



Farmers' perception about skills of extension workers in enhancing tomato production in District Peshawar with reference to climate change

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Abstract. This study analyzed farmers' perception about extension workers' skills in enhancing tomato production with reference to climate change in District Peshawar, Khyber Pakhtunkhwa Pakistan. Two villages were taken purposively from three union councils of Town 2 in District Peshawar for data collection. Data were collected through a well-structured interview schedule which was analyzed using SPSS V.20 software. Descriptive statistics, likert scale was used. Thirty-one percent of respondents were found in the age of above 40 years with 37% of respondents having 1-2 acres of land. Moreover, maximum tomato growers were literate in joint families, whereas the majority was small landholders and owner cultivators. About 31% of tomato growers were getting Pakistani Rupees 40,000-80,000 per season as a maximum (52%) of them were getting 3,001-6,000 kg/acre tomato production from local varieties. Farmers' perceptions about extension workers' familiarity with climate change on record-keeping about climate change issue were ranked 1st with highest mean value 3.22 and standard deviation 0.98 and recording and reporting climate change were ranked 2nd with higher mean value 2.69 and standard deviation 0.99, while understanding and communicating weather forecast was ranked 4th with lowest mean value 2.50 and standard deviation 1.10. The study recommends that extension personnel should visit tomato growers regularly at each stage of tomato growing which was highly discouraging in regards to visits for addressing their issues regarding climate change and weather suitability of tomato varieties for getting higher production. Local agriculture programs should be broadcast on FM radio channels in the local language and pamphlets may be used.

Keywords : Climate change capabilities, extension workers, tomato crop, Khyber Pakhtunkhwa, Pakistan

1. Introduction

Pakistan is an agriculture-based country, agriculture contributes 19.3% of the Gross Domestic Product (GDP), hires nearly 42.3% of the overall labour force, and contributes largely to export earnings. Currently, around 68% of people in rural areas are engaged in agriculture, either directly or indirectly, through the cultivation, refining, and trade of both minor and large agricultural products, as it is their primary source of income and support, meeting the food needs of the entire population and supplying raw materials to industries [1].



Climate change is the most pressing environmental issue confronting all communities across the world, and it has a direct or indirect impact on human activities. Climate and weather are both important factors in agricultural output. It has been predicted that climate change would lower food yields in several places throughout the world in the next epoch. Climatic variation refers to changes in climatic patterns across time. Climatic variation causes increases in temperature, precipitation, and other weather conditions such as greenhouse gas (GHG) emissions, variations in the magnitude, frequency, and distribution of rainfall, and other weather extreme conditions such as flood, drought, and intensification of sea level and cyclone, all of which have a negative impact on agricultural economic growth. Since the 1980s, around 400-500 natural cataclysms have occurred as a result of climate change [2].

Tomato (*Lycopersicon esculentum*) originated in the premises of Central America and South America. It is the 3rd largest vegetable grown around the world and ranks after potato and onion in the area and first in processing. Its plants usually reach a height of 1-2 meters (3-6 feet), they are vines with a weak stem that sprawls and requires support while the local varieties reach a height of 2 feet when fully matured. Indeterminate tomato plants are perennial, but they must be planted every year because determinate or bush tomato plants stop growing at a certain height and yield a crop all at once. Tomato is cultivated in the warm season with 25 - 29 °C optimum growing temperature but tomato is grown in winter as well [3].

Tomato is a fruit as well as a vegetable. It is a vegetable because it is annual and herbaceous; a vegetable will be herbaceous and annual or biannual. Due to its much lower sugar content than culinary fruit tomato is also considered a culinary vegetable [4]. Botanically every ripened ovary that contains seed is a fruit so the tomato is a fruit- a berry consisting of the ovary, together with its seeds, of a flowering plant. Tomato is used in every home throughout the year in diversified forms and shapes because of its important position nutritionally in all vegetables. Tomato has the richest source of vitamin A, vitamin C, Riboflavin, Thiamin and Niacin with an excessive amount of mineral salts of iron and lime which is very much important for human health [5].

