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ECONOMICS OF VEGETABLE PRODUCTION BY FARM LOCATION

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Three vegetables namely bitter gourd, tinda gourd and muskmelon were selected to determine the profitability of these vegetables with special emphasis on location of the farms with respect to market. The study was based on secondary data. Two categories were made i.e. the farms near to market and the farms far from market and profitability was determined separately for each category thereby indicated that cost of production per acre was higher on the farms near to market than that of the farms far from market. Nevertheless, higher returns were also estimated for this category. Results of the study highlight the need for the development of market infrastructure to boost up vegetable production in the country to meet the increasing requirement of food supplies and to create more employment opportunities in the rural economy.
Keywords: Summer vegetables; profitability; location of the farms; Punjab

INTRODUCTION

Pakistan is facing food security problem since its independence because the main focus of the policy makers has remained on staple food crops and these crops could not fulfill the increasing demand of continuously rising population which has reached around 152 million (GOP, 2005). On the other hand, food supplies do not meet the dietary requirement of people of Pakistan particularly in rural areas. Such food deficiency in essential nutrients badly affects the economic activities in any economy (Doryan, 2000). In such scenario, there is a need to diversify our cropping pattern from mono-cropping to those enterprises which supply essential nutrients in a short duration of time. Enterprises providing dietary nutrients at a cheaper rate are vegetables. Unfortunately, adoption of vegetables at commercial level is not satisfactory due to ignorance of different stakeholders and small percentage of cropped area under vegetable cultivation (Ahmad *et al.,* 2003). Therefore, the per capita per day consumption of vegetable in Pakistan is almost half of the recommended level of 200 grams per person per day (Farooq and Ali, 2002). Besides providing crucial dietary nutrients, vegetables generate far higher income than other crops such as wheat, cotton, etc. and low-micronutrient staple food and they help to improve the productivity and sustainability of the cereal-based production system (Ali and Abedullah, 2002). So, there is a great demand of labour for different agronomic practices and thus, vegetable cultivation generates higher employment at the farm level than cereals (Abedullah *et al.*, 2002; AVRDC, 2000).

Profitability analysis of vegetables has been conducted by many researchers (Thakur *et al.,* 1985; Borcz, 1992; Singh and Sikha, 1992; Muuttama, 2000; Bakhsh, 2002; Ahmad *et al.,* 2004; Bakhsh *et al.,* 2005, Hassan *et al.,* 2005). However, the focus of these studies remained on the determination of profitability, and some researchers estimated profitability with reference to yield levels. In the above mentioned studies, one important factor that remains un-touched is the location of the farms with respect to market which is the most crucial and relevant factor in estimating the profitability of vegetables. Input and output markets have significant role in the selection of enterprises and determining the farm income. Ahmad *et al.* (2004) found that lack of market infrastructure was one of the limiting factors causing low returns in vegetable cultivation. Profitability is not only determined by the use of input resources but it is also dependent on the availability of proper logistic for transporting the farm produce from farm gate to the market. Vegetable production is also influenced by the location of the farms due to the fact that the farms near to input market are in a better position to purchase different inputs such as seed, fertilizer, etc. at the appropriate time. On the other hand, most of the vegetables are perishable in nature and suffer less loss if produced near the market. Keeping in view all such factors, the present study was designed to determine the profitability of summer vegetables on the basis of farm location and its impact on vegetable yield. This study will help the stakeholders especially policy makers to make the well managed decisions about the formulation of future strategies for the development of the livelihood of vegetable growers.

MATERAILS AND METHODS

The vegetables are generally grown in two seasons i.e. summer and winter. The selection of the summer vegetables was carried out depending upon their

concentration in different areas of the Punjab. The study was confined to the Punjab province only for three summer vegetables (Bitter gourd, Muskmelon and Tinda gourd). The concentration of the selected three vegetables i.e. bitter gourd, tinda gourd and muskmelon was found in Faisalabad, Rahim Yar Khan, Leiah, Khanewal, and Bahawalpur (Ahamd *et al.*, 2003).

