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AN ECONOMIC ANALYSIS OF OFF-SEASON TOMATO PRODUCTION IN PUNJAB

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ABSTRACT

Vegetable cultivation in off-season is a new concept to meet increasing demand with more profit. This study was designed to estimate the costs, returns and revenue affecting factors in off-season tomato production. Primary data were collected from 70 off-season tomato growing farmers with stratified random sampling method. On average, total production cost of small, medium and large farmers per acre was Rs. 546841.04, Rs. 542636.04 and Rs. 598125.66, respectively. Per acre production was higher for large farmer (295,63 Kg) than small (275,24 Kg) and medium farmers (290,66 Kg). The net income per acre was higher for small farmers (Rs. 828679.19). Benefit-Cost Ratio is the ratio of total revenue with total cost and shows the return received on the costs of one rupee. BCR was higher for small farmer (2.52); but it was 2.47 and 2.22for medium and large farmers. Age, off-season tomato experience, education, irrigation and contact with extension agents had positive and significant effect on revenue. The model was significant on the basis of R^2 (0.69) and F-value (10.35). Major problems were price fluctuation of the produce, disease attack, lack of extension services and higher initial investment. Government should take steps for the elimination of the problems.

Key words: Tomato, Off-Season, Production Cost, Net Income, BCR, Cobb-Douglas.

INTRODUCTION

Cultivation of vegetables is helpful in achieving the target of food security and reduction in poverty. On average, annual vegetable consumption is 35.6 kg per capita in Pakistan (Abedullah *et al.,* 2006). Per capita annual consumption of vegetables is 73 kg as recommended by World Health Organization (WHO). So, the difference in vegetable consumption is 27.4 kg per person on annual basis (Shaheen *et al.,* 2011). Yield and area of vegetable cultivation are two factors behind less per capita production of vegetable in Pakistan. On the basis of area and production, vegetables are termed as minor crops and research studies on vegetables are not enough due to its minor classification in Pakistan. (Bakhsh, 2007).

Increasing population is the factor behind increase in domestic consumption and demand of tomatoes. It is found in each house and it is an important ingredient in vegetable, chatni, salad, ketchup and other delicious eating items. Tomato is cultivated in different zones of Pakistan round the year and it is available to consumers round the year in every market (Chohan and Ahmad, 2008). Important elements like fiber, vitamin A, vitamin C and potassium are found in tomatoes. The contribution of tomatoes is 20% in per day requirement of vitamin A on the basis of 2000 calorie diet. The share of tomato is 26% in daily requirements of vitamin C. Lycopene is a dominant antioxidant which is naturally available in tomatoes and it is useful to avoid the growth of various cancer types (Adenuga *et al.,* 2013).

In Pakistan, there is an increase in the area of about 1.71% because of higher output prices but production decrease by 0.65% due to heavy rains and floods (GOP, 2015a). During 2013-14, tomato consumption was 0.39 kg per month for rural household with family size of 6.49 members while, tomato consumption was 0.42 kg per month for urban household with family size of 6.09 members (GOP, 2015b).

In Pakistan, it is difficult to increase the production area of vegetable in order to increase the supply of vegetables. Cropping pattern change is a hurdle in area reallocation from major crops to minor crops like vegetables. Time and investment are needed for changing the cropping pattern which is not easy in short period of time. Moreover, social, economic, agronomical and political factors are also making problem in reallocation of area from major to minor crops (Bakhsh, 2007).

In Pakistan, fruits and vegetables shows higher demand in all months. Prices of vegetables are higher in the beginning and ending of vegetable season. In order to push the prices downward, adoption of new technology and cultivation of vegetables in off-season are better options. With the help of tunnel technology, farmers can grow vegetables and fruits in off-season. In tunnels, temperature and moisture levels are under control for growing vegetables at specific situation. Technically, competent growers of vegetables can earn higher income by efficient use of inputs for whole year as compared to vegetable cultivation with traditional manner.

Fortunately, the environmental conditions of Punjab province are favorable in off-season vegetable

production under polythene or plastic sheet tunnels. This technology is useful in order to increase the supply of vegetables and eliminate the shortage of vegetables in markets during winter. So, the vegetables are available in the markets earlier as compared to the produce of vegetables grown under traditional or open field conditions and the vegetable season is expanding in the markets. Internationally, vegetables are growing on commercial basis by using plastic mulches in tunnels covered with polythene sheet. The benefits of plastic mulch are decrease in weeds, greater water use efficiency by plant, early and quality production of vegetables. In Pakistan, there is an increase in the area of vegetable production under plastic tunnels and it becomes a new technology. Use of plastic mulch with plant residues and synthetic material is a new method to increase the profit from vegetable production. As compared to traditional vegetable cultivation in open field, off-season vegetables are reaching the markets before 7 to 14 days. The yield of off-season vegetables isincreases by 2 to 3 times (Iqbal *et al.*, 2009).

