farmers who did not organize festival activities or petting zoos, more than 33 percent had per-acre income below $500 and nearly 50 percent of them had less than $1,000 income per acre. Almost 75 percent of these farmers earned less than $3,500 per acre. Only about 14.6 percent of these farmers had per-acre income of at least $10,000. The frequency distribution shows that the proportion of the farmers in the *high-income* category is greater among those who organize on-farm festivals relative to those who do not (Figure 1).

4.1.2. Comparison of Farms With and Without Farm Tours, Hayrides, or Picnic Areas

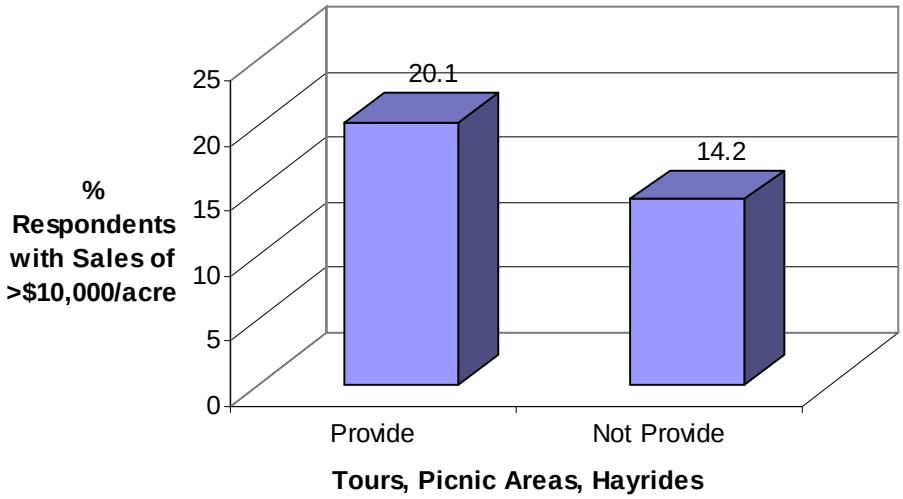
Among the 370 farmers surveyed, 159 (43 percent) reported having provided farm tours on their farms, whereas 211 farmers (57 percent) did not organize any such activity (Table 3). Among the 159 farmers providing farm tour activities, 40 percent had per-acre income below $1,000 while about 68.6 percent of these farmers had per-acre income greater than $3,500. More than 20 percent of these farmers reported having per-acre income

Table 3. Income Comparison of Farms Providing Farm Tours, Picnic Areas, or Hayrides

	Farms Providing Tours, Picnic Areas, or Hayrides					
	YES			NO		
Per-Acre Sales Range	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Less than $500	42	26.4	26.4	72	34.1	34.1
$500–$1000	22	13.8	40.3	37	17.5	51.7
$1001–$1500	13	8.2	48.4	21	10.0	61.6
$1501–$2000	9	5.7	54.1	13	6.2	67.8
$2001–$2500	13	8.2	62.3	12	5.7	73.5
$2501–$3000	2	1.3	63.5	1	0.5	73.9
$3001–$3500	8	5.0	68.6	5	2.4	76.3
$3501–$4000	5	3.1	71.7	0	0	76.3
$4001–$5000	7	4.4	76.1	11	5.2	81.5
$5001–$6000	0	0.0	76.1	2	0.9	82.5
$6001–$7000	3	1.9	78.0	1	0.5	82.9
$7001–$8000	0	0.0	78.0	3	1.4	84.4
$8001–$9000	1	0.6	78.6	2	0.9	85.3
$9001–$10,000	2	1.3	79.9	1	0.5	85.8
$10,001 or More	32	20.1	100.0	30	14.2	100.0

of at least $10,000. On the other hand, among the 211 farmers belonging to the other group, more than 34 percent had an income per-acre of less than $500 and 52 percent of them earned less than $1,000 per-acre. Almost 76 percent of these farmers had income per acre below $3,500. Only about 14.2 percent of these farmers had per-acre income of at least $10,000. The frequency distribution shows that there are proportionately more farmers in the *high-income* category among those who are involved in providing farm tour activities compared to those who are not doing the same (Figure 2).

Figure 2. Income Distribution of Farms Providing Tours, Picnic Areas, Hayrides



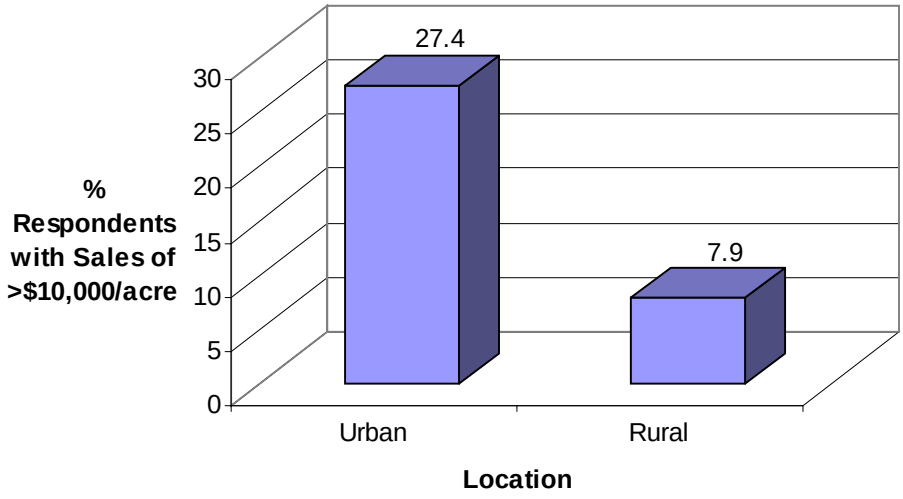
4.1.3. Comparison of Farms in Urban and Rural Areas

Among the 370 farms surveyed, 168 were located in urban or suburban areas, and the remaining 202 were in rural areas (Table 4). Among the farms located in urban areas, 19 percent had per-acre income of less than $500 and 35 percent had less than $1,000. Almost 60.7 percent of these farmers had per-acre income below $3,500, while about 27.4 percent had per-acre income of at least $10,000. Among farms located in rural areas, 56.4 percent had per-acre income below $1,000, and almost 83.2 percent earned less than $3,500 per acre. Only 7.9 percent of these farmers reported having per-acre income of more than $10,000 (Figure 3). The frequency distribution shows that there are relatively more farmers in the *high-income* category among farms located in urban areas

