Global Social Sciences Review (GSSR)
p-ISSN 2520-0348, e-ISSN 2616-793X
Vol. III, No. I (Winter 2018) Page: 83 – 100

URL: http://dx.doi.org/10.31703/gssr.2018(III-I).06
DOI: 10.31703/gssr.2018(III-I).06

The Impact of Education, Health, Experience and Government Loans on Farmers' Productivity in District Nowshera

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Abstract *This study generally examines the influence of education, health, experience and government loans on farmers' productivity in district Nowshera. Specifically, this study (a) finds out the role of socio-economic factors determining tomato production in district Nowshera and (b) estimates technical efficiency of the tomato farmers in the area. Primary data has been collected through a field survey from 61 tomato producers of selected villages of the district. The results reveal on the average tomato farms in the study area are 95% efficient, indicating a 5% potential for the farms to attain the maximum output level while the range of efficiencies was 89% to 99%. Moreover, the results also showed education, health, experience and government loans playing a significant role in the determination of the tomato production. On the basis of these results, it is suggested that government increase spending on education and health as such loans can play an important role in the tomato farming in district Nowshera*

Key Words:

Cobb Douglas Production Function, Technical Efficiency, Determinants, KP (Khyber Pukhtunkhwa)

Introduction

The concept of economic efficiency can be categorized into two main components; technical efficiency and allocative efficiency. Technical efficiency is the ability of a farm to obtain maximum output from a given set of resources, on the other hand allocative efficiency is the ability of a farm to maximize profit by equating marginal revenue product with marginal cost of inputs (Himayatullah & Bashir, 1995). Technical efficiency can also be defined as the situation where a farm or a piece of land produces, with the given know how (a) a larger output from the same inputs or (b) the same output is obtained with less of one or more inputs without increasing the amount of other inputs is termed as Technical efficiency (Mari & Lohano, 2007).

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Measurement of technical efficiency has recently become an important issue in agriculture highlighting efficient use of resources. These resources include capital resource, capital and land resource. The inputs are used in different combinations for a desired level of agricultural output. Some of the factors which constitute farm inputs are land, labour, management services, and capital. Due to difference in combinations of various factors of production and also differences in the use of different factors of production, the yields of crops vary. Technology is the term used for such combinations. Due to technology difference, the farms have different levels of production. (Mari & Lohano, 2007).

In Pakistan, the production of fruits and vegetables is about 12.0 million tons annually. The exports of fruits and vegetables were US$ 134 million (2003-04) of which the share of fruits is 102.7 million US$, vegetables 25.7 million US$ and juices 5.6 million US$ (GOP, 2004).

Increased use of agricultural input, technological change and technical efficiency are three main factors that contribute to agriculture growth. Although the importance of agriculture sector cannot be ignored yet the potential of production in developing countries remains unrealized, this is due to various reasons e.g. under-investment in rural health, education, infrastructure, irrigation and also inefficiency in research and development.

Cultivation of vegetables is not only a cheap source of obtaining essential nutrients but it also helpful in creating more employment opportunities in comparison to other crops such as growing of cereals (AVRDC, 2001). However, vegetable production has a limitation that vegetables are only cultivated in the areas near the cities and it contributes to only one percent of the total cropped area in Pakistan, (Government of Punjab, 2002) if we compare it to Taiwan where vegetable cultivation is fifteen percent of the total cropped area (Ali, 2000). All this means vegetables are available in Pakistan at a low quantity to consumers. From studies it is revealed that in Pakistan the per capita consumption of vegetables is low i.e. it is35.6 kg per capita annually, while in comparison the per capita consumption of vegetable in Korea is 155 kg. Theper capita suggested level of vegetable consumption is 73 kg annually (Ali & Abedullah, 2002).