A ripened tomato weighing 135gm contains approximately 94% water, 0.5mg riboflavin, 25 calories from fat of energy, 1.1-gram water-soluble protein, 28 mg ascorbic acid solution, 7.0-gram sugars, 33 mg phosphorous, several salts and more than 200 mg of Potassium (K). These vitamins and minerals help prevent diseases like gastritis, erythema, cardiovascular diseases and are useful to avoid the growth of different cancer types [6]. A good variety of 150-gram seeds are sown in the nursery that will be sufficient for one acre of land. As tomato is cultivated through nursery raising keeping in view the small size of tomato seeds. Roma varieties are cultivated on large scale in Pakistan till yet but Maker and FM-9 are also cultivated by farming communities for getting higher profits. Furthermore, tomato cultivars are extremely vulnerable to harsh conditions, posing a barrier to optimum production of summer tomato crops in Pakistan's plains [7].

2. The capability of agricultural extension workers

Climate change has had a negative impact on various sectors, including agriculture workers. Climate Smart Agricultural efforts entail the adoption of initiatives that promote resilience and stability in agriculture, therefore assisting farmers in adapting to climate change risk [8]. Several studies have found that farmers have a poor degree of acceptance and application of climate change approaches. This has been ascribed to a lack of understanding and human capacity to adapt to the negative effects of climate change. Globally, agricultural extension agents are tasked with disseminating technology and programs to farmers. Agricultural extension services include all elements of providing timely information to farmers, connecting them with sources of farming supplies and financing facilities, and, most crucially, transferring technology and providing education services to farmers in all parts of agriculture [9].

The role of agriculture extension workers is not only too aware of the farming community and rural masses to follow a proper cropping pattern and prepare their lands and but also to disseminate the latest technology and motivate them to use improved methods of farming to adopt for uplifting their socio-economic condition and standard of living. Extension workers must help the farming community to increase their tomato yield by adopting improved practices and the latest technologies. One of the major



causes of this low production of tomatoes might be due to inappropriate knowledge and skills of the farming community about seasonal needs, prices and the practical usage of farming equipment. Besides these reasons, various findings and studies about tomato cultivation in District Peshawar were the poor communication between agriculture extension agents and rural masses. For that very reason, the current study was conducted to determine the socio-economic characteristics of tomato growers and find farmers' perceptions about the skills of extension workers in tomato production by investigating the link of farmers and extension workers to enhance tomato cultivation in District Peshawar. The findings of the study will offer us suggestions for improving tomato production in the future. Furthermore, this research will help planners and policymakers to make better decisions in the future for the enhancement of tomato productivity keeping in view the present climate scenario in the study area.

3. Materials and methods

The present study was carried about farmers' perception of skills of extension workers in enhancing tomato production in District Peshawar with reference to climate change. A multistage sampling technique was used to draw the sample size for the study. District Peshawar has been divided into 4 towns, which are town 1, town 2, town 3 and town 4. In stage I Town 2 were purposively selected as the majority of the farmers in the study area are involved in tomato cultivation. In stage 2 selection of union, councils were made. Among the total 25 union councils, 3 union councils Pajjagi, Larama and Dag Sepan were purposively selected, where majority of the farmers are involved in the growing of tomatoes. In stage 3 selection of villages were made where list of villages was obtained from local Agriculture Extension Office and two villages from each of the 3 union council were selected randomly from the selected union councils. In stage 4 selection of respondents were made where all the farmers who grow tomato in their fields were the population of the study from the selected villages. A list of tomato growers was obtained from the agriculture extension department among them 20% of respondents were selected using proportional allocation technique with the following formula:

$$n_i = N_i \times n/N \quad (1)$$

Whereas,

n_i = No. of Sampled respondents in i th village.

N_i = Total No. of farmers in the i th village.

n = Whole sample size.

N = Total No. of farmers in the study area.

Thus from total of 1040 tomato growers, 208 farmers respondents were selected for the study. Data from both primary and secondary sources were included in this study. Primary data were collected through a well-structured interview schedule which was pre-tested on 10 farmers to ensure its strength, consistency, and inclusion of relevant questions while excluding irrelevant ones. Tables, graphs, and frequencies were used to display the results. Five-point likert scale was used to define the skills of extension workers' skills regarding capabilities of climate change from tomato growers' point of view.