Table 4. Income Comparison of Farms Located in Urban vs. Rural Areas

	Farm Location					
	YES			NO		
Per-Acre Sales Range	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Less than $500	32	19.0	19.0	82	40.6	40.6
$500–$1000	27	16.1	35.1	32	15.8	56.4
$1001–$1500	13	7.7	42.0	21	10.4	66.8
$1501–$2000	11	6.5	49.4	11	5.4	72.3
$2001–$2500	12	7.1	56.5	13	6.4	78.7
$2502–$3000	2	1.2	57.7	1	0.5	79.2
$3001–$3500	5	3.0	60.7	8	4.0	83.2
$3501–$4000	3	1.8	62.5	2	1.0	84.2
$4001–$5000	9	5.4	67.9	9	4.5	88.6
$5001–$6000	1	0.6	68.5	1	0.5	89.1
$6001–$7000	2	1.2	69.6	2	1.0	90.1
$7001–$8000	3	1.8	71.4	0	0.0	90.1
$8001–$9000	1	0.6	72.0	2	1.0	91.1
$9001–$10,000	1	0.6	72.6	2	1.0	92.1
$10,001 or More	46	27.4	100.0	6	7.9	100.0

Figure 3. Income Distribution of Farms Located in Urban vs. Rural Areas



compared to those located in rural areas.

4.1.4. *Comparison of Farms With Retailing vs. Wholesaling Businesses*

Among the 370 farmers surveyed, 295 farmers reported being primarily in the farm retailing business, and the remaining 75 sold their output primarily through wholesale business (Table 5). Among the farmers engaged in retail business, 23 percent had per-acre income below $500, and 40.3 percent earned less than $1,000 per acre. Almost 69.2 percent of these farmers had per-acre income below $3,500, while only about 20 percent of them had a per-acre income of $10,000 or more. Among farmers catering primarily to the wholesale businesses, 72 percent had per-acre income of less than $1,000. Almost 88 percent of these farmers earned less than $3,500 per acre, while only 4 percent of them had per-acre income greater than $10,000 (Figure 4). The frequency distribution reveals that a greater proportion of the retailing farmers are in the *high-income* range compared to those selling primarily through wholesale markets.

4.1.5. *Comparison of Farms in Commercial and Non-Commercial Zones*

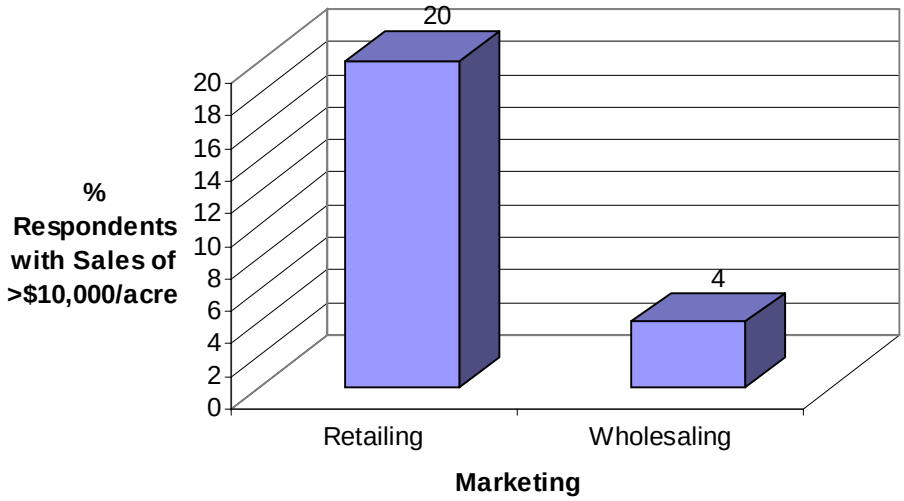
Among the 370 farmers surveyed, 214 were located in areas designated as commercial zones, and the other

Table 5. Income Comparison of Farms by Retailing vs. Wholesaling Businesses

	Farm's Primary Business					
	YES			NO		
Per-Acre Sales Range	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Less than $500	70	23.7	23.7	44	58.7	58.7
$500–$1000	49	16.6	40.3	10	13.3	72.0
$1001–$1500	28	9.5	49.8	6	8.0	80.0
$1501–$2000	19	6.4	56.3	3	4.0	84.0
$2001–$2500	25	8.5	64.7	0	0.0	84.0
$2501–$3000	3	1.0	65.8	0	0.0	84.0
$3001–$3500	10	3.4	69.2	3	4.0	88.0
$3501–$4000	5	1.7	70.8	0	0.0	88.0
$4001–$5000	17	5.8	76.6	1	1.3	89.3
$5001–$6000	1	0.3	76.9	1	1.3	90.7
$6001–$7000	4	1.4	78.3	0	0.0	90.7
$7001–$8000	2	0.7	79.0	1	1.3	92.0
$8001–$9000	2	0.7	79.7	1	1.3	93.3
$9001–$10,000	1	0.3	80.0	2	2.7	96.0
$10,001 or More	59	20.0	100.0	3	4.0	100.0

156 were located in noncommercial zones (Table 6). Among those located in commercial zones, 22.4 percent had per-acre income of less than $500, and 35.5 percent had less than $1,000 in per-acre income. More than 65 percent of these farmers had per-acre income below $3,500, while 22.4 percent had per acre income of $10,000 or more (Figure 5). For those with business located in noncommercial zones, 62.2 percent had less than $1,000 income per acre. About 83.3 percent of these farmers had per-acre income below $3,500, and only 9 percent of them earned more than $10,000 per acre. As is reflected in the frequency distribution, relatively more farmers are in the *high-income* category among those with businesses located in commercial zones compared to farm businesses located in noncommercial zones areas.

Figure 4. Income Distribution of Farms by Retailing vs. Wholesaling Business



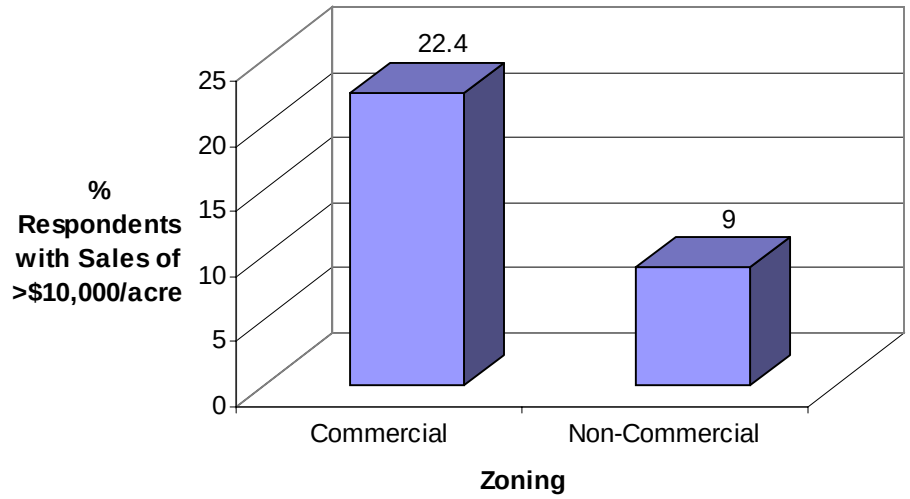
4.1.6. ***Comparison of Farms Selling Value-Added Products With Farms Selling Conventional Products***

