

Profitability Analysis of Carrot Production in Selected Districts of Punjab, Pakistan: An empirical Investigation

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ABSTRACT

This paper aims to conduct profitability analysis of carrot production in selected districts and also to investigate the factors that affect the profitability of carrot crop. The study sample consists of 140 carrot growers and district Nankana Sahib and Sheikhpura were surveyed in year 2014 for data collection. Descriptive statistics, simple budgeting technique and log-linear profit function has been employed to estimate the desired results. Per acre estimates showed average variable cost was Rs. 81936 with total cost Rs. 97094, gross revenue Rs. 158236, net revenue of Rs. 66436 and benefit-cost ratio of Rs. 1.64. Average Per acre cost of production was estimated highest for owner-cum-tenants (Rs. 98877) followed by tenants (Rs. 98138) and owners (Rs. 94953). Tenants earned highest net revenue/acre as estimated Rs. 68513 followed by Rs. 67861 and Rs. 49992 by owners and owner-cum-tenants. The results of regression analysis indicate inverse relationship between costs and profit whereas direct association of price and yield with profit. The profitability analysis however indicates that growing carrot is a remunerative and successful agro enterprise during winter season in Punjab, Pakistan.

KEYWORDS: carrot, production, profitability, gross revenue

INTRODUCTION

A wide range of vegetables are grown in Pakistan and the major vegetable species grown include potato, tomato, carrot, chillies etc. Vegetables are the rich source of important micro-nutrients required for the human body and also a good source of income for farmers. Vegetables are risky to grow but can fetch higher returns than other cereal crops, wheat, maize, pulses etc (Adil *et al.* 2007). Vegetable cultivation is a labor intensive activity which can also helpful to generate employment in the rural economy. Thus it is multi-dimensional activity and can serve the economy in various ways due to their higher yield potential, higher return, high nutritional value and highly labor intensive attributes (Abedullah *et al.* 2006, Tahir and Altaf, 2013).

The land and weather in Punjab is very favorable for vegetable cultivation and different vegetable species are produced. Punjab province has comparatively highest share of overall vegetable area and production than other provinces estimated about 60% and 67% respectively (Khokhar, 2014). Among the vegetables grown in Punjab Potato occupies the larger share of area (34.01%) and the second important vegetable is onion that occupies around 8.87% of total vegetable area in Punjab. The relative share of carrot is 2.67% (Ahmad *et al.*, 2005). According to the estimates 65% of the total area under carrot cultivation in Pakistan lies in Punjab province and it contributes in 68.4% of total carrot production¹.

Carrot is one of the major vegetable produced and consumed in Pakistan and it occupies a prime position among the winter vegetables. Carrots are cultivated on an area of 13.9 thousand hectares, with 242.3 thousand tones production (FAO, 2008). The national average yield for carrot is only 17.5 tones per hectare, which is quite low as compared to other advanced carrot producing countries, such as Belgium (47.64 tones/ha), Denmark (44.29 tones/ha), and the

¹See more at: <http://www.agricorner.com/production-status-of-major-vegetables-in-pakistan-their-problems-and-suggestions/#sthash.LUX0zN8n.dpuf>

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United Kingdom (44.28 tones/ha). Moreover, India and China neighboring countries are also getting higher average yield i.e 30 and 38.54 tones /ha, respectively (Ahmad T. *et al.*, 2012).

In Pakistan, the production of crops like cotton, rice and some horticultural crops has recently been spreading in areas which were not specific for the production of these crops. For instance, the production of cotton has been gradually increasing in some regions of Balochistan; new basmati rice growing areas are emerging in mixed cropping belts touching the cotton zone of southern Punjab (i.e. Sahiwal, Okara, etc.); and some pockets of gladiolus flower production have emerged in some parts of AJK. A similar development has been noticed for the emergence of carrot production region in various tehsils of Sheikhpura District. The self-development of a crop specific production region has developed interest of the researchers and policy practitioners to investigate into the factors contributing to its development as no intentional or planned effort from public sector is involved in it. Such study is also important as the area and production of carrots has been slowly increasing in Punjab i.e. the area and production of carrot increased by 16.5% and 10.9% respectively during 2000-12(GOP 2012). The basic thrust of the study is to evaluate the economic feasibility of producing carrots, to identify the factors that determine the profitability of carrot production in study area and to recommend some policy measures for improvement of carrot production in selected district.