4. Results and discussion

4.1 Demographic characteristics of the respondents

Age, education, household size, family structure, land size, tenancy, and source of income were the key demographic factors assumed for this research study. These features are extremely beneficial for gathering data and acquiring vital information from responders. Demographic characteristics always have an influence on other variables, which is why gathering data in these areas is critical. [10, 11, 12, 13, 14] are some examples. The demographic data were obtained and presented in light of the importance of these attributes.

4.1.1 Age. Age is a key element in acquiring and comprehending new information abilities, as well as problem-solving. Individuals in their early twenties are said to be more open to new ideas. Several



research found a strong relationship between age and adoption [15]. Data regarding the age of the respondents are categorized into four groups which are given in Fig I. Results showed that from the total 208 respondents, 64 (30.8%) were above the age of 40 years and respondents between the age group of 31 to 40 years were 62(29.8%), whereas 60 (28.8%) respondents were between 21 to 30 years of age, while only 22 (10.6%) were below the age of 20 years as depicted in figure 1.

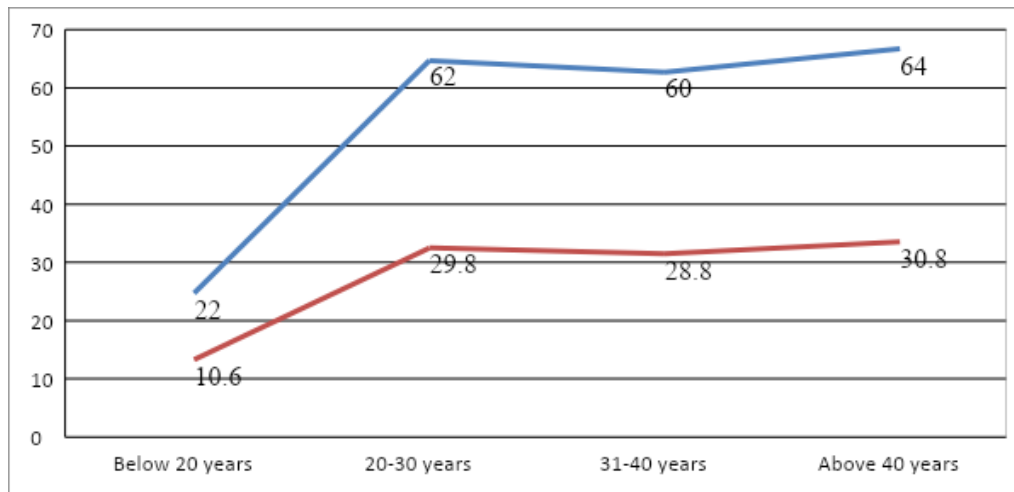


Figure 1. Age of the respondents

4.1.2 Literacy status. Education is regarded as the most important pillar in the growth of nations. Literacy rates in all industrialized nations exceed 90%. Illiterates are now seen as paralyzed and unsound individuals. In comparison to illiterate growers, literate growers readily adopt the notion of contemporary techniques [12]. Education can affect an individuals' attitude toward the adoption of improved farming techniques [10]. The data regarding literacy of the respondents indicated that (23.1%) of the total respondents were illiterate while the majority (76.9%) were literate in the study area as revealed in figure 2.