Among the 370 farmers surveyed, 159 reported selling other value-added farm-related products, while the other 211 were not involved in any such activity (Table 7). Among the farmers selling value-added products, 16.4 percent had per-acre income below $500 and 12.6 percent had per-acre income between $500 and $1,000. Almost 58 percent of these farmers had per-acre income below

Table 6. Income Comparison of Farms by Commercial vs. Noncommercial Zoning

	Zoning by Farm Location					
	YES			NO		
Per-Acre Sales Range	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Less than $500	48	22.4	22.4	66	42.3	42.3
$500–$1000	28	13.1	35.5	31	19.9	62.2
$1001–$1500	21	9.8	45.3	13	8.3	70.5
$1501–$2000	16	7.5	52.8	6	3.8	74.4
$2001–$2500	17	7.9	60.7	8	5.1	79.5
$2501–$3000	2	0.9	61.7	1	0.6	80.1
$3001–$3500	8	3.7	65.4	5	3.2	83.3
$3501–$4000	4	1.9	67.3	1	0.6	84.0
$4001–$5000	15	7.0	74.3	3	1.9	85.9
$5001–$6000	1	0.5	74.8	1	0.6	86.5
$6001–$7000	2	0.9	75.7	2	1.3	87.8
$7001–$8000	1	0.5	76.2	2	1.3	89.1
$8001–$9000	2	0.9	77.1	1	0.6	89.7
$9001–$10,000	1	0.5	77.6	2	1.3	91.0
$10,001 or More	48	22.4	100.0	14	9.0	100.0

Figure 5. Income Distribution of Farms by Commercial vs. Noncommercial Zoning



those who do not sell other related items in their farm businesses (Figure 6).

4.1.7. *Comparison of Farms That Sell Organic Produce With Farms That Do Not Sell Organic Produce*

Among the 370 farmers surveyed, 328 farmers reported not selling any organic produce; only 42 reported being involved in the production and sale of organic produce (Table 8). Among those not selling any organic produce, 45.7 percent had less than $1,000 income per acre, and 72.9 percent of these farmers earned less than $3,500 per acre. Only 16.5 percent of these farmers had per-acre income of $10,000 or more. Among the 42 farmers selling organic produce, 26.2 percent had per-acre income of less than $500 and 54.8 percent of them earned less than $1,000 per acre. Almost 73.8 percent of them had per-acre income below $3,500. On the other hand, only about 19 percent of these farmers had per-acre income of $10,000

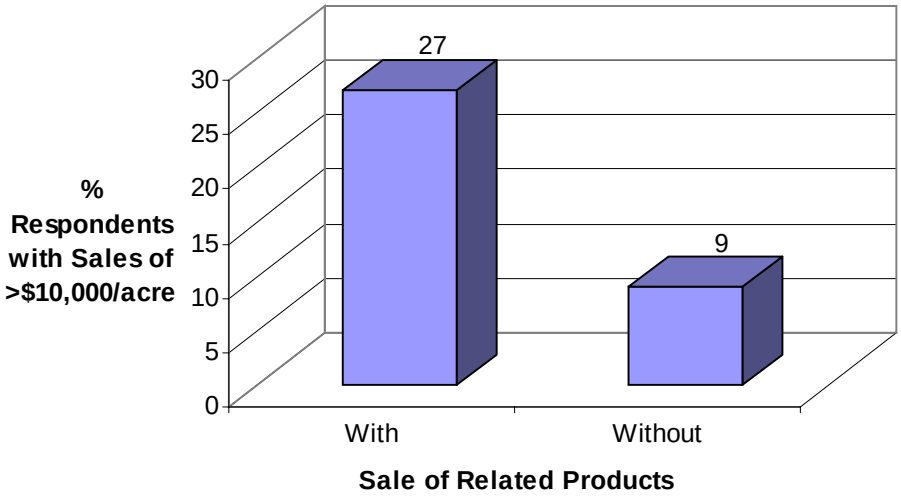
$3,500, while about 27 percent of them earned $10,000 or more per acre. Among the farmers not involved in production and sales of value-added products, 60.2 percent had less than $1,000 in income per acre and 84.4 percent of them earned less than $3,500 per acre. Only 9 percent of farmers had per-acre income of $10,000 or more. The frequency distribution shows that there are more farmers in the *high-income* range categories among those selling other related farm products compared to

Table 7. Income Comparison of Farms Selling Related Products

	Farms that Sell Related Products					
	YES			NO		
Per-Acre Sales Range	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Less than $500	26	16.4	16.4	88	41.7	41.7
$500–$1000	20	12.6	28.9	39	18.5	60.2
$1001–$1500	14	8.8	37.7	20	9.5	69.7
$1501–$2000	12	7.5	45.3	10	4.7	74.4
$2001–$2500	12	7.5	52.8	13	6.2	80.6
$2501–$3000	1	0.6	53.5	2	0.9	81.5
$3001–$3500	7	4.4	57.9	6	2.8	84.4
$3501–$4000	4	2.5	60.4	1	0.5	84.8
$4001–$5000	10	6.3	66.7	8	3.8	88.6
$5001–$6000	1	0.6	67.3	1	0.5	89.1
$6001–$7000	4	2.5	69.8	0	0.0	89.1
$7001–$8000	2	1.3	71.1	1	0.5	89.6
$8001–$9000	2	1.3	72.3	1	0.5	90.0
$9001–$10,000	1	0.6	73.0	2	0.9	91.0
$10,001 or More	43	27.0	100.0	19	9.0	100.0

or more. The frequency distribution reflects that the income distribution patterns are not very different between the two groups of farmers, although the sample size of organic producers is small compared to that of the other group (Figure 7).

