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Evaluation of Farmers Socioeconomic Characteristics Influencing Tomato Output in District Peshawar, Khyber Pakhtunkhwa, Pakistan

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Abstract | Tomato (*Lycopersicon esculentum L.*) is one of the most important and widely distributed horticultural vegetable crops in the world. It is economically attractive to farmers, due to its short duration for ripping which increases productivity. Thus, it is becoming an indispensable source of farmer's income in Pakistan. The production of tomato has been decreased considerably during the last five years. The present study has been conducted to explore the farmer's socio-economic characteristics, affecting the tomato production in district Peshawar, Khyber Pakhtunkhwa, Pakistan. A multi-stage-sampling technique and interview method were adopted for data collection. A sample of 160 tomato (Kharif) growers was drawn from 16 villages of district Peshawar. Chi-Square and Pearson Rank correlation tests were employed to find out the association and correlation between level of productivity and socio-economic characteristics of tomato growers such as education level, work involvement, family size, farming experience, age, and source of income and land size. The results showed a highly significant positive relationship of tomato production with all socio-economic factors except female involvement in the study area. Therefore, extension services and training should be fortified through extension agents for those farmers having no basic education for improving their skills and production of tomato, in turn it will contribute the demands of tomato at provincial and national level.

Introduction

Tomato (*Lycopersicon esculentum* L.) is one of the most important and widely distributed horticultural vegetable crops in the world. It is also (*Lycopersicon esculentum* L.) an important cash crop, ranked second after potato globally (Adalid *et al.,* 2004). It belongs to the family of potato, eggplant, tobacco and peppers known as *Solanaceae* family and has vitamins A, B and C (Naika *et al.,* 2005). This crop is economically attractive due to ripe in short

duration, leading to its high productivity rate among farmers. Its production has increased about 300% in last four decades in the world given its economic and nutritive importance (Atherton and Rees, 2005). Approximately 130 million tons of tomatoes were produced in the world in 2008 with China being the largest producer, accounting for about one quarter of the global output, followed by the United States and Turkey (Atherton and Rees, 2005). Tomatoes are major contributors of the carotendiondes (specially lycopene), phenolic and vitamin C in daily diets

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(Causses *et al.*, 2003). Moreover, results from the epidemiological studies have shown that tomato and its products may have a positive effect against various forms of cancer, especially prostate cancer and cardiovascular diseases (Ellinger *et al.*, 2006).

Tomato crop is grown twice in a year in all provinces of Pakistan, one is cultivated in spring and other is cultivated in autumn. During 2017-18, total production of tomato crop was 414645 tons grown over an area of 41731 hectares. It was cultivated in Punjab, Sindh, Baluchistan and Khyber Pakhtunkhwa (KP) on areas of 8274, 24968, 5354, 3135 hectares respectively in 2017-018 and production was 109445, 182198, 37556, 85446tons respectively (GoP, 2018).

Many factors such as climate, soil type, market, inputs used and economic situation can affect tomato productivity depends (Toenniessen *et al.*, 2008). However, socio-economic factors are also known to power agricultural productivity, mostly among smallholder farmers in terms of quantity and quality of agricultural production (Al-Shadiadeh, 2012).

Enete and Okon (2010) found that socio-economic characteristic like farmers education, fertilizers application, farmers income and seed rate significantly affect agriculture productivity in Nigeria. Further, Ozor and Cynthia (2010) argued that basic education and family size of the farmers were the key socio-economic characteristics of agriculture productivity. Similarly, Opara (2010) and (Abu *et al.*, 2011) also concluded that basic formal education was the main source of higher agriculture productivity in Nigeria agriculture. Adenuga *et al.* (2013) investigated that tomato productivity was influenced by education level of the farmers. Besides that, Mathenge and Tschirley (2008) found that agriculture productivity increased with the increase in the income level of the farmers. Khan and Ghafar (2013) revealed that shortage of land is the responsible factor of tomato productivity in Peshawar, Pakistan.

Peshawar is one of the ten tomato producing districts of Khyber Pakhtunkhwa province. Tomato crop is cultivated in two seasons, one is cultivated in spring (Kharif season) and the other is in autumn (Rabi season) in district Peshawar. During Rabi season 2013-14, total production was 1056 tons grown over 93 hectares of area while in Kharif season, tomato was cultivated on an area of 42 hectares having total production of 9524 tons (GoKP, 2014). As tomato production is an important source of income for the farmers, it is, therefore necessary to find-out its determinants. The aim of this paper is to investigate the existence of relationship in tomato productivity and socio-economic characteristics of farmers in district Peshawar.