The present study was mainly based on secondary data. The study used the cross-sectional survey data collected by the Dept. of Environmental and Resource Economics, UAF under "Agricultural Linkage Program" financed by the Pakistan Agricultural Research Council (PARC). The data consisted of a total of 261 vegetable growers for the three selected vegetables. Consideration was given to the distance of farms from market, because it has significant effect on the cost of production and net benefits earned by the vegetable growers. For this purpose, categories were made according to distance of the farm from market. An area at 10 kilometers from the main market was considered as near to market while area at more than 10 kilometers was considered as far from main market. The respondents taken from each district/category are detailed in Table I.

Table I. Selection of the respondents for various vegetables

Vegetables/Farm location	Near to market	Far from market	Total
Bitter gourd	44	46	90
Muskmelon	45	30	75
Tinda gourd	56	40	96
Total	145	116	261

Partial budgeting technique employed by Ahmad *et al.* (2003, 2004) was used to determine the cost of production and profitability of summer vegetables.

Cobb-Douglas type of production function was chosen because this function gave the most appropriate explanation for the input output relationship in agricultural production and it was easy to estimate the response of various inputs. A number of different variables (Farm size, land preparation, labor, location of the farms, etc.) were incorporated in the production function in order to take into account the yield variation. Consider the following Cobb-Douglas production function in general form

$$y_i = \prod_{i=1}^{m} \chi_{ij}^{\ b_i} e^{u_i}$$

where,

i = 1, 2, ...,_m are inputs; j = 1, 2, ...,n are farms, y_i is output of the j-th farm; χ_{ij} is the level of i-th input on the j-th farm, b_i is parameters including intercept to be estimated, u_i is error term and e is the natural exponent (Ali & Chaudhry, 1990). We can write the above production function in log linear form as

$$\ln y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_6 + \beta_7 D_1 + \beta_8 D_2 + \mu$$

ln is natural logarithm. y is yield of vegetable of the i-th farm in kg/acre. β_0 is intercept. X1 represents number of tractor hours for land preparation (hours). X2 shows seed Rate (Kg/acre). X3 is number of irrigation (hours). X4 is plant protection measures (no.). X5 indicate labour used for weeding and application of inputs (hours). X6 is fertilizer nutrients (kg). D_1 is a dummy variable for farm size. It was taken as 1 if farm size was large else zero. Another dummy variable D_2 is distance of farm from market. It was taken as 1 if farm was away from market else zero.

RESULTS AND DISCUSSION

The major purpose of the study was to estimate the cost of production and to determine the profitability of selected vegetables. Results are reported in Table II. The cost incurred on land preparation by the farmers near to market was considerably higher as compared to that of far from market, since price per tractor hour was high near to city in all three vegetables. In cases where bitter gourd, tinda gourd and muskmelon were planted on raised beds, the time consumed to prepare the beds was also included in the tractor hours. The variety and quantity of seed was an important factor for achieving high yield of vegetables. The costs involved in using the seed among both categories were different. In case of near to market the cost of seed was 984.85, 167.13 and 335.64 (rupees) for bitter gourd, tinda gourd and muskmelon, respectively, while in case of far from market, the cost of seed was Rs890.30, 171.44 and 361.08 for the respective vegetables.

Farmyard manure, another yield increasing input, helped to maintain the soil fertility in the long run by maintaining the organic matter and other important micronutrients in the soil. The costs involved in the purchase of the farmyard manure were Rs369.54, 111.98 and 182.71 for bitter gourd, tinda gourd and muskmelon, respectively on the basis of near to market, while in case of far from market the costs involved in applying the farmyard manure were Rs389.54, 249.28 and 98.68 for the respective vegetables. Most of the sampled farmers used relatively large quantity of nitrogenous fertilizers. It indicated the ignorance of the farmers about various nutrients required by the crop. The cost involved in

applying fertilizer by near to market was Rs1830.88, 524.92 and 2569.82 for tinda gourd bitter gourd and muskmelon respectively, while in case of far from market the above cost was Rs2190.26, 594.24 and 2110.26 for the respective three vegetables. Sufficient and timely irrigating a crop improves the yield per acre of any crop. Because vegetables needed more irrigation, the costs in applying the irrigation were higher than other crops. The cost involved in irrigation was also higher on the respondents' farms near to market as compared to that of far from market. Vegetables are more sensitive to insect and disease attacks. Other costs incurred on plant protection measures, labour, transportation and land rent were far higher on the farms near to market than those of far from market in all vegetables (Table II).