At present, the people are less aware about the off-season vegetable production under tunnel or commonly known as tunnel farming. The planned study was conducted to estimate production cost, gross margin, net income, benefit-cost ratio and identify the factors affecting revenue. The paper is further organized as: research methodology is discussed in part 2. Section 3 provides results and discussion of the study findings while last section 4 represents conclusions and recommendations in the light of results.

MATERIALS AND METHOD

Primary data were collected from district Faisalabad and Toba Tek Singh of Punjab, of off-season tomato farmer's during the year, 2014. A well-structured and pre-tested questionnaire was used for data collection. Forty farmers were interviewed from district Faisalabad and thirty from district Toba Tek Singh. (Poate and Daplyn, 1993, cited in Mari, 2009) said that a sample size of 60 respondents is considered as appropriate for decision making in case of larger population. Thus, total 70 respondents were selected, by employing stratified random sampling technique. In stratifies random sampling, the entire population is divided into different sub groups (like small, medium and large for current study) and then a sample is randomly selected from each strata or sub group (Teddlie and Yu, 2007). The sampling respondents were categorized as large, medium and small farmers according to area under cultivation. A farmer with operational land of less than 12.5 acres was considered as small farmer, while a farmer having operational land of more than 12.5 acres and less than 25 acres was considered as medium farmer. A farmer having operational land of more than 25 acres was considered as large farmer (Hassan *et al.*, 2005).

Table 1.Distribution of respondents according to agricultural farm size.

Particulars	Off-season tomato	
	Frequency	Percentage
Less than 12.5 acres (small)	24	34.29
Greater than 12.5 acres and less than 25 acre (medium)	21	30.00
Greater than 25 acres (large)	25	35.71
Total respondents	70	100.00

Estimation of Costs and Returns: Present study estimated the costs involved and net value of the produce. Variable costs like tunnel preparation cost, land preparation cost, seed cost, seedling transplantation cost, fertilization cost, hoeing cost, pesticides cost, earthling up cost, irrigation cost, picking cost and marketing cost were calculated. Tunnel cost includes cost of iron pipes or bamboos purchased for establishing tunnel structure, iron wire cost, string cost, nut bolt cost, polythene sheet cost, cost of sheet for mulching, transportation cost for tunnel material and labor charges for tunnel preparation. Iron pipes, bamboos and iron wirewere used for more than one year due to their long life. So, the depreciation value was calculated for each material, which is used for more than one year as described by Mwangi (2012). The formula for calculation of depreciation used by Mwangi (2012) is expressed as:

$$D = \frac{P - S}{N} \quad \text{---------- (1)}$$

Salvage value is 10 percent of purchase price of equipment and the entire depreciation is considered as a fixed cost (Mwangi, 2012). However, depreciation for off-season tomato was calculated for eight month because the average life span of off-season tomato was eight months on average.

Mwangi (2012) calculated the interest on total initial investment cost and total variable cost. Therefore, interest on total initial investment cost and total variable cost was calculated at 8% interest rate.

Gross margin, net income and benefit-cost ratio were calculated by using formulas used by Usman *et al.* (2013) expressed as:

Gross Margin

$$GM=TR-VC$$

Where,
GM=Gross Margin
TR=Total Revenue
VC=Variable Cost

Net Income

$$NI=TR-TC$$

Where,
NI=Net Income
TR=Total Revenue
TC= Total Cost

Net income was calculated by subtracting total cost from total revenue. Total cost was a combination of variable cost and fixed cost like land rent and abyana(canal water charges). There are two kinds of water charges in Pakistan. Water charges for tube well water are part of variable cost but canal water charges (abyana) is considered as fixed cost because it is collected by the government at a fixed rate from each farmer irrespective of water use. Noonari*et al*. (2015) also considered water charges as fixed cost.