Materials and Methods

Data collection

This research was carried out in district Peshawar of Khyber Paktunkhwa, Pakistan. A multi-stage-sampling technique and interview method were used for data collection. District Peshawar is divided administratively in four towns known as tehsil in local dialect i.e. Town-I, Town-II, Town-III and Town IV. Out of which, Town-II and Town-IV were selected on the basis of rural population. In these two towns, three Union Councils were selected on the basis of tomato production. Out of six cells (union councils), three villages were selected from each selected union councils on the purpose of dominating tomato production. From total of eighteen villages, 160 tomato growers were randomly interviewed in August-September 2019. Tomato productivity is divided into three categories on the basis of tomato yield per hectare. These categories are low level (less than 5.0 tons ha^{-1}, medium level (5.0-10.0 tons/hectare) and high level (above 10.0 tons ha^{-1}).

Analytical technique

Descriptive statistics were employed to analyze the socio-economic characteristics of tomato growers. In addition, Chi-square and Spearman Rank Correlation were employed to test the association and correlation between various categories of tomato productivity and socio-economic characteristics of tomato growers. The Chi-square statistic is computed as (Masood *et al.*, 2012)

$$\chi^2 = \Sigma\Sigma \ (o_{ij} - e_{ij})^2 / e_{ij} \text{ with } (r-1)(c-1) \text{ degree of freedom}$$

Where;

$$e_{ij} = (A_i * B_j) \ / \ n = (i^{th} \text{ row total} * J^{th} \text{ Colum total}) \ / \text{Total number of observation})$$

The Spearman Correlation is computed is as:

$$rs = 1 - \frac{6\Sigma d^2}{n(n^2 - 1)} \quad \text{(Kazmi, 2015)}$$

Where;

d_i = difference ranks of between corresponding values

of categorical variables, *n*= Number of data points of the two categorical variables. The value of spearman correlation coefficient (r_s) lie between -1 and +1.

Results and Discussion

Socioeconomic factors of tomato farmers

The results show different socioeconomic characteristics of tomato growers in the study area. According to the results, education level of respondents was mostly up to primary level. 31% of the respondents were illiterate, and 28% had education up to primary level while 40% were above the primary level. This indicates that majority of the farmers could not continue their education after primary level and joined farming profession as a source of income. In term of work involvement, results shows that about 44% females were involved to help their males. In case of family size having 4-6 members were about 40% followed by 30% having members between 6-8. It indicates that higher family size implies higher farm laboring. It was evident from the Table 1 that most of the tomato growers were aged and experienced (42% in the age group of 41-60 and 50% having more than 10 years' experience in tomato production). The results shown in Table 1 that tomato production was the main source of income of 37% respondent followed by the about 44% respondent having tomato and livestock. Finding shows that 50% of the farmers have farm size less than 0.5 hectare while only 8% holding more than 1.0 hectare in the study area.

Relationship between socio-economic of tomato growers and different productivity levels

The Table 2, presents the association and correlation among the tomato productivity level and different socio-economic characteristics of tomato growers in the study area. The findings as shown in the Table 2 shows a significance difference between the tomato productivity level and socioeconomic characteristics. Results show that educational level has a significant association and correlation with tomato productivity. Farmers with low level of education were lagged behind (only 10%) the farmers with high level of education (53%) in tomato productivity. The results were similar to Masood *et al.* (2012).

Results reveled that both female involvement and family size were statistically significant at 5% significant level (χ^2 = 2.06476.03 d.f = 2 P-value=0.002 and χ^2= 164.89d.f = 6 P-value=0.000). It implies that less female involvement and small family size, less will be tomato productivity.

Table 1: *Socio-economic factors of tomato farmers.*

Socio-economic factors	Frequency (N)	Percentages (%)
Educational status (ES)		
Illiterate	50	31.25
Primary level	45	28.12
Above primary	65	40.62
Total	160	100
Work involvement		
Male	90	56.25
Female	70	43.75
Total	160	100
Family size (FS) (No.)		
0-3	20	12.50
4-6	63	39.37
7-10	47	29.37
Above 10	30	18.75
Total	160	100
Farmers experience (years)		
< 5	30	18.75
6- 10	50	31.25
>10	80	50.00
Total	160	100
Age of respondent (years)		
Below 25	20	12.50
25-40	63	39.37
41-60	67	41.87
Above 60	10	6.25
Total	160	100
Source of income		
Tomato production	60	37.50
Tomato and livestock	70	43.75
Employment	20	12.25
Others	10	6.25
Total	160	100
Land size (ha.)		
< 0.5	80	50.00
0.5- 1.0	67	41.87
> 1.0	13	8.125
Total	160	100

Farming experience determines the efficiency of performing a task to get high productivity level. The results show that high level of productivity were observed from 30 (50%) farmers who have more than ten years' experience tomato production and the relationship between the variables was found statistically significant.