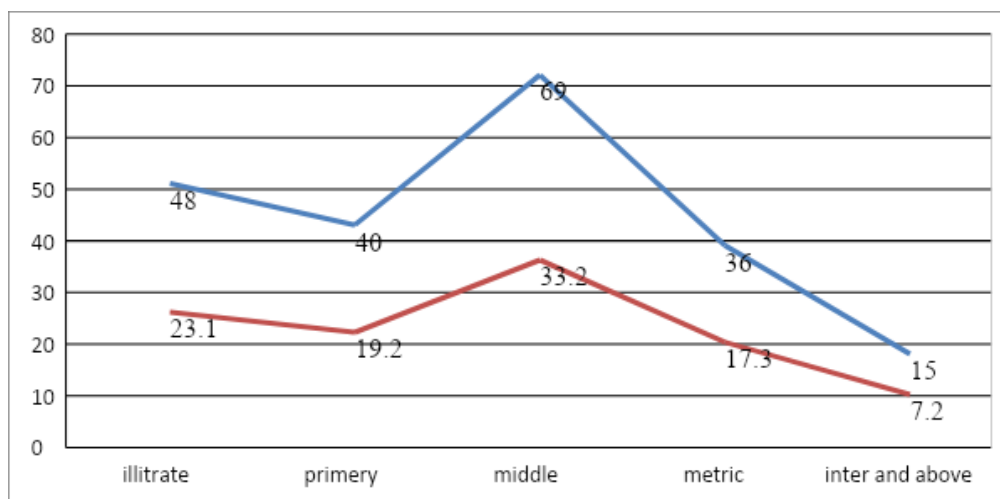


Figure 2. Literacy status of sample respondents

4.1.3 The area under the tomato crop. The area under tomato cultivation is dependent on the size of land holdings possessed by the farmers and land holdings are different from farmer to farmer. The area under tomato crop is an important aspect for mechanized farming as these field operations depend on the size of the allocation for particular crop which is largely concerned with farm production [11]. Land



size has a projecting involvement in the agreement attitude of farmers regarding innovations [12]. The results show that most of the farmers i.e. 51% of the total farmers cultivated tomatoes on an area of up to 1 acre, while only 9.6% of the farmers grew tomatoes on farm sizes of above 3 acres. Furthermore, 14.9% of the growers cultivate tomatoes on an area of 2-3 acres and 24.5% of the respondents belong to group of 1-2 acres as presented in figure 3.

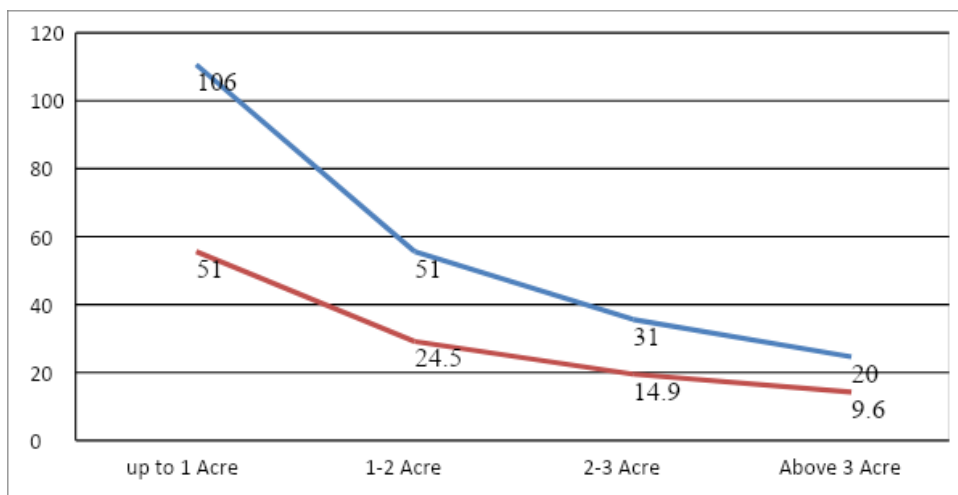


Figure 3. The area under the tomato crop

4.1.4 The average yield of tomatoes. Tomato is one of the widely grown vegetables of District Peshawar. It is one of the major sources of income of the farming community. Data regarding the production of the tomato crop is presented below which shows average yield of the tomato crop in kg/acre in the study area. The average yield of tomato was divided into four categories of the farmers; from up to 3000 kg/acre, 3001-6000 kg/acre, 6000-9000 kg/acre and above 9000 kg/acre. The outcomes revealed that the majority 51.9% of the total tomato growers belong to the group of 3001-6000 kg/acre and the least number 9.1% of tomato growers lies in the group above 9000 kg/acre. The data further revealed that 10.6% of the tomato farmers were getting only up to 3000 kg/acre and 28.4% of the respondents were those getting yields of tomato from 6000-9000 kg/acre (Figure 4).