Figure 6. Income Comparison of Farms Selling Related Products



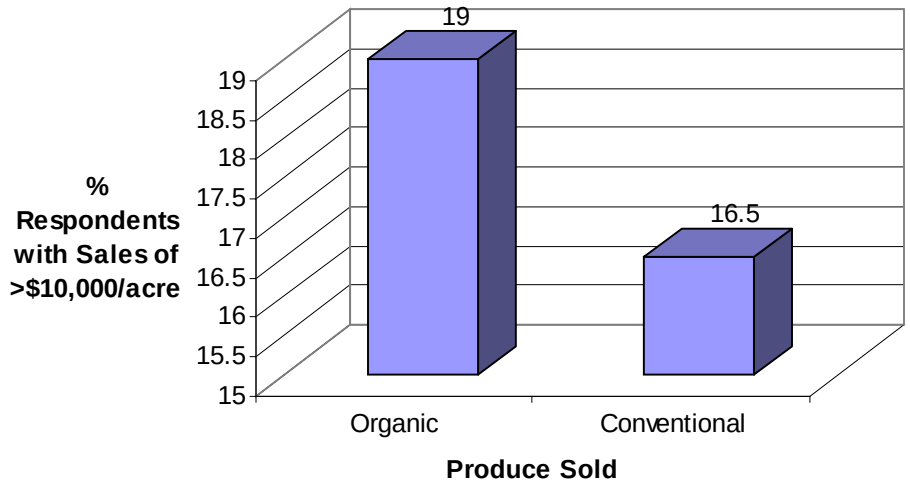
4.1.8. *Comparison of Farms With and Without Temporary Direct Marketing Facilities*

Among the 370 farmers surveyed, 239 farmers (65 percent) reported not having any temporary facilities, while 131 (35 percent) reported having these facilities for marketing their products (Table 9). Among the first group of farmers, more than 29 percent had an income per acre of less than $500 and 43 percent had per-acre income of less than $1,000. Almost 67.8 percent of them fell in the (per-acre) income range of less than $3,500, while about 21.3 percent among them reported per-acre income of $10,000 or more. For those farmers who reported having temporary facilities, 53 percent had an income per acre of less than $1,000. Almost 82.4 percent of these farmers fell in the income range of less than $3,500 per acre, but only 8.4 percent reported a per-acre income of $10,000 or more. The frequency distribution shows that there are proportionately more farmers without temporary facilities in the *high-income* category compared to those with temporary facilities (Figure 8).

Table 8. Income Comparison of Farms Selling Organic Produce

	Farms that Sell Organic Produce					
	YES			NO		
Per-Acre Sales Range	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Less than $500	11	26.2	26.2	103	31.4	31.4
$500–$1000	12	28.6	54.8	47	14.3	45.7
$1001–$1500	1	2.4	57.1	33	10.1	55.8
$1501–$2000	1	2.4	59.5	21	6.4	62.2
$2001–$2500	5	11.9	71.4	20	6.1	68.3
$2501–$3000	0	0.0	71.4	3	0.9	69.2
$3001–$3500	1	2.4	73.8	12	3.7	72.9
$3501–$4000	0	0.0	73.8	5	1.5	74.4
$4001–$5000	0	0.0	73.8	18	5.5	79.9
$5001–$6000	0	0.0	73.8	2	0.6	80.5
$6001–$7000	0	0.0	73.8	4	1.2	81.7
$7001–$8000	1	2.4	76.2	2	0.6	82.3
$8001–$9000	1	2.4	78.6	2	0.6	82.9
$9001–$10,000	1	2.4	81.0	2	0.6	83.5
$10,001 or More	8	19.0	100.0	54	16.5	100.0

Figure 7. Income Distribution of Farms Selling Organic Produce



than $1,000 in per-acre income. More than 80 percent of the farmers earned per acre income of less than $3,500, while only 10.2 percent of them had more than $10,000 in per-acre income (Figure 9). For farmers with garden centers, only 10.4 percent had per-acre income below $1,000, and 25 percent fell in the income range of less than $4,000 per acre. About 60.4 percent of these farmers reported having income per acre of more than $10,000. The frequency distribution shows that a larger proportion of the farmers having a garden center on their farms belongs to the *high-income* category compared to those without any garden center on their farms.

4.1.9. ***Comparison of Farms With and Without Direct-Marketing Garden Centers***

Among the 370 farmers surveyed, 322 farmers (87 percent) reported not having any garden centers on their farms, while 48 farmers (13 percent) reported having some kind of garden center (Table 10). Among the farmers not having any garden center, 34.5 percent had per-acre income below $500 and 52.2 percent had less

4.1.10. ***Comparison of Farms With and Without Greenhouse Direct Marketing Facilities***

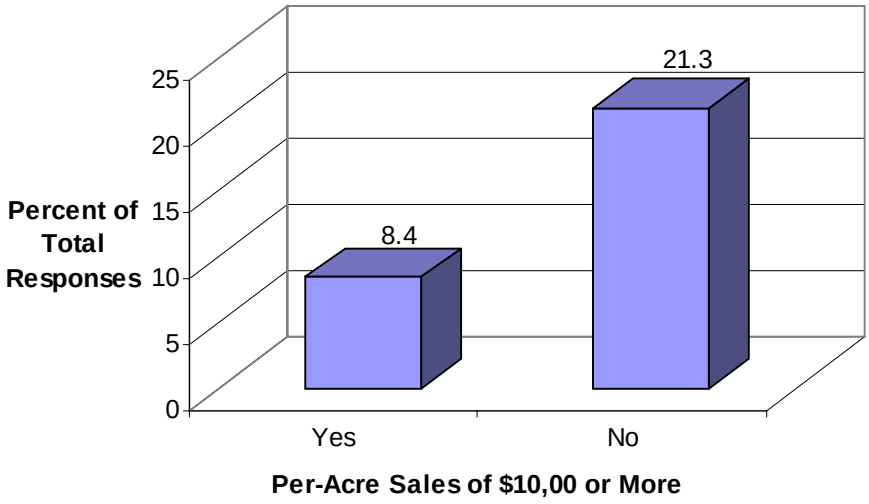
Among the 370 farmers surveyed, 289 farmers (78