METHODOLOGY

For the purpose of this study District Nankana Sahib and Sheikhpura were selected. Major carrot growing villages were selected with the consultation of Agricultural Extension Department Punjab. A sample of 140 carrot growers was selected by using purposive sampling technique. A well-structured and field pre-tested comprehensive interviewing schedule was used for the data collection on various aspects of carrot crop for the year 2014. Simple budgeting technique has been employed to estimate the cost and returns of carrot production. Carrot cost of production was estimated by incorporating all costs such as land preparation cost (LPC_c), seed cost (SC_c), Irrigation cost (IC_c), Labor cost (LC_c), Harvesting cost ($HrvC_c$) and Miscellaneous cost ($MscC_c$)

The variable cost (VC) for carrot production was calculated by following expression;

$$VC_c = LPC_c + SC_c + IC_c + FC_c + LC_c + MscC_c + HrvC_c$$

Further the total cost was calculated by incorporating land rent (LR_c) in variable cost. Miscellaneous cost includes farm yard manure cost, weeding cost and pesticide cost. The estimated expression is given below.

$$TC_c = VC_c + LR_c$$

In the next step the gross revenue of carrot production was calculated by multiplying gross yield/acre with price/kg received by carrot growers. Furthermore net returns to carrot growers were estimated by following expression.

$$NR_c = GR_c - TC_c$$

Furthermore the benefit cost ration was calculated to estimate the return on per rupee investment through division of net revenues to total cost.

To evaluate the factors determining profitability of carrot production in study area the regression analysis has been conducted by using ordinary least square method to identify the determinants of carrot growers profit in Nankana Sahib district and log-linear function has been employed to find the results. The empirical estimation was based on profit function stated as;

$$\Pi = f(P, Q, C) \dots \dots \dots (equa. 1)$$

Where Π is profit (net revenue Rs/acre), P is output price (Rs/kg) and C is cost per unit (Rs/acre) and Q is the quantity produced (Kg/acre)

Based on profit function the estimated regression model may be given as;

$$\ln Y_c = \beta_0 + \beta_1 \ln LPC_c + \beta_2 \ln SC_c + \beta_3 \ln IC_c + \beta_4 \ln FC_c + \beta_5 \ln LC_c + \beta_6 \ln HrvC_c + \beta_7 \ln Yld_c + \beta_8 \ln P_c + \mu_i \dots \dots \dots (equa. 2)$$

RESULTS AND DISCUSSION

Average age, education, vegetable and carrot farming experience of sample respondents was 39.2 years, 6.7 years, 23.6 years and 18 years respectively. Average age, vegetable farming and carrot farming experience was highest in case of owners 41.2 years, 26. 4 years and 18.1 years, whereas mean schooling years was highest for owner-cum-tenants 7.3 years. A study conducted by Ahmad, *et al.* 2012 also found that carrot growers were mature adults and majority of them almost 60 percent lies between 31-40 years of age (Table 1).

Table 1. Socio-economic Profile of Sample Respondents

	Owner	Owner-cum-tenant	Tenant	Overall
Age (years)	41.2	39.3	35.3	39.3
Education (years)	6.3	7.3	6	6.7
Vegetable farming experience (years)	26.4	21.7	21.4	23.6
Carrot farming experience (years)	18.1	17.9	17.8	18.1

Owner-cum-tenants have highest average operational holding (22.1 acres) followed by owners (17.5 acres) and tenants (8.9 acres). All operational holding of owners (17.5 acres) was their own land while owner-cum tenants have 7.1 acres own land and 15.2 acres rented-in land on average annual rent of Rs. 37652/acre. The tenants have zero own land and they rented-in all operational holding (8.9 acres). Difference in the operational holding, own land and rented in land among farming groups is statistically significant at 5 percent and 1 percent level respectively. The overall analysis shows that combined average operational holding of carrot growers were 17.5 acres, with own land 10.0 acres and rented in land 7.6 acres (Table 2).