Measuring technical efficiency of different crops separately is feasible due to the fact that the type and intensity of efficiency is different for different crops (Ali et al., 1994). Production of agriculture crops such as tomato is stochastic and various shocks effect growth of these products. These shocks include rains, water shortages, or uncertainty about floods, crop diseases and yearly price changes. The major cause of low yields of tomato is the poor-set of tomato along with the high temperatures in the tropics and subtropics (Villareal & Lai, 1979). In the tropics and subtropics the seasonality in the production of tomato can produce a drastic and severe price fluctuation (Ali, 2000). Certain management practices for example protection measures, application of fruit-set regulator and shading etc.

can improve production of tomato even if the conditions are hot-wet, (Midmore et al, 1997). Tomato production is playing a vital role in the economy of Pakistan in a sense that it is not only providing economic benefits and creating employment opportunities for the poor but also it is supporting in the food consumption of the ever growing population at a lower price. Tomato requires 80 kg of phosphorous, 40 kg of potassium and 100 kg of nitrogen fertilizer per hector for optimum production. The soil type and climatic conditions play a vital role in the requirement of water for tomato e.g. it requires almost irrigation every week during cold period. Its fruit can be picked every three days and gives a yield of 20,000 to 24,000 kg/hac. (Baloch, 1996).

The consumption of vegetables like Tomato usually has high income elasticity of demand, thus there will be more demand for these vegetables with the rise in income or if there is economic growth, increase in population or urbanization.(Mari & Lohano, 2007). Pakistan has the potential to export Tomato and other vegetables as there is trade liberalization word wide. Production of tomato is a profitable business for the farmers and it has turned into a cash crop for the farmers of the province (GOP, 2009). Despite the importance of agriculture sector, current yields of various crops in Pakistan are comparatively lower against other countries of the world (Himayatullah, 1995). Among the reasons for this low productivity, one is the availability of less area for cultivation in Pakistan, lack of adoption of new technology and due to fragmentation, availability of small piece of land with the farmers etc.

Rationale of the study

More than 81% of the land is under cultivation (from data above) in Akbarpura in district Nowshera. The land is remarkably fertile in the sample study area. Major crops of the area are vegetables and orchards. Plumbs were observed to be the most common fruit and its orchards cover an area of more than 44 percent. (Tahir, 2008). Due to this very reason, it was demandable to measure the technical efficiency of tomato farms in this specific area. Moreover orchards and vegetables are the most grown crops it will be of high interest for the researchers to perform a comparative study of grain production and vegetable production. The basic aim of the current study is to find out the determinants of tomato production in the district Nowshera. Moreover, the study also estimates the cost, production and technical efficiency of tomato farmers. Therefore, the study highlights important policy implications regarding the agriculture sector in the area which can be helpful for the policy makers.

Purpose of the Study

The key objectives of the study are given as follow. Following are the main objectives of the study:

- To estimate the cost and production of tomato farmers in district Nowshera.
- To find out the determinants of tomato production in district Nowshera.
- To measure the technical efficiency of tomato farmers in the area.

Literature Review

Heady *et al.* (1956) started work on technical efficiency for the first time. To estimate the level of farm efficiency he used production function. Debreu (1951) and Farell (1957) worked on it and they laid the foundations for further research in estimating efficiency of farms. Using Cobb-Douglas type of production function it is easy to interpret results more-over this method grants an adequate degree of freedom while carrying out statistical tests (Heady and Dillon, 1961; Griliches, 1963). Chennareddy (1967) were of the view that it is practicable to estimate output and input relationship through Cobb-Douglas type of production function.

Koopman (1989) carried out his research in Soviet Union. During his analysis he revealed that technical efficiency of aggregate production as a whole was 94% and the other Republics of Union had a very little variation in results. Koopman used time series data for his research. Danilin et al. (1985) worked on the refining plants of cotton in Soviet Union using cross section samples and the revealed results were similar to Koopman. On average the technical efficiencies of the plants were found to be 92.9%.

Kumbhakar *et al* (1991) proposed the computation of technical and allocative inefficiencies through Bayesian inferences in the commercial banking system of United States using panel data. This method is adopted in cost system in which cost functions are estimated along with its equation. For this purpose they proposed and implemented Markov chain Monte Carlo techniques in over or under use of inputs and input price distortions. They estimated a well-specified Translog system where error terms show internal consistency in the frame-work.