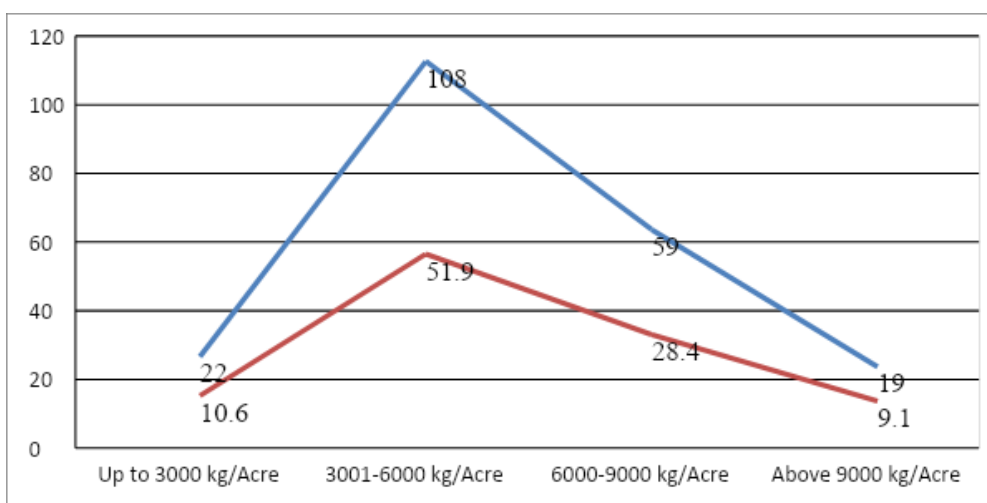


Figure 4. The average yield of tomato



4.1.5 *Increase in the average yield after technological application from the extension department.* As tomato is widely grown in Peshawar hence it is the main source of income for most farmers. For this purpose extension department introduced technologies to be used during tomato cultivation for productivity enhancement. The outcome indicates that the majority of farmers i.e. 40.4% reported their average yield increased from 401-800 kg/acre while only 7.2% of the respondents reported that their yield increased above 1200 kg/acre. Apart from that 36.5% of the respondents reported that they increased their yield from 800-1200 kg/acre and 15 % of the respondents reported their yield increase up to 400 kg/acre as revealed in figure 5.

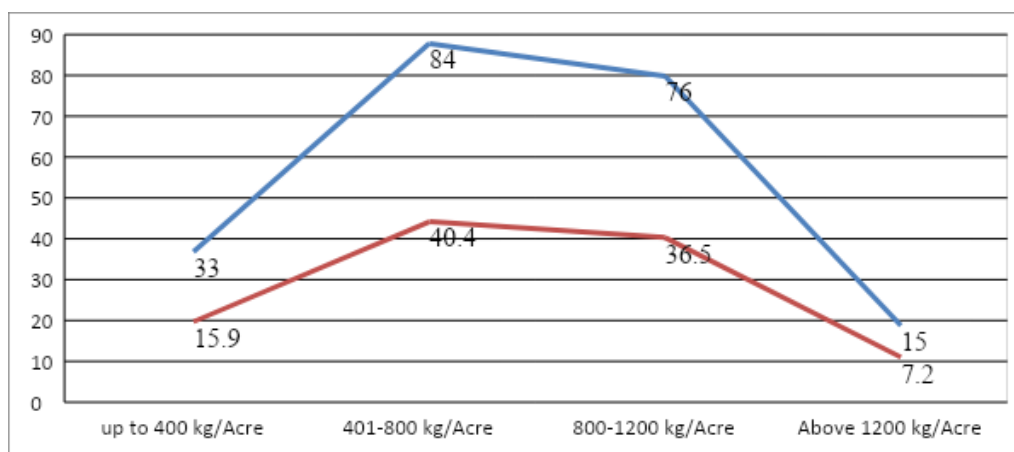


Figure 5. Increase in average yield after the technological application

4.1.6 *Frequency of extension worker visit to farmers' fields.* The agricultural extension department is extremely important for the farming community to cater their services for the betterment of the farming community. The primary goal of extension staff is to educate farmers about various types of difficulties that they may encounter in their farms especially in the present climate change scenario. Farmers were asked how often extension workers visited their fields to advise them for tomato cultivation. Table 1 summarizes data on the frequency of extension workers' visits to farmers' fields.