Benefit Cost Ratio (BCR): Benefit-Cost is the ratio of total revenue with total cost. It is interpreted as the return received on the costs of one rupee. The mathematical formula for computing BCR was given below:

$$BCR=TR/TC$$

Econometric Model Specification: In the analysis of agricultural production, the first choice is to use Cobb-Douglas model due to its functional form. The main factors behind the use of Cobb-Douglas model were its simplicity of computation, interpretation and mathematical properties (Heady and Dillon, 1961, cited in Usman and Ashfaq, 2013). The logarithmic transformation of Cobb-Douglas model into linear form make the estimation of coefficient more easy and simple (Beattie and Taylor, 1985). The functional form of Cobb-Douglas production model was linearized by taking double logarithmic to make it useful for practical purposes, which is given below:

$$lnY = lna + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4 + \beta_5 lnX_5 + \beta_6 lnX_6 + \beta_7 lnX_7 + \beta_8 lnX_8 + \beta_9 lnX_9 + \beta_{10} lnX_{10} + \beta_{11} lnx_{11} + \beta_{12} lnX_{12} + lnU_i$$

Where;
Y=Average revenue (Rs.)
X_1= Age (Years)
X_2=Education (Years)
X_3=Growing experience of Off-season tomato (Years)
X_4=Tunnel cost (Rs.)
X_5=Land preparation cost (Rs.)
X_6=Total labor man days (No.)
X_7=Seed (Kg.)
X_8=NPK cost (Rs.)
X_9=Pesticide cost (Rs.)
X_{10}=Irrigation applied (No.)
X_{11}=Contact with extension agents (No.)
X_{12}=Packing material cost (Rs.)
ln=Natural logarithm
a=constant
Ui=Error term which included the effect of unexplained factors on yield.
$\beta_{1.....}$ β_{12}, are coefficients of estimates in the model.

RESULTS AND DISCUSSION

The average age was 42.52 years in case of medium farmers and it was above the average age of large and small farmers. Age difference was found insignificant at 5% level of significance. Education was recorded in number of schooling years and large farmers were found more educated with 11.48 year schooling than medium and small farmers. On the basis of f-statistics, there was a significant difference in the mean value of education for small, medium and large farmers. On average, operational land was 92.36 acres for large famers and it was 16.14 acres and 7.27 acres for medium and small farmers, respectively. The experience of vegetable production in off-season was 10.04 in case of large farmers and it was higher as compared to small and medium farmers (Table 2). Large farmers cultivated more area with tomatoes in off-season than medium and small farmers. Off-season tomato cultivation area was 2.39 acres for large farmers and it was 1.24 acres and 0.92 acres for medium and small farmers, respectively.

Table 3 also revealed that the difference in the mean values of total operational holdings, off-season vegetable experience and off-season tomato area were found significant at 0.00%, 0.3% and 0.1% level of significance, respectively.

Table 2.Socio-economic characteristics of off-season tomato growers.

Particulars	Farm Size Category		
	Small	Medium	Large
Age (years)	38.42	42.52	40.88
Education (years)	7.52	9.14	11.48
Total Operational Holding (acres)	7.27	16.14	92.36
Off-season vegetables Experience (years)	5.71	7.52	10.04
Off-season tomato Area (acres)	0.92	1.24	2.39

Table 3.Analysis of variance for socio-economic characteristics of off-season tomato growers.

Particulars		Sum of Squares	d.f.	Mean Square	F-value	Sig.
Age (years)	Between Groups	193.73	2	96.87	0.51	0.601
	Within Groups	12631.71	67	188.53		
	Total	12825.44	69			
Education (years)	Between Groups	190.52	2	95.26	4.74	0.012
	Within Groups	1326.55	66	20.10		
	Total	1517.07	68			
Total operational holding (acres)	Between Groups	106193.20	2	53096.60	27.24	0.000
	Within Groups	130594.82	67	1949.18		
	Total	236788.02	69			
Off-season vegetables experience (years)	Between Groups	29.30	2	14.65	6.48	0.003
	Within Groups	151.40	67	2.26		
	Total	180.70	69			
Off-season tomato area (acres)	Between Groups	319.10	2	159.55	8.15	0.001
	Within Groups	1310.85	67	19.56		
	Total	1629.94	69			

Table 4 described per acre average cost of inputs in the production of off-season tomato. Large farmers spend more money on tunnel material(Rs. 70,927.30), seedling transplantation (Rs. 14,360.00), fertilization (Rs. 87,763.00), hoeing (Rs. 4,949.95), pesticide (Rs. 33,434.00) and marketing (Rs. 139,057.00). Medium farmers spend more financial resources on land preparation (Rs. 14,254.16), irrigation (Rs. 11,398.02) and picking (Rs. 75305.54). Small farmers spend more money on seed (Rs. 49,488). On average, per acre total variable cost for small, medium and large farmers was Rs. 451,202.51, Rs. 446,441.14 and Rs. 511,267.04, respectively and it was more for large farmers and less for medium farmers. Eight month land rent for large farmers was higher and it was Rs. 36,466.67. Medium farmers paid more money as Abyana. Depreciation was calculated for long-life tunnel material which was higher for large farmers (Rs. 22,401.07). Large farmers also spend more resources on interest payments as well as on administration cost. Higher total cost of amount Rs. 5,98,125.66 was observed for large farmers.