Bravo-Ureta *et al*. (1994) in their study compared the efficiencies of Paraguan cotton and cassava producers. They were of the opinion that the average efficiency of Paraguan cotton was 40.1% while in comparison the efficiency of Cassava producers was 52.3%. According to them the production of these crops can be increased as they were not producing at their potential level. Socioeconomic characteristics were however found to have no effect on the efficiency level. They explained that this surveillance is possible due to the existence of a stage of development threshold below which such relationships may not be observed. They were of the view that the sampled Paraguan farmers were producing below their potential output.

Ahmad (2003) showed that elasticities of production varied among poor and non-poor farms in Pakistan. He also showed that production elasticity of land is

higher on rich farms than those of poor farms. Rich farmers had a higher investment returns than poor farmers. The farms having salinity problem and whose location was at the tail-ends comparatively had less productivity and efficiency. He found that the average technical inefficiency was 43 percent in terms of loss in output and it ranged from 17 percent to 62 percent, mainly due to lack of access to farm inputs. He called for a strong and active role on the part of government for initiating income generating activities and input supply chain for the poor to break the nexus of poverty, control land degradation and low agriculture productivity. All this can be done in close partnership with the private sector.

Ahmad et al (2002) was of the view that the use of production function and also cost and profit function approaches on horticultural crops particularly on vegetables crops are inadequate.

He used production function analysis on Production, Marketing and Export of Citrus. According to him farmers' education, number of ploughing, pesticide cost and quantity of fertilizers affected the productivity of citrus positively. He also confirmed that Farm Yard Manure application and number of irrigations through tube well showed non-significance in the production function. Results also indicated that spraying and plowing were under-utilized while the other inputs were used in excess quantity.

Materials and Methods

Details about the data, sample size, sampling procedure and methodology of the study are given below:

Universe and Sample of the Study

Nowshera District forms universe of this study. It comes in Peshawar valley and is situated on both sides of River Kabul. Nowshera is predominantly an agricultural area and most of its people depend directly or indirectly on agriculture for their livelihood. This district is blessed with a fertile land and an agriculture supporting climate. Tomato, Ladyfinger (Okra), Brinjals, Tinda (squash) and Bitter gourd are its major Kharif vegetables while Radish, turnip, spinach and cauliflower are its major Rabi crops. The main sources of irrigation water for district Nowshera are Kabul and Warsak gravity canals.

It is generally known that if the sample size is kept large, it will have a higher reliability. As a consequence the error will be lower and we will have greater confidence that our findings will reflect the characteristics of the whole population.

The researchers take Akbarpura and its allied small villages as our sample study area. Population wise it is a big village of district Nowshera. Vegetable sale is an important source of income for the farmers of the area. Vegetables are

grown on a large scale because of three main reasons, the fertility of land, existence of large local vegetable markets and the last of all is easy access to the markets of other cities. The total area of Akbarpura is 1850 Acres, of which 1503 Acres is cultivated and 345 Acres remain uncultivated. A brief summary is given in table below.

Table 1. Cultivated and Non-cultivated Area of the Study

Total area in Acre	Cultivated Area	Uncultivated Area	Major Crops	No. of farm families
1850	1503	349	Vegetable & Orchards	1140

Office of the Agriculture Officer, Akbarpura Circle, 2017.

The main crops of the village are vegetables and orchards. For our present study we keep our study limited to a single vegetable of Kharif. Among the different vegetables of Kharif, Tomato is grown the most. The total number of Tomato growers in the sample village is approximately 410. For our study, we take a sample of 61 farmers at the rate of 15 percent as shown in the table 2 below:

Table 2. Details of Farmers and Sample Size Selection

Vegetables	Total Farmers	Sample Farmers
Tomato	410	61

Office of the Agriculture Officer Akbarpura Circle, 2017

Empirical Model

The main objective of this study is to investigate the input-output relationship using a mathematical function. For this purpose, the input to output relationship in tomato production is identified by using Cobb Douglas type of production function. The study involved several costs, then these costs were classified into three main categories comprising of Land inputs, Labour inputs and capital cost (It is suggested by (**Nix-1979**).