Table 2. Farm Characteristics of Sample Respondents

Variables	Owner	Owner-cum-tenant	Tenant	Overall	F. Stat
Operational holding (acres)	17.5	22.1	8.9	17.5	3.549**
Own land (acres)	17.5	7.1	-	10.0	13.212***
Rented in land (acres)	-	15.2	8.9	7.6	17.728***

*** and ** shows 1 and 5 percent level of significance

In study area during Rabi season 2012-13 overall majority cropped area almost 80% was under two crops wheat and carrot. Wheat was the leading rabi crop grown on 40.3% of total cropped area on sample respondents farms, followed by carrot (39.3%), sugarcane (7.5%), cabbage (3.0%), sweet potato (2.5%), turnip (1.9%), cauliflower (1.7%), barseem (1.5%) and fellow area (1.2%). The highest percentage area was allocated for wheat by owners (46.9%) whereas owner-cum- tenants and tenants are allocating more of their cropped area for carrot 39.0% and 48.1% respectively. The owner-cum-tenants have highest percentage area under sugarcane (10.1%), barseem (1.9%), cauliflower (2.8%), sweet potato (2.9%) than owners and tenants. The proportion of fellow land was highest for owner-cum-tenants (1.9%), followed by owners (1.2%) and tenants (0.6%). The difference in the percentage distribution of operational Rabi area between wheat, carrot, cabbage crop and fellow land is statistically significant across farming categories. During Kharif three main crops rice, cotton and sugarcane were planted on almost 65% of cropped area. Rice was the main Kharif crop grown on average 45.2% total cropped area followed by sugarcane (10.5%), pumpkin (8.9%), cucumber (7.8%), ladyfinger (6.8%), sorghum and millet (4.2% each). Overall almost 22% area was allocated for vegetables cultivation, highest for pumpkin (7.9%), followed by cucumber (6.8%), ladyfinger (5.8%) and bitter guard (1.2%). The highest mean percentage area for rice was allocated by tenants (52.1%), followed by owners (49.7%) and owner-cum-tenants (37.1%). The proportion of fellow land was highest for owner-cum-tenants and tenants (3.1%), followed by owners (2.6%). The difference in the percentage distribution of operational Kharif area between sugarcane, maize, ladyfinger and fellow land is statistically significant across farming categories (see Table 3).

Table 3. Cropping Pattern by Tenancy Status (percent area)

Crops	Owner	Owner-cum-tenant	Tenant	Overall	F-stat
Wheat	46.9	35.6	35.7	40.2	2.679*
Carrot	35.3	39.0	48.1	39.2	2.675*
Sugarcane	7.4	10.1	3.2	7.5	3.018
Barseem	1.1	1.9	1.8	1.5	0.726
Chillies	1.3	1.1	0 (0)	1.1	1.370
Cauliflower	1.5	2.8	0.6	1.7	1.485
Cabbage	1.2	2.8	5.4	3.0	3.488*

Spinach	0	0.3	0	0.3	0.471
Turnip	2.1	1.6	1.9	1.9	0.314
Sweet potato	2.0	2.9	2.7	2.5	0.177
Fellow	1.2	1.9	0.6	1.2	3.208*
Kharif cropping pattern					
Rice	49.4	37.1	52.1	45.2	2.193
Cotton	10.5	12.1	0	9.1	1.857
Sugarcane	10.4	15.2	1.9	10.5	3.331*
Maize	0.1	1.8	0	0.7	3.005*
Sorghum	4.8	7.5	5.1	4.2	1.189
Millet	3.6	4.3	5.1	4.2	0.278
Bitter guard	1.3	0.6	1.6	1.1	0.686
Cucumber	6.4	5.6	9.7	6.8	0.568
Ladyfinger	4.2	5.7	9.4	5.8	2.549*
Pumpkin	6.3	7.4	12.2	7.9	2.197
Fellow	2.6	3.1	3.1	2.9	2.613*