Table 9. Income Comparison of Farms With Temporary Direct Marketing Facilities

	Farms With Temporary Facilities					
	YES			NO		
Per-Acre Sales Range	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Less than $500	44	33.6	33.6	70	29.3	29.3
$500–$1000	26	19.8	53.4	33	13.8	43.1
$1001–$1500	9	6.9	60.3	25	10.5	53.6
$1501–$2000	5	3.8	64.1	17	7.1	60.7
$2001–$2500	20	15.3	79.4	5	2.1	62.8
$2501–$3000	1	0.8	80.2	2	0.8	63.6
$3001–$3500	3	2.3	82.4	10	4.2	67.8
$3501–$4000	2	1.5	84.0	3	1.3	69.0
$4001–$5000	6	4.6	88.5	12	5.0	74.1
$5001–$6000	0	0.0	88.5	2	0.8	74.9
$6001–$7000	1	0.8	89.3	3	1.3	76.2
$7001–$8000	1	0.8	90.1	2	0.8	77.0
$8001–$9000	1	0.8	90.8	2	0.8	77.8
$9001–$10,000	1	0.8	91.6	2	0.8	78.7
$10,001 or More	11	8.4	100.0	51	21.3	100.0

percent) reported not having greenhouse facilities on their farms and 81 (22 percent) reported having these facilities on the farms (Table 11). Among those without greenhouses, 35.3 percent had an income per acre of less than $500 and 52.9 percent had an income of less than $1,000 per acre. About 80.6 percent of these farmers fell in the income range of less than $3,500 per acre, while only 10 percent had a per-acre income of $10,000 (Figure 10). For farmers with greenhouse facilities, 24.7 percent had less than $1,000 in per-acre income and 45.7 percent of them earned below $3,500 per acre. However, 40.7 percent of the farmers with greenhouse facilities reported per-acre income $10,000 or more. The frequency distribution shows that there are more farmers in the *high-income* category among those with greenhouses on their farms compared to those without these facilities.

Figure 8. Income Distribution of Farms with Temporary Direct Marketing Facilities



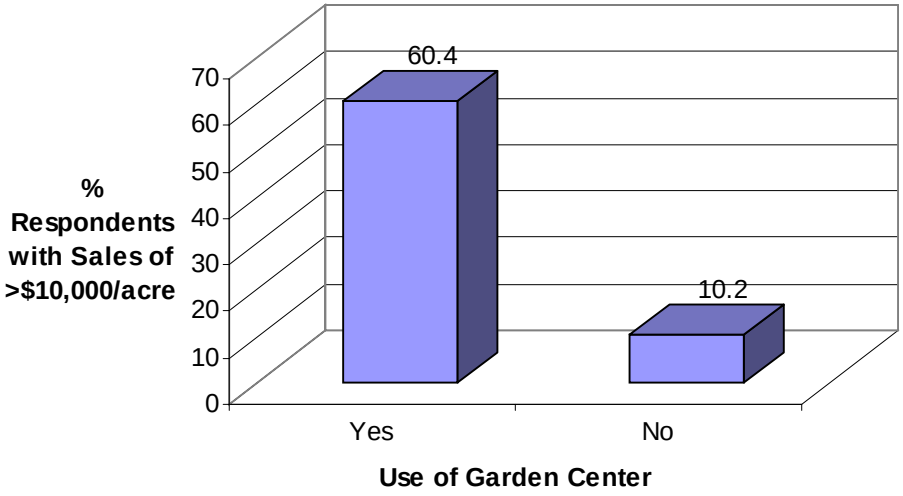
4.1.11. ***Comparison of Farms With and Without Pick-Your-Own, U-Pick, or Choose-and-Cut Direct Marketing Facilities***

Among the 370 farmers surveyed, 248 farmers (67 percent) reported not having any kind of pick-your-own operation, and 122 (33 percent) had these operations on their farms. (Table 12). Among the farmers without any such operation, more than 26.6 percent had per-acre income below $500 and 42.7 percent had less than $1,000 in income per acre. Almost 67.3 percent of them fell in the

Table 10. Income Comparison of Farms With Garden Centers

	Farms That Have Garden Centers					
	YES			NO		
Per-Acre Sales Range	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Less than $500	3	6.3	6.3	111	34.5	34.5
$500–$1000	2	4.2	10.4	57	17.7	52.2
$1001–$1500	2	4.2	14.6	32	9.9	62.1
$1501–$2000	2	4.2	18.8	20	6.2	68.3
$2001–$2500	1	2.1	20.8	24	7.5	75.8
$2501–$3000	1	2.1	22.9	2	0.6	76.4
$3001–$3500	0	0.0	22.9	13	4.0	80.4
$3501–$4000	1	2.1	25.0	4	1.2	81.7
$4001–$5000	1	2.1	27.1	17	5.3	87.0
$5001–$6000	0	0.0	27.1	2	0.6	87.6
$6001–$7000	1	2.1	29.2	3	0.9	88.5
$7001–$8000	1	2.1	31.3	2	0.6	89.1
$8001–$9000	1	2.1	33.3	2	0.6	89.8
$9001–$10,000	3	6.3	39.6	0	0.0	89.8
$10,001 or More	29	60.4	100.0	33	10.2	100.0

Figure 9. Income Distribution of Farms With Garden Centers



income range of less than $3,500 per acre, while about 21.4 percent reported having a per-acre income of $10,000 or more (Figure 11). For the farmers who reported having these operations, 55 percent had a per-acre income of less than $1,000. Almost 84.4 percent of these farmers earned less than $3,500 per acre, and only 7.4 percent reported a per-acre income of more than $10,000. The frequency distribution shows that there are relatively more farmers in the *high-income* category among those without any pick-your-own type facilities compared to those who have these arrangements on their farms.

4.2 Logit Analysis

This section presents the results of a logit analysis that attempts to estimate the probability of attaining *high income levels* by incorporating various non-traditional *innovative* activities into the farm routine. In order to estimate the logit model, farmers are classified into three different income categories on the basis of dollar values of **gross farm income per acre**. The variable 'gross income' per acre used in the analysis is discrete in nature. This is because the questionnaire asked farmers to identify themselves within one of the various predefined income ranges. The decision not to ask farmers to state their income in exact dollars was made because such questions tend to reduce participation. In addition, farmers are often unwilling or unable to report their

Table 11. Income Comparison of Farms With Greenhouses

	Farms That Have Greenhouses					
	YES			NO		
Per-Acre Sales Range	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Less than $500	12	14.8	14.8	102	35.3	35.3
$500–$1000	8	9.9	24.7	51	17.6	52.9
$1001–$1500	8	9.9	34.6	26	9.0	61.9
$1501–$2000	5	6.2	40.7	17	5.9	67.9
$2001–$2500	2	2.5	43.2	23	8.0	75.8
$2501–$3000	0	0.0	43.2	3	1.0	76.8
$3001–$3500	2	2.5	45.7	11	3.8	80.6
$3501–$4000	2	2.5	48.1	3	1.0	81.7
$4001–$5000	4	4.9	53.1	14	4.8	86.5
$5001–$6000	1	1.2	54.3	1	0.3	86.9
$6001–$7000	0	0.0	54.3	4	1.4	88.2
$7001–$8000	1	1.2	55.6	2	0.7	88.9
$8001–$9000	1	1.2	56.8	2	0.7	89.6
$9001–$10,000	2	2.5	59.3	1	0.3	90.0
$10,001 or More	33	40.7	100.0	29	10.0	100.0

income in exact dollar figures. Even when they report exact income, such figures are often not reliable. Since the dependent variable is discrete in nature, a limited dependent variable approach is used in the econometric analysis.