Cobb-Douglas function is used to represent the functional form of the production function and is given as under:

$$y = A\, x_1^{\beta 1} x_2^{\beta 2} x_3^{\beta 3}\, e^{\varepsilon} \quad \text{………………………………………………… (1)}$$

In the above equation output is represented by y and x_1,x_2 and x_3 are used to represent the three variable inputs. A, β_1, β_2, β_3, symbolize the coefficients and ε

is the error. Various variables that could possibly affect the production of tomato are represented by the error term.

For the current study, all the three inputs and output are considered in value terms to bring the variables to a common unit. In the equation *y* is the output and it represents the total production of the tomato crop in rupees. Labour inputs are represented by variable x_1 and it includes labour activities rendered for various farm operations like cost of irrigation in rupees, number of weedings and ploughings. Furthermore it also includes leveling and other activities from seedling to picking of the tomato. Capital inputs are represented by variable x_2 and it includes seedlings cost, fertilizers cost and pesticides costs measured in rupees. Land inputs are represented by variable x_3 and it includes rent of land in rupees and land tax.

We re-arrange the different terms used in the model for the purpose of testing test the significance of β_1, β_2, and β_3. First Multiplying and then dividing it by $x_3^{\beta 1} x_3^{\beta 2}$ will not change the model:

$$y = A x_1^{\beta 1} x_2^{\beta 2} x_3^{\beta 3} e^{\varepsilon} x_3^{\beta 1} x_3^{\beta 2} \quad \text{.....} \quad (2)$$

If we re-arrange the terms in equation 2 we get

$$y = A[x_1/x_3]^{\beta 1} [x_2/x_3]^{\beta 2} \; x_3^{\beta 1+\beta 2+\beta 3} e^{\varepsilon} \quad \text{.....} \quad (3)$$

Let $\beta_1 + \beta_2 + \beta_3 = h$then equation 3 can also be written as

$$y = A[x_1/x_3]^{\beta 1} [x_2/x_3]^{\beta 2} \; x_3^{h} e^{\varepsilon} \quad \text{.....} \quad (4)$$

The model in Equation (4) shows that the degree of homogeneity can directly be estimated and tested for its significance. The value of homogeneity shows different possibilities for returns to scale.

Statistical Frontier Model (Corrected OLS)

The above equation was transformed into log so as to workout basic productions function for tomato crop:

$$ln\, y = \beta_0 + \beta_1 ln\, [x_1/x_3] + \beta_2 ln\, [x_2/x_3] + h\, ln\; x_3 \quad \text{.....} \quad (5)$$

In this equation, *y* is the total revenue production for the tomato farms. x_1 is the labor input, x_2 is the capital input and x_3 is the land input in value terms. Ordinary least square is used to estimate this equation for tomato crop, the function was shifted to correct the intercept by omitting all the positive residuals and at least one was left zero.

The ratio of actual output and output predicted provides the technical efficiency of tomato farms.

$e_j = Log\, Y_j - Y_j^*$

$j = 1,2,3 \ldots\ldots\ldots 61$

$e_{j<0}$

$T.E_j = \exp(ej) = Y_j / Y_j^*$

Results and Discussions

Socio-Economic Features of Sampled Respondents

Socio economic features are a valuable source of providing useful information to the researchers. Socioeconomic features are very important and are responsible for the cropping patterns of the farmers. These features are also responsible in bringing technological changes, for higher production as well as these help in making trading system to work efficiently. These features include age group, level of education, net operational area and tenancy status etc. The socioeconomic characteristics have been described in the following section so that it may help to understand the production environment of tomato. The age wise distribution of farmers is given in table 3 as under.

Table 3. Age-wise Distribution of Sampled Respondents

Age (years)	Number	Percentage
29-45	19	31.15
46-62	28	45.90
63-79	14	22.95
Total	61	100

(Field Survey March-April 2017)

The results of survey in table 3 show that around 31% sampled respondents were in the age group between 29-45 years while the age groups between 46-62 and 63-79 comprised more than 45% and 22% of the total sampled respondents respectively. In the Akbarpura village, majority of the farmers fall in the age group 46-62 i.e. more than 45%, the reason behind it may be the non-availability of young ones for farmig or it may be due to concentration of young generation towards education.