Table 1. Distribution of respondents regarding extension workers' visit to their fields

Villages Names	Frequency of Extension Worker visits farmers fields						Total
	Yes	No	Frequency of Visits				
			Weekly	Monthly	Annually	Upon request	
Garhi Sohbat Khan	16(7.7)	24(11.5)	0(0)	8(3.8)	8(3.8)	0(0)	40
Mandrakhel	20(9.6)	16(7.7)	0(0)	4(1.9)	8(3.8)	8(3.8)	36
Maqsoodabad	20(9.6)	16(7.7)	2(1)	4(1.9)	8(3.8)	6(2.9)	36
Esakhel	16(7.7)	16(7.7)	2(1)	0(0)	10(4.8)	4(1.9)	32
Dag Sepan	20(9.6)	12(5.8)	0(0)	4(1.9)	10(4.8)	6(2.9)	32
Terai Bala	18(8.7)	14(6.7)	4(1.9)	8(3.8)	2(1)	4(1.9)	32
Total	110(52.9)	98(47.1)	8(3.8)	28(13.5)	46(22.1)	28(13.5)	208

Source: Field Survey data 2021

Note: Values in parenthesis are percentages

Table 1 highlights the data regarding visits of agricultural extension workers to farming community for assistance. According to the collected data out of total, 52.9% tomato growers told that extension workers visit their fields in which maximum (22.1%) told about extension workers' visits annually and least number of respondents (3.8%) replied the visits of their field weekly. About 13.5% of the respondents revealed their visits upon personal requests while same 13.5% respondents told their monthly visits showing not a good sign for agricultural development particularly for tomato cultivation



in the study area. Our data is in similarity with [16] majority of the respondents replied that mostly extension personnel visited to farmers' fields yearly while majority response was about a yearly basis in this research study.

4.1.7 Capabilities of extension workers regarding climate change from the farmer's point of view. Several recently created indices of climate change sensitivity are generally believed to be more vulnerable to its adverse impacts by modifying their environmental conditions [13]. Several studies have been conducted to investigate the gap between climate change responsibility and the ability to contribute, on the one hand, and climate changes economic repercussions, on the other [14]. Data regarding farmers' perception about extension workers' capabilities regarding climate change is presented in Table 2.

Table 2. Farmers' perception regarding extension workers' skills in climate change

Skills regarding climate change	1	2	3	4	5	Mean	S.Dev	Ranks
Familiarity of Ext. workers with climate change	12(5.8)	26(12.5)	83(29.9)	69(33.2)	18(8.7)	3.2644	.98407	I
Recording and reporting climate change	31(14.9)	44(21.2)	99(47.6)	26(12.5)	8(3.8)	2.6923	.99833	II
Promoting cultivation of improved varieties of tomato	48(23.1)	53(25.5)	69(33.2)	31(14.9)	7(3.4)	2.6923	.99833	III
Understanding and communicating weather forecast	44(21.2)	52(25)	61(29.3)	30(14.4)	21(10.1)	2.5000	1.10335	IV

Scale: 1= Very Low 2= Low 3= Medium 4= High 5= Very High S.D Standard deviation

Table 2 depicts the ranking of skills of extension workers regarding climate change from tomato farmers' point of view based on mean and standard deviation. Data showed the familiarity of extension workers with climate change was ranked Ist with the highest mean 3.2644 and standard deviation 0.98407 while recording and reporting climate change to farmers was ranked 2nd with the mean value of 2.6923 and standard deviation 0.99833. Promoting cultivation of improved varieties of tomato" was ranked 3rd with the mean value of 2.6923 and standard deviation of 0.99833 while understanding and communicating weather forecast was ranked 4th with lowest mean value of 2.5000 and standard deviation of 1.10335.

5. Conclusions and recommendations

From the present study, the following conclusions were inferred: It was concluded that the majority of the respondents were cultivating tomatoes for their income. The majority of the respondents were literate. It is concluded that the majority of farmers in the study area had a small piece of land holdings from 1 to 2 acres. Extension workers visited farmers' fields on annual basis. The frequency of extension workers visits was also unsatisfactory and showed that extension workers failed to satisfy farmers and could not transfer the modern agricultural techniques to the tomato growers and failed in solving their problems regarding tomato production in the present climatic change in the study area. It was revealed that Farmers were unsatisfied with the skills of extension workers regarding climate change. It is recommended that extension workers should visit tomato producers' fields regularly to give basic knowledge about climate change and new profitable tomato production practices along with climate compatible varieties.



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