*shows 10 percent level of significance

Table 4 highlights different cost estimates incurred for carrot production, their respective values, gross revenues generated and net profit obtained by carrot growers. Carrot production involves different variable costs; as estimated average land preparation cost was Rs. 11474/acre, seed cost (Rs. 11727/acre), irrigation cost (Rs. 2871.58), fertilizer cost (Rs. 3780.0/acre), labor cost (Rs. 14373.92) and harvesting cost (Rs. 32661.42/acre). Overall average variable cost was Rs. 81936/acre with total cost Rs. 97094.08/acre. According to tenancy status owner-cum-tenants incurred higher land preparation cost (Rs. 12091.3/acre), seed cost (Rs. 12541.30/acre) and fertilizer cost (Rs. 3997.83) than owners and tenants whereas tenants incurred highest per acre labor cost (Rs. 14600.0), harvesting cost (Rs. 34045.83) and miscellaneous cost (Rs. 5310.41) than owners and owner-cum-tenants. Carrot cost of production was estimated highest for owner-cum-tenants (Rs. 98877.09/acre) followed by tenants (Rs. 98137.92/acre) and owners (Rs. 94953.0/acre). The value of F-stat indicate that different cost across farm types didn't differ significantly except irrigation cost which is significant at 10 percent level.

Table 4. Carrot Cost of Production Production(Rs/acre)

Tenancy Status	Owner	Owner-cum-Tenant	Tenant	Overall	F-stat
Land Preparation Cost	10930.0 (4263.2)	12091.3 (3350.6)	11425.0 (4668.8)	11474.2 (3989.7)	0.500
Seed Cost	11508.0 (5184.24)	12541.30 (4314.26)	10625.0 (5260.34)	11727.50 (4853.66)	0.651
Irrigation Cost	2311.80 (1613.38)	3217.39 (1660.96)	3375.0 (1804.73)	2871.58 (1710.48)	2.442*
Fertilizer Cost	3640.00 (2584.85)	3997.83 (2131.61)	3654.17 (1641.16)	3780.00 (2223.59)	0.174
Labor Cost	14270.0 (1819.34)	14368.91 (2088.16)	14600.0 (1887.64)	14373.92 (1910.93)	0.117
Harvesting Cost	32419.00 (5406.70)	32202.61 (6720.98)	34045.83 (5792.65)	32661.42 (5957.14)	0.405
Miscellaneous cost	4772.00 (1695.83)	5209.57 (1162.14)	5310.41 (1737.96)	5047.42 (1514.28)	0.719
Variable Cost	79850.80 (9352.88)	83628.91 (9143.24)	83035.42 (11776.39)	81936.00 (293.66)	0.986
Interest Cost	2395.64 (280.63)	2509.17 (274.20)	2491.33 (353.30)	2458.30 (293.66)	0.990
Land Rent	12706.68 (1785.38)	12739.0 (1780.78)	12611.17 (1656.40)	12699.97 (1729.01)	0.021
Total Cost	94953.0 (9476.06)	98877.09 (9298.17)	98137.92 (12367.46)	97094.08 (10034.30)	0.997

*shows 10 percent level of significance

Figures in parenthesis are standard deviations

Table 5. Carrot Gross and Net return Estimates

Tenancy Status	Owner	Owner-cum-Tenant	Tenant	Overall	F-stat
Yield (Kg/acre)	10819.20 (1616.54)	10497.39 (1608.38)	11240.0 (822.59)	10780.0 (1492.84)	0.990
Price (Rs/kg)	12.09 (1.14)	11.45 (1.33)	11.90 (1.16)	11.81 (1.24)	1.687
Gross Revenue (Rs/acre)	162814.40 (24399.97)	148868.48 (18447.32)	166650.00 (14995.29)	158235.58 (21644.50)	3.987***
Net Revenue (Rs/acre)	67861.40 (21407.03)	49991.96 (18140.64)	68512.58 (17227.59)	61141.53 (23573.74)	6.150***
Benefit Cost Ratio	1.72 (0.23)	1.51 (0.20)	1.72 (0.24)	1.64 (0.24)	6.266***

***shows 1percent level of significance Figures in parenthesis are standard deviations

Overall yield was estimated 10780.0kg/acre with price/kg of Rs. 11.81. Overall average gross revenue attained by carrot growers in study area was estimated Rs. 158235.58/acre with net revenue of Rs. 66436.17/acre and benefit-cost ratio of Rs. 1.64/rupee investment. The tenancy wise average estimates of carrot returns showed highest per acre gross revenue in case of tenants (Rs. 166650.0) followed by owners (Rs. 162814.40) and owner-cum-tenants (148868.48). Tenants earned highest net revenue/acre as estimated Rs. 68512.58 followed by Rs. 67861.40 and Rs. 49991.96 by owners and owner-cum-tenants and difference is statistically highly significant. The estimated benefit cost ratio was estimated same for tenants and owner operators Rs. 1.72 followed by Rs. 1.51 owner-cum-tenants (see Table 5).