Education also plays a key role in the production. For this purpose, farmers were also asked about their education level. Their responses are given in table 4 as below:

Table 4. Educational Level of the Sampled Respondents

Level of Education	Number	Percentage
Illiterate	31	50.8
Primary	18	29.5
Middle	7	11.5
SSC and above	5	8.2
	61	100

(Field Survey March-April 2017)

Table 4 shows that that majority of the sampled farmers in the study area were illiterate (i.e. 50.8 %). The second largest percentage i.e. 29.5% of the sampled farmers was primary passed. 11.5% were having middle level and 8.2% of the sampled farmers were having matric or above level of education. It was deducted that as a whole the educational level of the sampled respondents was low. Despite the fact that the literacy rate of the study area is better, majority of the educated people were not involved in farming. This occupation was mainly adopted by uneducated, marginal educated or those people who received this profession in inheritance.

The farmers were also divided into three groups i.e. Owner, Tenants and Owner-cum-tenants on the basis of tenancy. The perceptions obtained from tomato farmers are given in table 5 as follows:

Table 5. Distribution of Tomato Farmers on Basis of Tenancy Status

Tenancy Status	Number	Percentage
Owners	23	37.7
Owner-cum-Tenant	10	16.4
Tenant	28	45.9
Total	61	100

(Field Survey March-April 2017)

Data given in the table shows that about half of the sampled respondents i.e. 45.9% are tenants while the owners are smaller in number i.e.37.7% as compared to tenants. It may be due to the fact that more off -farm jobs are available to the people or it may be due to the increasing trend towards education.

Data regarding the Size of the Land holding or net operational land of the sampled respondents is given in the table 6 below:

Table 6. Division of Respondents by Farm Size

Farm Size	Number	Percentage
Up to 1	28	45.90%
1>to<2	25	40.98%
2>to<3	6	9.84%
3>to<4	0	0%
4>to<5	2	3.28%
Total	61	100

(Field Survey March-April 2017)

The data given in the table above revealed that most of the farmers of the area were operating on small and marginal lands. Majority of the farmers i.e.45.90% were operating on farm size upto 1 Acre, 40.98% were operating on upto two acres, 9.84% upto three acres and 3.28% upto five acres respectively.

Involvement in Farming of the Sampled Respondents

The rural area accommodates the major part of population i.e. more than 65% and farming is the major source of income of the rural people. Due to their heavy dependence on agriculture, farming remains the major source of income of rural people. Table 7 shows the involvement of farmers in farming as a part time or full time farmer.

Table 7. Involvement of SAMPLED Respondents in Farming

Involvement in Farming	Number	Percentage
Part time	10	16.4
Full time	51	83.6
Total	61	100

(Field Survey March-April 2017)

The table above shows that about 84% of the sampled respondents represent full time involvement in farming while the remaining 16.4% of the farmers are partly involved in farming indicating that these respondents derive their income from other sources as well.

Farming Experience of the Sampled Respondents

This section presents the information regarding the experience of the farmers. The table 8 represents the averages and standard errors of the farming experience; here the standard error indicates the robustness of the mean value.

Table 8. Experience of Farmers

Particulars	Average	Std. error of the mean
Farmers' age	51.75	1.61
Farming Experience	22.655	1.42

(Field Survey March-April 2017)

Cost of Production

It is divided into two main categories, 1st is fixed cost which includes land input and 2nd is variable cost, labor and capital inputs are included in this cost. Land rent and land taxes are included in land input cost. All activities within the farm which start from sowing and last till harvesting are included in labour input cost e.g. production practices and field operations which animals, humans and machinery perform. Activities such as sowing and pesticides applications, irrigation etc and then picking are incorporated in labour cost. While some other costs e.g. seeds purchasing cost, pesticides and herbicides, farm yard manure and nurseries raising, fertilizers etc. are incorporated in capital cost.