Table 5 depicted that large farmers obtained more production from per acre tomato cultivation in off-season. Per acre off-season tomato production was 27,524.17 kg, 29,065.65 kg and 29,563.20 kg for small, medium and large farmers, respectively. Price received by small farmers was more than medium and large farmers and it was Rs. 49.98 per kg. The difference in price was found significant at 7.3% level of significance while f-value was 2.719. Small farmers have less operational holdings than medium and large farmers and they concentrate on the production of quality produce. Usman *et al.* (2013) also reported that small farmers produce quality product and fetch more price in the market due to small land holdings. Large and medium farmers received Rs. 44.85 and Rs. 46.03, respectively by selling 1 kg off-season tomatoes in the market. On average, small farmers received higher amount as total revenue and it was Rs. 1,375,520.23/acre. Total revenue was Rs. 1,325,968.65/acre and Rs. 1,337,892.09/acre for large and medium farmers, respectively. Per acre gross margin for large, medium and small farmers was Rs. 838,591.69, Rs. 891,450.94 and Rs. Rs. 924,317.72, respectively. Small farmers received more money in the form of net income than medium and large farmers and it was Rs. 828,679.19, and it has a support from the results of Murthy *et al.* (2009) study. Net profit or net income was \$1.96, \$1.88 and \$1.72 per m^2 for small, medium and large farmers, respectively which was higher than \$1.41 per m^2 calculated by Abdal*et al.* (2009) in Kuwait. Benefit-Cost ratio (BCR) was more in case of small farmers and it was 2.52. It shows that by investing Rs. 1 in off-season tomato production, small farmer's return was Rs. 2.52. Murthy *et al.* (2009) estimated that the benefit-cost ratio was 2.17 for small farmer, 1.79 for medium farmer and 1.90 for large farmer. According to Tzouramani and Mattas (2003), the benefit-cost ratio in greenhouse tomato production was 1.62 and 1.48.Ibekwe and Adesope (2010) estimated the benefit-cost ratio in the production of vegetables and it was 1.64. Off-season tomato production is profitable business and return was found more than double as compared to cost.

Table 4.Average input costs/acre (Rs.).

Production Practices	Farm Size Category		
	Small	Medium	Large
Tunnel Material**	58419.58	52523.33	70927.30
Land Preparation	13741.12	14254.16	13953.84
Seed	49488.54	48995.24	44544.00
Seedling Transplantation	4405.21	7747.62	14360.00
Fertilization	67362.50	64711.90	87763.00
Hoeing	4658.47	4782.98	4949.95
Pesticide	32724.70	32752.38	33434.00
Irrigation	9308.27	11398.02	9068.61
Picking	72295.21	75305.54	68319.26
Marketing	138798.91	133969.96	139057.00
Total Variable Cost	451202.51	446441.14	486376.96
	(0.451)*	(0.446)*	(0.486)*
Depreciation	18986.63	19790.00	22401.07
Interest on initial investment	7524.89	8310.20	12255.35
Interest on variable cost (@ 8% for8 month)	24064.13	23810.19	25940.10
Administrative cost (@ 3% of variable cost)	13536.08	13393.23	14591.31
Land Rent (Eight Months)	31430.56	30793.65	36466.67
Abyana	96.25	97.62	94.20
Total Cost	546841.04	542636.04	598125.66
	(0.547)*	(0.543)*	(0.598)*

*Amount in Million Rupees

** It includes cost of string, nut bolt, polythene sheet, mulch sheet, labour charges.

Table 5.Economic Analysis.