Empirical Analysis: Determinants of Carrot profitability

The results of regression model indicate significant negative relationship between land preparation cost, seed cost, fertilizer cost and harvesting cost with the profit earned by carrot growers, whereas yield/acre and price/kg positively affect the profitability of carrot production and had highly significant coefficients. The coefficient of land preparation cost, seed cost, irrigation cost, fertilizer cost and harvesting cost indicates that 1 percent increase in these costs will drop the profitability of carrot production by 0.190 percent, 0.194 percent, 0.066 percent, 0.094 percent and 0.627 percent respectively. The coefficients of seed cost and harvesting cost are significant at 1 percent level, whereas land preparation cost and fertilizer cost are significant at 5 percent and irrigation cost coefficient is significant at 10 percent level. According to Delgado *et al.* 2008, costs are negatively correlated with the net revenue. The study conducted by Awal, 2013, postulated the same results and stated that gross return of carrot production is significantly affected by the human labor, tillage operation, seeds, fertilizers, irrigation, insecticide and manure. The coefficients of price/kg and yield/acre have positive signs thus indicate that an increment in the yield per acre and price per kg will bring 3.039 percent and 3.044 percent increase in profitability of carrot production respectively and these coefficients are highly significant. Ebiowei, 2013, comes up with the same finding that price have the positive association with the net returns as higher the price, higher will be the return to growers (see Table 6). The value of F-stat indicates that model is overall significant at 1 percent level and almost 90 percent of variation in endogenous variable is explained by exogenous variables.

Table 6. Determinants of Carrot Profitability

Independent Variable= Net Revenue/acre		
Variables	Coefficient	t-Stat
Constant	-12.257	-4.730***
Land preparation cost/acre	-0.190	-3.004**
Seed cost/acre	-0.194	-4.472***
Irrigation cost/acre	-0.066	-1.863*
Fertilizer cost/acre	-0.094	-2.050**
Labor cost/acre	-0.191	-1.340
Harvesting cost/acre	-0.627	-3.768***
Yield kg/acre	3.039	13.386***
Price/kg	3.044	14.958***
R-Square= 0.918	Adjusted R-square= 0.902	F-Statistics= 57.312***

Source: Author's Estimation

Conclusion and Recommendations

Carrot area and production is expanding as it occupies almost 40 percent of Rabi cropped area in study area. Carrot production is risky but coupled with the higher returns in good years of production. It's basically a labor intensive activity as used of labor start from sowing till harvesting. Carrot production involves mainly costly operations like land preparation, sowing, irrigation and fertilizers. This crop is prone to pest attacks which cause severe damage to crops and affects badly its profitability that's why include complex plant protection measures which adds to its production cost. The economic analysis however indicates that carrot farming is a profitable business and promises the farmers a return of Rs. 1.75 per rupee investment. The profitability analysis however indicates that growing carrot is a remunerative and successful agro enterprise during winter season in Nankana sahib district, Pakistan.

In the light of the paper findings it is highly recommended that due to lack of education among carrot growers their understanding of crop production and management is limited and most of them are doing carrot farming on traditional methods that's why provision of informal and formal trainings of modern production technologies and methods/ techniques for pest and disease management is the need of time to develop carrot farming as profitable agro enterprise. Corporate farming can emerge as a viable option to make the Shahkot zone as the comparatively advantage area for carrot production in order to establish export oriented carrot farming through technology transfer. Processing industry should be established in the major carrot production sites that will enhance the profitability of the crop to benefit the farmers while, on the other hand, it will generate employment opportunities for the local community and contribute significantly to the balanced diet of the local people to improve their health.

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