The cost of tomato production per acre is presented in table below. In the study, the production cost has been split into three main categories including expenditure on land inputs, expenditure on labor inputs and on capital inputs. From the results it was observed that per acre average cost of labour input was 8972 and it ranged from 5789 to 16899. Similarly, per acre average production cost of Land input was 8212 ranging from 6533 to 12433, the average per acre cost of production of capital input was 19629 and it ranged from Rs 7433 to Rs 28590. Labour input contributed 24.37 percent to total cost of production while Capital and Land input contributed 53.32 percent and 22.31 percent respectively to total cost of production.

The above information is present in table 9. The yield or the production of tomato in value terms is presented in Table 10, which shows the minimum, maximum and average yield per acre.

Table: 9 Percentage contributions of inputs to total cost of production

Inputs	Contribution			Percentage
	Min	Max	Avg.	
Labour	5789	16899	8972	24.37%
Capital	7433	28590	19629	53.32%
Land	6533	12433	8212	22.31%
Total			36814	100%

(Field Survey March-April 2017)

Table 10. Average Yield of Tomato farms per Acre

Particulars	Yield (Rs)
Minimum	33500
Maximum	58530
Average	45426

(Field Survey March-April 2017)

Production Function Analysis

It is generally considered that agricultural production especially those of vegetables is a complex process. The tomato production can be used as function which consists different of variables and these variables are a part of production process. Its productions depend on different things e.g. fluctuations in natural environment and usages of different inputs and along with this, it also depend on how the farmers manage their practices. In our present study production function analysis has been carried out to assess efficiency in production and returns to scale of tomato farms. The function then helped to work out the relation between input and output of tomatoes. The production function has been estimated in district Nowshera (Khyber Pakhtunkhwa).

To investigate about the efficiency of farms the analysis of production function was conceded in Nowshera district (Khyber Pakhtunkhwa), the Cobb-Douglas production function was estimated. Results of the regression are described in table 11. In the following table, the values of coefficients and their respective standard errors are given. Similarly t'statistic is also presented to test the significance. It has already been discussed in the methodology that the value of h represents the measure of homogeneity. In the present study (h<1), from which the tomato production function was clearly showing a decreasing returns to scale which by its definition expresses that by increasing inputs in the same proportion, the output is not increased proportionately.

Table 11. Estimation Results

Model	Unstandardized Coefficients			Standardized Coefficients	T	Sig.
	B		Std. Error	Beta		
(Constant)	β_0	5.479	.331		16.562	.000
ln $\{x_1/x_3\}$	β_1	.694	.198	.263	3.512	.001
ln$[x_2/x_3]$	β_2	.684	.188	.238	3.648	.001
ln x_3	h	.468	.036	.959	13.024	.000
a. Dependent Variable: ln yield						

For the current study the critical value of student, t distribution at 5 percent confidence interval was kept at 2 and the sample size was 61. The regression results showed that the t value for all the three variables i.e. Labour input, capital input and land input was high and they were statistically significant. The value of R square was .769 and R square adjusted was .757. These high values showed that the model as a whole is statistically significant. The results of individual

variables showed that all the three variables are positively related to Yield of the tomato crop. The value of F was found to be 63.3 which proved the significance of model. The R-squared value is 0.769. This shows that 76% variation in the tomato production of farmers is explained by the independent variables in the study area.

Technical Efficiency

Now a day one of the important concerns for the economists is the issue of farm efficiency. For measuring inefficiencies' level in production environment, technical efficiency is used as a tool. In simple words the concept of technical efficiency is a method to express the effects of inputs on output and for this purpose their various combinations (inputs, output) are taken into consideration. For the purpose of correcting the intercept, the function is shifted and all the positive residuals are removed with the exception of one zero. Following this method, production function for tomato is estimated as follows:

Tomato $y^* = 5.712 + 0.534\ x_1/x_3 + 0.503\ x_2/x_3 + 0.424x_3$

Here in the above function y* which is the predicted output, is on a level which is higher than its inputs level as well as the level of combinations of different inputs for tomato. The actual level of output will be in equality to the predicted level of output on the condition that the farm is operating on the frontier, and the actual inputs used on tomato farms are given, else production of farm in actual will be less in comparison to production of farm predicted.