Gross income per acre is defined as the dollar value of sales per acre. The cutoff points for the three income groups are selected such that they represent the median value, the 75th percentile value, and the 25th percentile value of gross sales per acre for all 370 respondents. Hence, the base model defines farmers with a gross income greater than or equal to $1,200 per acre as in the *high-income* category, and those below $1,200 per acre as in the *low-income* category. This model is referred to as the *high-income model*. Two other logit models are estimated where *high income* is defined at a different level of gross income per acre. In particular, the *narrow-range high-income* model defines a farmer with per acre gross income greater than or equal to $4,166 as high income category. The *broad-range high-income* model classifies a farmer in the *high-income* category if the gross income per acre is at least $375. In each model, a farmer is classified in the *low-income* category if the gross farm income per acre falls below the definition of the *high-income* category for the respective model.

Agrotourism activities are grouped under two variables on the basis of how much additional investments are needed to set up these facilities. Activities such as

Figure 10. Income Comparison of Farms With Greenhouses

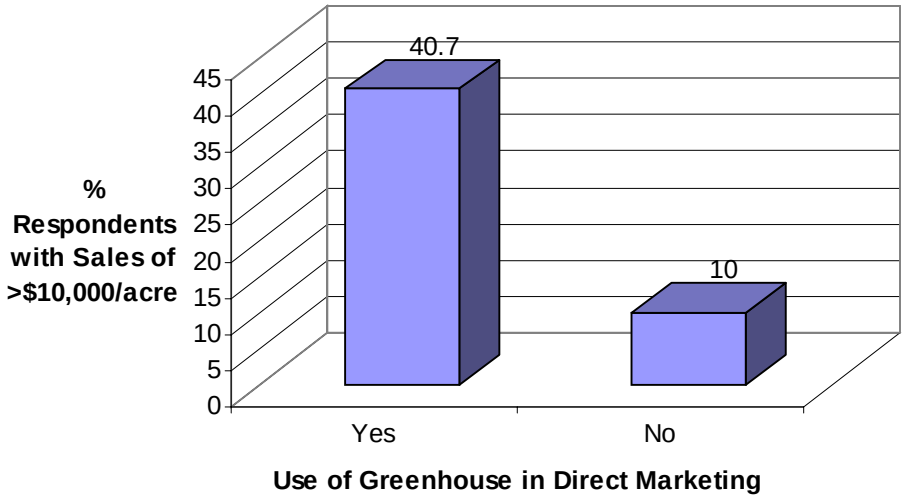
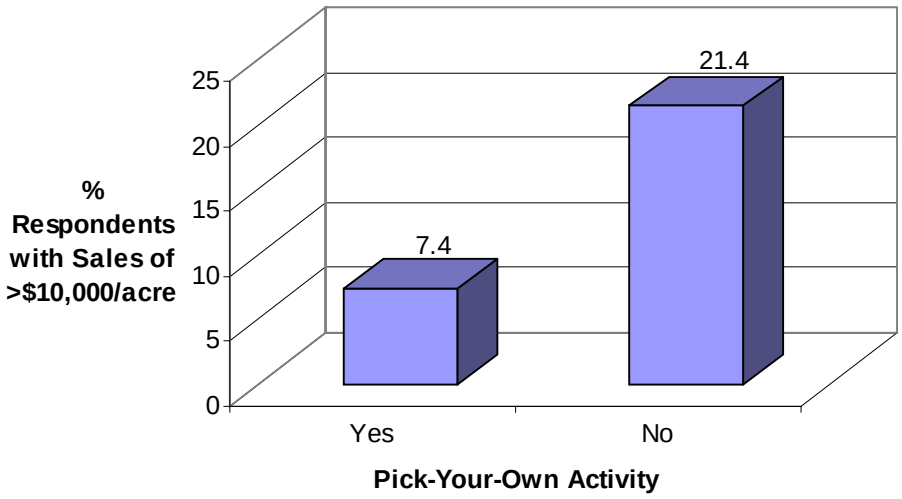


Table 12. Income Comparison of Farms With Pick-Your-Own Activity

	Farms Providing Pick-Your-Own Activity					
	YES			NO		
Per-Acre Sales Range	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Less than $500	48	39.3	39.3	66	26.6	26.6
$500–$1000	19	15.6	54.9	40	16.1	42.7
$1001–$1500	8	6.6	61.5	26	10.5	53.2
$1501–$2000	9	7.4	68.9	13	5.2	58.5
$2001–$2500	11	9.0	77.9	14	5.6	64.1
$2501–$3000	2	1.6	79.5	1	0.4	64.5
$3001–$3500	6	4.9	84.4	7	2.8	67.3
$3501–$4000	2	1.6	86.1	3	1.2	68.5
$4001–$5000	4	3.3	89.3	14	5.6	74.2
$5001–$6000	0	0.0	89.3	2	0.8	75.0
$6001–$7000	1	0.8	90.2	3	1.2	76.2
$7001–$8000	0	0.0	90.2	3	1.2	77.4
$8001–$9000	1	0.8	91.0	2	0.8	78.2
$9001–$10,000	2	1.6	92.6	1	0.4	78.6
$10,001 or More	9	7.4	100.0	53	21.4	100.0

Figure 11. Income Distribution of Farms With Pick-Your-Own Activity



organizing farm tours and hayrides and providing on-farm picnic areas are grouped under the variable 'Tours.' These activities require very little additional investment in infrastructure, as they mostly utilize on-farm resources. On the other hand, facilities such as festivals, petting zoos, etc., require relatively more additional investments by farmers in terms of establishment, care, and maintenance. Therefore, these activities are separated from others (included in the variable 'Tours') and are grouped together under the variable 'Fest.'