Indicator/Unit	Farm Size Category		
	Small	Medium	Large
Total Variable Cost (Rs.)	451202.82	446441.14	486376.96
	(0.451)*	(0.446)*	(0.486)*
Total Cost (Rs.)	546841.04	542636.04	598125.66
	(0.547)*	(0.543)*	(0.598)*
Production (Kg)	27524.17	29065.65	29563.20
Average Price/Kg (Rs.)	49.98	46.03	44.85
Average Cost/Kg (Rs.)	19.87	18.67	20.23
Total Revenue (Rs.)	1375520.23	1337892.09	1325968.65
	(1.376)*	(1.338)*	(1.326)*
Gross Margin (Rs.)	924317.72	891450.94	839591.69
	(0.924)*	(0.891)*	(0.840)*
Net Income (Rs.)	828679.19	795296.05	727842.99
	(0.829)*	(0.795)*	(0.728)*
BCR	2.52	2.47	2.22

*Amount in Million Rupees

Table 6 demonstrated the estimated results of log-linear Cobb-Douglas model for off-season tomato production in the study area. It showed that the value of R^2 was 0.69 and value of adjusted R^2 was 0.62. The value of R^2 shows that 69 percent variations in revenue were explained by our model. The value of R^2 was 79.4% for dry season vegetables model found by Ibekwe and Adesope (2010). The F-value was 10.34 which show the overall goodness of model and it was found significant and it was 10.29 for dry season vegetable model run by Ibekwe and Adesope (2010). The regression coefficient of age was 0.13 that showedsignificant and positive impact on revenue and the result was in accordance with Mwangi (2012). Khan and Ghafar (2013) also pointed out that with increasing age the farmer become more efficient but the coefficient was negative and insignificant according to Murthy *et al.* (2009). The value of education coefficient was 0.14 that showed significant and positive impact on revenue and it was same as told by (Ibekwe and Adesope, 2010; Khan and Ghafar, 2013; Murthy *et*

al., 2009; Mwangi, 2012). The education plays a key role in the production of tomato under a new technique. It was found that an educated farmer had more revenue. The coefficient of off-season tomato growing experience was 0.13 which shows significant and positive effect on revenue and it is matched with the findings of (Ibekwe and Adesope, 2010; Khan and Ghafar, 2013). It revealed that the total revenue is increased by 0.13% for 1% increase ingrowing experience of off-seasontomato. The coefficient of tunnel cost was 0.05 which indicated a positive and insignificant effect on revenue. The coefficient of land preparation cost was 0.13 which explained a positive and insignificant effect on revenue. The coefficient of labor man days was -0.03 which shows a negative effect on revenue and it was found highly insignificant.Insignificance of labor impact is in line with the finding of Murthy *et al.* (2009). The coefficient of lobour cost was also negative for off-season vegetables when it was estimated by Ibekwe and Adesope (2010)but labour input impact was positive and significant when estimated by (Khan and Ghafar, 2013; Mari, 2009; Mwangi, 2012).

The coefficient of seed quantity was -0.08 which represent a negative impact on revenue and it was found insignificant but it was positive when calculated by Khan and Ghafar (2013). The coefficient of NPK cost was -0.07 which shows a negative impact on revenue and it is in line with the finding of (Ibekwe and Adesope, 2010; Khan and Ghafar, 2013).The coefficient of pesticide cost was -0.18 which shows a negative impact on revenue and it was found significant but it was positive when calculated by Khan and Ghafar (2013). The coefficient of pesticide cost was negative because mostly farmers had less technical knowledge about disease attack, its type and recommended chemical usage. Therefore, the use of chemical exceeds the required quantity and effect negatively on production. It means that one percent more usage of pesticide reduces the revenue by 18 percent. The use of pesticide is beneficial for a crop but if we use it without recommendation than it shows negative impact on crop. The value of irrigation coefficient was 0.16 which shows a significant and positive impact on revenue and it was in the line with the findings of Khan and Ghafar (2013). Many vegetable crops require more water and their production increases subject to the availability of water. The coefficient of contacts with extension agent was 0.16 which showed a positive impact on revenue and it was found significant.It means that when a farmer having 1 percent more contacts with an extension agent than their revenue rises by 16 percent. The value of packing material cost coefficient was 0.03 which shows a positive impact on revenue and it was found insignificant.

There was significant effect of education, age, access to credit and status of the farmers on off-season tomato efficiency. Coefficients of education, family size, growing experience, farm size, labor cost, fertilizer cost, planting materials cost, irrigation cost were found significant at 5% significance level (Abdal*et al.,* 2009; Mwangi, 2012).

Table 6.Regression results of Cobb-Douglas production function.