Actual level of output and predicted output was calculated and then their ratio was taken which provided the technical efficiency of individual tomato farms. During this process the output (predicted) was estimated after correcting the residuals.

$$e_j = lnY_j - lnY_j^*$$

$$j = 1,2,3\ldots\ldots\ldots 61$$

$$ej \leq 0$$

$$T.E_j = exp\ (ej) = Y_j / Y_j^*$$

From the results of this study it was observed that tomato farms on the average were 95 percent efficient or the other way they were producing 5 percent less than the potential output level. These farms were efficient because the farmers followed standard practices in the use of inputs and also the stability in prices during the research period. The following table 12 presented the technical efficiency of tomato farms.

Table 12. Technical efficiency score of tomato farms

No of Farmers	Percentage	Cumulative Percentage	Technical Efficiency Levels
1	1.63	1.63	0.89
4	6.55	8.18	0.9
1	1.63	9.81	0.94
5	8.19	18	0.96
7	11.47	29.47	0.97
20	32.7	62.17	0.98
5	8.19	70.36	0.99
5	8.19	78.55	0.88
6	9.83	88.38	0.93
7	11.47	100	0.91
61	100.0	100	Total

(Field Survey March-April 2017)

The results given in table 12 shows the technical efficiency levels of all selected tomato farmers. It has been found out that the technical efficiency level of all the farmer was high. Out of 61 farmers the technical efficiency 1 farmer was 0.89, 4 farmers were 0.90, 1 farmer was 0.94, 5 farmers, 7 farmers 0.97, 20 farmers 0.98, 5 farmers 0.99, 5 farmers 0.88, 9 farmers 0.92, 6 farmers 0.93 and 7 farmers 0.91 respectively. The results showed that the technical efficiency levels of the farmers were in the range of 0.89 to 0.99. And out of 61 farmer's majority of the farmers were having technical efficiency score of 0.98.

These farms indicated diminishing returns to scale which concluded that addition of more and more inputs to the farms will not increase the output. Further it can be concluded that farm inputs including Farm yard manure, various fertilizers, quality seeds, use of tractors, irrigation water etc. were positively related to farm efficiency and years of schooling, farmer's experience and age of the farmers had little or no impact on the efficiency level. This result is line with Hussain (1989) who found no association between education and wheat farm inefficiency.

The reason for this high level of efficiency could be that the services of extension are available to the farmers at their door. Officers often visit the area and provide expert advices moreover less of the distance from farm to market, better road infrastructure and use of modern input are some of the causes of efficient production. Better infrastructure facilities and access to roads not only expand the output market but also increase the demand for modern input, Ghura and Just (1992). During the study it was observed that tenants were

comparatively efficient than owners and the reason could be that the tenants are usually under economic pressures like paying rents, high variable costs and last but not the least, saving something for the survival of their families. So they struggle more for the achievement of high production potential. It still remains a valuable and well established fact that input and output prices have a critical role in determining the profitability of crops, in choosing appropriate production technology and also in the supply of agriculture commodities. Chhibber (1988); Thomas and Chhibber (1992) and Ghora and Just (1992) were of the view that to boost the supply of agriculture commodities, price incentives should be supplemented with investment in rural infrastructure, roads, markets and financial institutions and agriculture education, agriculture research and improved extension services.

Conclusion

The study analyzed the technical efficiency of tomato farmers in district Nowshera. For this purpose, primary data has been collected from 61 sampled tomato farmers in selected villages of the district by using random sampling method. Regression technique has been used for the analysis of the data. The results of the study showed that on the average tomato farms in the study area are 95 percent efficient indicating a 5% potential for the farms to attain the maximum output level while the range of efficiencies was from 89% to 99%. It is suggested that farmer's education, health, experience and loan from government plays an important role in the tomato farmer's production. Hence, the government should take appropriate measures for their facilitation.

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