4.2.1. *The Base High-Income Model*

The maximum likelihood estimates for the logit model for the base high-income model (where the cut-off point for high income is set at $1,200 per acre in gross farm income) are presented in Table 13. The results show that farmers who sell their produce primarily through retailing are 31 percent more likely to be in the high-income category compared to those not engaged in direct retailing to consumers. This may be explained by the fact that direct retailing to consumers eliminates the middlemen from the produce business. By selling directly to the consumers, farmers keep for themselves what the consumers pay for their output. By eliminating the middlemen's commissions, farmers receive a higher net price and thereby earn higher profits. The results further indicate that farmers with markets in the urban and suburban areas are 12 percent more likely to be in the high-income category compared to those with markets in the rural areas. Similarly, farmers with farms located in areas with commercial zoning are 16 percent more likely to be in the high-income category than those in noncommercial zones because of the same reason. This is perhaps due to the fact that there is a higher demand for fresh produce in the densely populated urban and suburban areas, and areas with commercial

Table 13. Maximum Likelihood Estimates of the Logit Model for Base High Income Model (Gross income ≥ $1200/acre)

Variable	Estimate	SE	Change in Probability[a]
Intercept	-2.1648[b]	0.5053	-0.5372
Tours	0.2708	0.3073	0.0672
Fest	0.4693	0.3795	0.1164
Stage I	0.0364	0.5776	0.0090
Stage II	0.1814	0.3788	0.0450
GOP	-0.2604	0.3912	-0.0646
Retail	1.2495[b]	0.3784	0.3100
Urban	0.4930[b]	0.2653	0.1223
RP	0.6235[b]	0.2830	0.1547
Com	0.6683[b]	0.2717	0.1658
Temp	-0.2325	0.2769	-0.0576
Green	0.5647	0.3776	0.1401
Garden	1.9843[b]	0.6234	0.0423
PYO	-0.9311[b]	0.3322	-0.2310
CI	0.000063	0.000049	0.00001559
McFadden's R^2	0.22		
Ratio[c]	0.51		

[a] Equal to the product of the parameter estimates times the value of the logistic density function (B*F(z)). At the sample means, the value of the density function [F(z)] is 0.24815 while the value of z is -0.17256.
[b] Indicates statistical significance at the 0.10 level.
[c] Ratio of non-zero observations to the total number of observations.

Table 14. Prediction Success of the Logit Model for Base High-Income Model (Gross Income ≥ $1200/acre).

		Predicted	
		0	**1**
Actual	**0**	110	54
	1	51	119

Number of right predictions = 229
Percent of right predictions = 68.6

zones. Being closer and conveniently located to the markets with higher demand allows these farmers to sell their fresh produce at a relatively higher price compared to those serving the markets in rural areas. Similarly, farmers who sell other value-added products such as jams, pies, bread, etc., are 15 percent more likely to be in the high-income category compared to those who do not sell any such products in addition to conventional farm products.

The estimated results also suggest that farmers using direct marketing arrangements such as pick-your-own (PYO) are less likely to be in the high-income category. Specifically, the probability that a farmer with PYO operation would attain a gross farm income of $1,200 per acre is 23 percent less than for those without the PYO arrangement. The returns from such operations are not cash intensive, as these operations are available for only a certain period of the year. Also, these arrangements are used to sell only selected seasonal products, and consumer participation depends primarily on weather conditions. On the other hand, it can be seen from Table 13 that farmers employing direct marketing facilities like nurseries or garden centers are more likely to be in the high-income category compared to those without these facilities. Relative to conventional farming, these facilities require higher levels of capital investment, and additional care and maintenance. However, they allow farmers to produce specialty cash crops that can be sold at a premium price (i.e., at a higher profit margin), and thereby help the producer attain a higher income level by earning high rates of return on investments.

The goodness of fit for the model is shown by the McFadden's R^2 of 0.22. The extent of prediction is shown in the classification table (Table 14). Approximately 68.6 percent of the survey participants were correctly classified as either high-income earners or low-income earners by the estimated logit model.

V. Sensitivity Analysis

The base high-income model classifies a farmer with per-acre gross farm income of $1,200 or more in the high-income category. The cutoff point of $1,200 per acre is chosen because it represents the average per-acre farm income of the survey respondents. The robustness of the model is examined by setting a narrow-range high-income group and broad-range high-income group. The narrow-range high-income model sets the minimum cut-off point for high-income classification at $4,166 in gross farm income per acre, whereas the broad-range high-income model classifies a farmer with per-acre gross income of $375 or more in the high-income category. The sensitivity analysis is conducted to examine the extent to which the predictions of the estimated logit model change with the change in the definition of the high-income category.

5.1. Narrow-Range High-Income Model

The maximum likelihood estimates for the logit model for the narrow-range high-income specification are presented in Table 15. The results indicate that farmers who provide agrotourism activities such as festivals and petting zoos are 12 percent more likely to be in the narrow-range high-income group compared to those who do not participate in these activities. Similarly, farmers who sell their products primarily through direct retailing are 14 percent more likely to be in the narrow-range high-income category compared to those who are not primarily retailers. This probability estimate is less than half of the estimated probability for a predominantly retailing farmer to be in the high-income group in the base model (14 percent in the narrow-range high-income model vs. 31 percent in the base high-income model). This suggests that direct retailing contributes much more towards attaining the base high-income range rather than the narrow high-income range. The results further indicate that farmers with markets in the urban and suburban areas are 12 percent more likely to be in the narrow-range high-income category, compared to farmers with markets in rural areas. This prediction is similar to that obtained in the base high-income model. Table 15 further shows that farmers who sell value-added products such as jams, pies, bread, etc., are 8 percent more likely to be in the narrow-range high-income category than those who do not. Thus, the probability of attaining a per-acre gross income of $4,166 is about half of that for attaining a per-acre gross income of $1,200 by selling other farm-related value-added products (i.e., 8 percent vs. 15 percent).

The estimated parameters of the model suggest that farmers with direct marketing facilities which are temporary in nature, such as stands, wagons, tables, etc., are 11 percent less likely to be in the narrow-range high-income category compared to those who do not utilize such facilities. This may be due to the fact that farmers employing such temporary facilities sell only seasonal produce and are limited to small local areas. The estimated coefficient of this variable is not statistically significant in the base high-income model. Marketers with pick-your-own, choose-and-cut, or U-dig facilities are 27 percent less likely to be in the narrow-range high-income category compared to those who do not have such operations. This result is very similar to the one obtained for this variable in the base high-income model. On the other

Table 15. Maximum Likelihood Estimates of the Logit Model for Narrow-Range High-Income Model (Gross income ≥ $4166/acre).