case of the farmers far from the market the net income per kg was Rs2.33, 0.59 and 0.32 (Table III). Ahmad *et al.,* (2003) also reported the similar results while considering yield levels of vegetable. They concluded that low yielder were not in a position to purchase inputs at the proper time so, income was far below than high yielder. Our findings indicated that those operating near to market were getting higher returns. Net income per kg (Rs 1.16) for carrot vegetable estimated by Ahmad *et al.* (2005) is closely related to our findings.

Results of Production Function Analysis

The main objective of this study was to determine the effect of location of the farm from the market on vegetable yield. For this purpose, a Cobb-Douglas type

Table II. Cost of various inputs in vegetable production

(Rs./acre)

Items/vegetables	Bitter gourd		Tinda gourd		Muskmelon	
	Near to market	Far from market	Near to market	Far from market	Near to market	Far from market
Land preparation	888.65	800.12	1121.01	1017.83	1335.46	1187.43
Seed	984.85	890.30	167.13	171.44	335.64	361.08
Farmyard Manure	369.54	389.76	111.98	249.28	182.71	98.68
Fertilizer	1830.88	2190.26	524.92	594.55	2569.82	2110.57
Irrigation	1061.63	985.88	400.50	392.00	1316.48	1147.90
Plant protection	1744.18	985.88	357.20	252.19	1718.84	1681.57
Labour	3050.24	2675.68	720.06	739.40	1433.04	1270.57
Transportation	930.88	2000.75	276.18	315.59	536.30	868.98
Land rent	2565.00	1875.52	1800.50	1650.25	2570.00	1947.30
Water charge	115.14	115.14	115.14	115.14	115.14	115.14
Total cost	13540.99	12909.29	5594.62	5497.67	12113.43	10789.22
Variable cost	10860.85	10918.63	3678.98	3732.28	9428.29	8726.78

Table III. Output and returns in vegetable production

(per acre)

Particular/vegetables	Bitter gourd		Tinda gourd		Muskmelon	
	Near to market	Far from market	Near to market	Far from market	Near to market	Far from market
Output (kg)	2825.60	3025.00	2485.20	2473.20	3164.80	2913.60
Gross income (Rs)	21309.59	19704.41	8759.87	6956.24	14429.11	11720.68
Gross margin (Rs)	10448.74	8785.78	5080.89	3223.96	5000.82	2993.90
Net income (Rs)	7768.60	6795.12	3165.25	1458.57	2315.68	931.46
Net income/kg	2.75	2.33	1.27	0.59	0.73	0.32
Cost/kg	4.79	4.23	2.25	2.22	3.83	3.70

Gross income from the cultivation of summer vegetables was higher on farms near to market as compared to those far from the market. The net income per Kg was Rs2.75, 1.27 and 0.73 for respective vegetables in case of farmers near to market, while in

of production function was employed to find out this objective and a use of dummy variable was made in the model along with other explanatory variables such as land preparation, seed, fertilizer, irrigation, plant protection measures and labour.

Results of the production function analysis reported in Table IV indicated that values of R^2 in all three vegetables were considerably high indicating that the regression fits the data well. Overall, significance of the models was also statistically significant. In case of individual coefficients, it was found that positive sign of irrigation variable indicated that more use of irrigation increased per acre yield of vegetables and coefficients of this variable were statistically significant except tinda gourd where it was non-significant. As far as coefficients of plant protection measures were concerned, it was found that negative ones were found for bitter gourd and muskmelon, although these were non-significant. In case of tinda gourd, a statistically significant and positive coefficient showed that one percent increase in plant protection measures increased tinda gourd yield by 0.03 percent.