Table 2: *Relationship between socio-economic of tomato growers and different productivity levels.*

Socio-economic factors	Different tomato productivity level			
	Low	Medium	High	
Educational status (ES)	**Total**			
Illiterate	27(64.28)	13(22.41)	10(16.63)	50(31.25)
Primary level	10(23.81)	17(29.31)	18(30.00)	45(28.12)
Above primary	05(11.91)	28(48.27)	32(53.33)	65(40.62)
Total	42(100)	58(100)	60(100)	160(100)

Chi-Sq = 32.996 d.f = 4 P- value =0.000, Spearman Rank Correlation=0.391, Sig.=0.000

Female involvement				
Yes	15(35.71)	25(43.10)	30(50.00)	70(43.75)
No	27(64.28)	33(56.90)	30(50.00)	90(56.25)
Total	42(100)	58(100)	60(100)	160(100)

Chi-Sq = 2.06476.03 d.f = 2 P-value=0.002, Spearman Rank Correlation=-0.113,Sig.=0.003

Family size (FS) (Nos.)				
0-3	11(21.27)	6(24.53)	3(16.67)	20(12.50)
4-6	19(59.57)	27(37.74)	17(25.00)	63(39.37)
7-10	10(14.89)	17(18.87)	20(30.00)	47(29.37)
Above 10	02(4.25)	8(9.43)	20(28.33)	30(18.75)
Total	42(100)	58(100)	60(100)	160(100)

Chi-Sq = 164.89 d.f = 6 P-value=0.000,Spearman Rank Correlation= 0.853,Sig.=0.000

Farmers experience (years)				
< 5	18(42.85)	8(13.79)	4(6.66)	30(18.75)
6- 10	14(33.33)	10(17.22)	26(43.33)	50(31.25)
Above 10	10(23.81)	40(68.96)	30(50.00)	80(50.00)
Total	42(100)	58(100)	60(100)	160(100)

Chi-Sq= 166.58 d.f = 4 P- value=.000, Spearman Rank Correlation= 0.842,Sig.=0.000

Source of income				
Tomato production	25(59.52)	23(39.65)	12(20.00)	60(37.50)
Tomato and livestock	15(35.71)	30(51.72)	25(41.67)	70(43.75)
Employment	6(14.29)	3(5.17)	11(18.33)	20(12.25)
Others	0(0.00)	2(3.5)	8(13.33)	10(6.25)
Total	42(100)	58(100)	60(100)	160(100)

Chi-Sq = 154.31 d.f = 6 P-value=0.000,Spearman Rank Correlation= 0.833,Sig.=0.000

Farmers age (years)				
Below 25	14(33.33)	6(10.34)	0(00.00)	20(12.50)
25-40	13(30.95)	24(41.37)	26(43.33)	63(39.37)
41-60	9(21.42)	25(43.10)	33(55.00)	67(41.87)
Above 60	6(14.28)	3(5.17)	1(1.67)	10(6.25)
Total	42(100)	58(100)	60(100)	160(100)

Chi-Sq = 154.31 d.f = 6 P-value=0.000,Spearman Rank Correlation= 0.833,Sig.=0.000

Land size (ha.)				
< 0.5	36(85.71)	20(34.48)	24(40.00)	80(50.00)
0.5- 1.0	4(9.52)	31(53.45)	32(53.33)	67(41.87)
> 1.0	2(4.76)	7(12.07)	4(6.67)	13(8.125)
Total	42(100)	58(100)	60(100)	160(100)

Chi-Sq= 219.8112.850 d.f = 4 P- value=.000, Spearman Rank Correlation=0.776, Sig.=0.000

Note: *Figures in parenthesis show percentages.*

The results shown in Table 2 reflect that almost 80% of the respondent having tomato production as a main source of income and shows a significant relationship with productivity level. It implies that tomato production was the main source of income of the farmers in the study area. Results in Table 2 reveals that 40% farmers having less 0.5 hectares producing high level of tomato productivity while only about 7% producing the same level having above 1 hectare. The relationship between variables was found significant at P= 0.000

Conclusions and Recommendations

Socioeconomic characteristics of tomato growers were deliberated arrangement of educational status, female involvement, family size, and farmer's experience, main source of income and size of land. Most of the factors reveal significant association and correlation with productivity level. Interestingly female involvements shows an insignificant correlation with tomato productivity level (r_s=-0.113, Sig. = 0.153).

- Extension services should be fortified through extension agents for those farmers having no basic education to improve their skills.
- The tomato growers should be trained and encouraged by the regular visits of extension agents to apply approved agronomic practices.
- Tomato growers should be mobilized for agriculture credit to meet the cost of inputs such as improved seeds, agrochemicals and fertilizers etc.
- Tomato growers should be mobilized to form groups and their own markets to establish a markets network to enable them to access reliable markets.

Novelty Statement

This research provides insight of tomato growers for boosting production and evaluated influence of the farmer's socioeconomic characteristics by employing Chi Square and Spearman Rank Correlation approach on tomato production in district Peshawar, KP.

Author's Contribution

Sajad Ali: Principal author, who conducted research, experiments and wrote 1st draft of the manuscript.
Jangraiz Khan: Helped in analysis of data and interpretation. Refined the paper.
Arshad Ullah Jadoon: Helped in materials and methods
Muhammad Riaz: Helped in overall format and proofreading.
Abid Khan: Helped in field work data collec-tion and questionnaire development

Conflict of interest
The authors have declared no conflict of interest.

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