Variable	Unit	B	t-value	p-value
Constant		12.84	8.29	0.00
Age	years	0.13	2.39	0.02
Education	years	0.14	2.19	0.03
Off-season tomato growing experience	years	0.13	2.05	0.04
Tunnel cost	Rs.	0.05	0.55	0.59
Land preparation cost	Rs.	0.13	1.37	0.17
Labor man days	No.	-0.03	0.45	0.65
Seed quantity	kg	-0.08	1.16	0.25
NPK cost	Rs.	-0.07	1.23	0.22
Pesticide cost	Rs.	-0.18	2.47	0.02
Irrigation	No.	0.16	2.09	0.04
Contact with extension agent	No.	0.16	3.73	0.00
Packing material cost	Rs.	0.03	1.51	0.14
R^2			0.69	
Adjusted-R^2			0.62	
F-ratio			10.35	

Conclusions and Recommendations: It is cleared from the results that off-seasontomato production is profitable business and return were found more than double as compared to cost and this statement has support from (Abdal *et al.,* 2009; Adengua *et al.,* 2013; Mwangi, 2012).Total cost of off-season tomato production by large farmers was more as compared to others and its monetary value was Rs. 598,125.66 but total cost was more in case of medium farmer according to Murthy *et al.* (2009). Large farmer obtained higher production from one acre of off-seasontomato which was 29,563.20 kg. Off-season tomato production was 29,065.65 kg and 27,524.17 kg

for medium and small farmer, respectively. Price received by small farmers was higher and it was Rs. 49.98 per kg and it was also found by Murthy *et al.* (2009). Small farmers received greater revenue from one acre of off-season tomato and it was Rs. 1,375,520.23 on an average. Gross margin received by small farmers was also higher than others and it was Rs. 924,317.72 /acre.The value of net income was Rs. 828,679.19 per acre for small farmers and it was also higher among others. The Benefit-Cost ratio (BCR) was 2.52 for small farmers and it was higher among others, and this result is also in the line of Murthy *et al.* (2009) study. It shows that by investing Rs. 1 in off-season tomato production, small farmer's return was Rs. 2.52. Benefit-Cost ratio was 2.47 and 2.22 in case of medium and large farmer respectively.

Estimation of log-linear Cobb-Douglas model provide the information that education, off-seasontomato growing experience, age, contact with extension agents and irrigation showed a significant and positive effect on revenue. Impact of pesticide was found negative and significant. Tunnel cost, land preparation cost and packing material cost have positive impact on revenue but these were found insignificant.Labor man days, NPK cost and seed quantity shows negative impact on revenue but theircoefficients were also insignificant.The value of R^2 was 0.69 and value of adjusted R^2 was 0.62. The value of R^2 shows that 69 percent variations in revenue were explained by the model. The F-value was 10.34 which show the overall goodness of model and it was found significant.

Ahmad *et al.* (2013) checked the economic efficiency of different systems of cropping in district Faisalabad. They calculated the income from rabi crops in different cropping systems. Income from per hectare production of rabi crops in different cropping systems like Rice-wheat (Rs. 168,600), Cotton-wheat (Rs.164,620), Radish-wheat (Rs. 165,230), Spinach-wheat (Rs. 166,420), Sesbania-potato-maize (Rs. 189,095), Bajra (fodder)-potato maize (Rs. 183,390), Sesbania-maize (grain)-wheat (Rs. 171,720) and Sesbania-maize (fodder)-wheat(Rs. 174,670) were calculated by Ahmad *et al.* (2013).

Although, it is economical to grow tomatoes in rabi season as an alternative crop but lack of support price and disease attack becomeshurdle in the way. Moreover, high initial investment in off-season tomato and staple food nature of wheat also divert the farmer's intension toward wheat in rabi season. Therefore, government should provide subsidy especially for small farmer for initial investment in this business. Small farmers have not enough resources to establish the proper tunnel structure. However they compete with large and medium farmers by using bamboo and sticks in their tunnel.

There exists variation in market prices and high initial investment. It is required to studythe marketing channels and marketing margins of tomatoes in Pakistan. Disease attack was found a major issue with tomato but farmers have less technical knowledge about the pesticide use according to attack. Therefore, it is the responsibility of extension staff to visit the areas frequently and recommend the fertilizers and pesticides according to nature of crop. A large number of farmers declared that there is lack of technical guidance from government. Government should educate and train those farmers which have interest in off-seasonvegetable cultivation. Farmers should aware about the balanced use fertilizer and pesticide. Government and other seed companies should introduce disease resistance and high yielding varieties. It is also useful for farmers to conduct a visit of soil scientist at the start of crop and it may also helpful in better use of fertilizers.

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