Table IV. Results of regression analysis

Variables/vegetables	Bitter gourd	Tinda gourd	Muskmelon
Constant	1.16 (0.30)	3.91 (0.18)	3.30 (0.22)
Land preparation	-0.05 (0.04)^{ns}	0.004 (0.08)^{ns}	-0.11 (0.94)^{ns}
Seed	0.04 (0.03)^{ns}	0.02 (0.03)^{ns}	-0.04 (0.82)^{ns}
Number of irrigation	0.07 (0.02)*	0.05 (0.04)^{ns}	0.04 (0.02)
Plant protection measures	-0.005 (0.01)^{ns}	0.03 (0.02)	-0.008 (0.02)^{ns}
Labour	0.05 (0.02)*	0.06 (0.02)	0.17 (0.02)
Fertilizer	0.05 (0.03)	0.02 (0.01)**	0.11 (0.05)
Farm size	-0.006 (0.03)^{ns}	-0.14 (0.08)**	-0.14 (0.05)
Distance of farm from market	-0.11 (0.03)	-0.23 (0.07)	-0.04 (0.05)^{ns}
R^2	0.56	0.61	0.72
F value	12.70	14.47	20.97

* and ** indicate respectively significance level at five and ten percent while ns stands for non-significant coefficients and figures in parenthesis are standard errors

Vegetables involve labour-intensive farming practices and cultivation of these crops requires more use of labour for controlling weeds, applying inputs, etc. Therefore, the production function showed that this coefficient had a positive sign and was statistically significant. Fertilizer is another important input that enhances vegetable yield substantially when applied at proper time. Statistically significant coefficients were determined for all three vegetables. Our findings are in full agreement with Bakhsh *et al.* (2004), Bakhsh and Hassan (2005, 2005a) and Ahmad *et al.* (2005). However, percentage effect of fertilizer was higher in case of muskmelon as compared to bitter gourd and tinda gourd because these vegetables needed fewer amounts of inorganic nutrients as compared to muskmelon.

Dummy variable for farm size had an expected negative sign showing that as farm size increased, vegetable yield decreased. This was due the fact that vegetable cultivation required a huge amount of financial resources at various stages of production whereas the vegetable growers could not afford such expenditures as farm size increased. Barett (1996) estimated an inverse relationship between agricultural productivity and farm size. Helfand and Levine (2004) concluded that the medium farms (20-50 ha) were more efficient in Brazil. They concluded that both the small and large farms were inefficient. This coefficient was statistically non-significant in case of bitter gourd production.

Dummy variable for the location of the farm from market had negative coefficient as priori hinting the need for improving marketing infrastructure relating to input and output to boost up vegetable production in the country. Similar findings were deduced by Helfand and Levine (2004). They found that market access had significant impact on efficiency of the farmers. In the case of muskmelon only, this coefficient was non-significant. This variable for other vegetables was statistically significant.

SUGGESTIONS

Following recommendations are made for increasing the yield of summer vegetables:

- Summer vegetable cultivation needs proper amount of irrigation water at different stages. Results of production function indicated that with increased use of irrigation, vegetable yield would increase substantially. Therefore, it is suggested that the farmers should make more and judicious use of irrigation water.
- The vegetable growers use the inorganic nutrients below the recommended level due to financial constraints. The results of production

function showed that fertilizer significantly increased vegetable yield. On the basis of these results, the vegetable growing farmers can increase the yield per acre by applying more fertilizer.

- Weeds in any crop negatively affect the production. That's why the vegetable growers using more number of labour hours for weeding and hoeing got higher yields. Herbicides using for weed control is an expensive technique. Alternative to weed control with herbicides include crop rotation, careful and timely cultivation, intercropping to out-compete weeds etc.

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