Variable	Estimate	SE	Change in Probability[a]
Intercept	-2.9935[b]	0.6670	-0.4113
Tours	-0.5094	0.3679	-0.0699
Fest	0.9255[b]	0.4711	0.1271
Stage I	0.1480	0.7523	0.0203
Stage II	-0.2008	0.4803	-0.0275
GOP	0.1108	0.4732	0.0152
Retail	1.0745[b]	0.4923	0.1476
Urban	0.9038[b]	0.3377	0.1241
RP	0.6377[b]	0.3487	0.0876
Com	0.4818	0.3688	0.6619
Temp	-0.8062[b]	0.3796	-0.1107
Green	0.9232[b]	0.3937	0.1268
Garden	2.7548[b]	0.5414	0.3784
PYO	-2.0178[b]	0.5111	-0.2772
CI	0.000038	0.000034	0.0000052049
McFadden's R^2	0.35		
Ratio[c]	0.25		

[a] Equal to the product of the parameter estimates times the value of the logistic density function (B*F(z)). At the sample means, the value of the density function [F(z)] is 0.1373 while the value of z is -1.6256.
[b] Indicates statistical significance at the 0.10 level.
[c] Ratio of non-zero observations to the total number of observations.

hand, the results indicate that farmers who employ direct marketing facilities such as greenhouses are 12 percent more likely to be in the narrow-range high-income category compared to those without these facilities. This may be because greenhouses allow farmers to meet consumer demand for fresh produce throughout the year; also, these facilities allow better quality control via scientific methods of intensive agriculture within a small area. The coefficient of this variable is statistically insignificant in the base high income model. Farmers with nurseries and garden centers are 37 percent more likely to be in the narrow-range high income category compared to those who do not have such direct marketing facilities. This probability is observed to be much higher, compared to the 4 percent probability observed in the high-income model, suggesting that income of farmers jumps significantly when they utilize facilities like garden centers. On the other hand, in order to attain a target income of $1,200 per acre, investments in structures like nurseries and garden centers may not be necessary. Overall, the results of the narrow-range high-income model show that more variables such as festivals, temporary retailing facilities, and greenhouses have significant contributions towards farm income compared to the high-income category.

The goodness of fit for the model is shown by the McFadden's R^2 of 0.35. The extent of prediction is shown in the classification table (Table 16). Approximately 83.2 percent of the survey participants were correctly classified as either (narrow-range) high-income earners or low-income earners by the estimated logit model.

Table 16. Prediction Success of the Logit Model for Narrow-Range High-Income Model (Gross Income ≥ $4166/acre).

		Predicted	
		0	1
Actual	0	235	43
	1	13	43

Number of right predictions = 278
Percent of right predictions = 83.2

5.2. Broad-Range High-Income Model

The maximum likelihood estimates for the logit equation for the broad-range high-income model are presented in Table 17. The results indicate that farmers who provide agrotourism activities such as festivals and petting zoos are 9 percent more likely to be in the broad-range high-income category compared to those who do not provide for any such activity. The coefficient of this variable is not statistically significant in the base high-income model, whereas in the narrow-range high-income model the likelihood probability is 12 percent. Similarly, it can be seen from Table 17 that farmers selling most of their products directly through retailing are 20 percent

Table 17. Maximum Likelihood Estimates of the Logit Model for Broad-Range High-Income Model (Gross income ≥ $375/acre).

Variable	Estimate	SE	Change in Probability[a]
Intercept	-0.8089	0.4970	-0.1007
Tours	-0.2920	0.3484	-0.0363
Fest	0.7735[b]	0.4580	0.0963
Stage I	0.0847	0.6357	0.0105
Stage II	0.0543	0.4207	0.0067
GOP	0.8838	0.5558	0.1101
Retail	1.6565[b]	0.3667	0.2063
Urban	0.5465[b]	0.3238	0.0680
RP	0.4448	0.3519	0.0554
Com	0.0427	0.3220	0.0053
Temp	0.0723	0.3180	0.0090
Green	0.8931[b]	0.5384	0.1112
Garden	2.2005[b]	1.0843	0.2741
PYO	-0.6138[b]	0.3625	-0.0764
CI	0.000132	0.000087	0.000016
McFadden's R^2	0.20		
Ratio[c]	0.23		

[a] Equal to the product of the parameter estimates times the value of the logistic density function (B*F(z)). At the sample means, the value of the density function [F(z)] is 0.12458 while the value of z is 1.76750.
[b] Indicates statistical significance at the 0.10 level.
[c] Ratio of non-zero observations to the total number of observations.

more likely to be in the broad-range high-income category compared to those not involved in retailing. This probability is estimated to be about 31 percent for the base high-income model, and about 14 percent in the narrow-range high-income model.

The estimated model coefficients also suggest that, compared to those serving rural markets, farmers with markets in the urban and suburban areas are 6 percent more likely to be in the broad-range high-income category. This probability is estimated to be less than the 12 percent for both the base high-income model and the narrow-range high-income model. Further, farmers with direct marketing facilities, such as pick-your-own and U-dig operations, are 7 percent less likely to be in the broad-range high-income category compared to those who do not have these operations. In contrast, engaging in these operations makes it 23 and 27 percent less likely to attain the high-income threshold in the base and narrow-range high-income models, respectively. On the other hand, farmers who employ direct marketing facilities such as greenhouses are 11 percent more likely to be in the broad-range high-income category. This is similar to the results obtained for the narrow-range high-income model, whereas the coefficient of the variable is statistically insignificant in the base high-income model. Farmers with nursery or garden centers are 27 percent more likely to be in the broad-range high-income category compared to farmers who do not have such facilities. This probability is found to be more than the 4 percent probability estimated for the base high-income model but less than the 37 percent probability estimated for the narrow-range high-income model.

The goodness of fit for the model, given by the McFadden's R^2, is 0.20. The extent of prediction is shown in the classification table (Table 18). Approximately 78.7 percent of the survey participants were correctly classified in term of their income range by the estimated logit model.

Table 18. Prediction Success of the Logit Model for Broad-Range High-Income Model (Gross Income ≥ $375/acre).

		Predicted	
		0	**1**
Actual	0	22	17
	1	54	241

Number of right predictions = 263
Percent of right predictions = 78.7

VI. Concluding Comments

Farmers and direct marketers today are not only looking for ways to increase production and income by incorporating more profitable alternative activities in addition to conventional farm operations. These alternatives not only help farmers increase their income but also reduce the risks associated with reliance on the single business of selling produce. This study attempts to estimate the contributions of various non-traditional innovative farm activities towards farmers' efforts to earn higher income levels. The results of the study should help farmers with limited resources to choose activities that have the greatest potential of yielding higher income levels.

The study indicates that among different agrotourism alternatives, activities such as arranging farm festivals and organizing petting zoos are effective ways of attaining higher income levels than other activities. Similarly, direct retailing seems to be an effective way to increase farm income. This is reflected by the study result that farmers who sell their product primarily through direct retailing are consistently more likely to attain high income levels compared to those who do not utilize this marketing option. Farmers with markets in urban and suburban areas or commercial zones are better positioned than those serving rural markets in terms of the probability of attaining higher income levels. The study finds that garden centers, nurseries, and greenhouses are the most effective ways to enhance farm income. This is reflected by the result that these operations consistently increase the farmers' chances of attaining the high-income category in both the base model and the narrow-range high-income model.

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