Research Article

Assessment of Knowledge Level and Information Sources of Vegetable Growers regarding Tunnel Farming in District Sargodha

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Abstract | This study is an effort to exploit the information sources of vegetable growers in district Sargodha aside from their knowledge level about vegetable production under tunnels. Every year there is a lot paid from the national exchequer for the import of vegetables, especially from the neighboring countries. To at least minimize those expenditures tunnel farming to a maximum level can give us a way forward. This transverse study has the Sargodha district as its universe. All the vegetable growers who used to grow off-season vegetables were the population of the study. The snowball sampling technique led us to have 8 off-season vegetable growers in Sargodha tehsil, 13 in Bhulwal, 27 in Bhera, 17 in Kot Momin, 9 in Shah pur, 11 in Sillanwali, and 5 in Sahiwal. This way a sample of 90 respondents was interviewed using a structured interview schedule. The content validity of the instrument was checked by the panel of experts and followed by the reliability test run through SPSS. Data were analyzed and evaluated by Microsoft Excel and SPSS to reach a meaningful decision in the consideration of data acquired. The maximum numbers of respondents were falling in the age range of 26 to 50 years, having qualifications of matric and intermediate, growing vegetables up to 5 acres, and depicting agriculture as the main source of income. Tomato, pepper, and cucumbers were the highest grown crops in the study area. Variables of site selection, land preparation, and sowing of seeds got a quite satisfactory response. Replantation of nursery and distance between plants and rows of plants were also answered quite satisfactorily. Farmers do not know how to overcome the increasing attack of insects, pests, and diseases in tunnel farming. Some areas were identified, which require the attention of responsible authorities for the relevant knowledge.

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1. Introduction

Pakistan is located in the southern part of Asia and it's the foremost agricultural country of the globe. Agriculture is that the lifeline of Pakistan's economy using 44% of the workforce (GoP, 2018); contributive 19.3% towards GDP and 62% of the agricultural population rely on this sector for his or her supply of revenue (GoP, 2020). Pakistan is amongst the most important producers of wheat, cotton, sugarcane, mango, dates, oranges, and rice within the world. Major crops (sugar cane, cotton,

rice, and wheat) give 6.5% whereas minor crops 2.3% of the country area unit value (Murgai *et al.*, 2001). Along with the World Food Program, over 48 percent of the population was barely combating food insecurity. Growing vegetables and pulses with excessive attention and innovative techniques to make their mark in the economic and health sector can minimize malnutrition. Research and institutions are the core places where highly nutritious vegetables can be developed for their economic and health aspect (Keatinge *et al.*, 2011). In comparison with the grains, legumes, and powdery materials there is more moisture content in the vegetables. This property of vegetables makes them more appealing to other food options. Studies show that moisture content in the vegetables is more than 70%. Their fleshy and fresh look makes them attractive to daily consumers.

Moreover, vegetables are the only way to have maximum nutritious food to meet the daily nutritious requirement of the body, in comparison with the other food options (Hanif *et al.*, 2006). To produce vegetables in unfavorable conditions of climate is termed as "growing off-season vegetables". Man always has the desire to induce those things that are barely found. Vegetables and fruits, which are grown out of their season, are mostly sold at high costs within the market. Vegetables are a wealthy supply of proteins, vitamins, salts, and carbohydrates. The high growth rate has given rise to high demand for basic dietary vegetables. It is a fact that our farmers can get benefited from this opportunity and exploiting with adapting traditional strategies (Keatinge *et al.*, 2011). Vegetable production shares an excellent contribution to viable agriculture in the economy of Pakistan. In Pakistan among the total 23.40 million square measure crop space vegetables conclude perfectly the 0.41 million hectares to supply a big contribution of 13.67 million a lot of recent turnout each year (GoP, 2012). Three ways or types of the tunnel are employed in the geographic region of Pakistan, low tunnel, walk-in tunnel, and high tunnel. Generally, the crops grown in tunnels are tomatoes, chilies cucumber, bottle and bitter gourd, pepper sweet, and pepper (Khan, 2000). Facts have proclaimed that farmers also are unaware of their level of best potential. Awareness programs for the farmers are useful as part of the government is antecedently doing its effort to introduce this technology to them (Mahmood *et al.*, 2012).

Tunnel farming is an alternative for the marginal as well as progressive farmers. The current situation explains that there is a possibility that the tunnel farmers do not have enough knowledge and training sessions. They could utilize that knowledge for their betterment and prosperity of their family farm. That's why there is a need to assess the actual situation.

2. Material and Methods

This cross-sectional study has its universe limited to only one district of Punjab province due to confined resources and less time. This quantitative study has the population of all the farming community growing off-season vegetables in the district Sargodha. The snowball sampling technique was adopted for the present study and 8 off-season vegetable growers were contacted in tehsil Sargodha, 13 in Bhulwal, 27 in Bhera, 17 in Kot Momin, 9 in Shah pur, 11 in Sillanwali, and 5 in Sahiwal. The aggregate sample size for this research was 90 vegetable growers, which is presented in the graphic form in Figure 1. Data was collected using a structured interview schedule, comprising open-ended, close-ended, and Likert type scale questions. The content validity of the instrument was checked by the panel of experts and followed by the reliability test run through Statistical Packages for Social Sciences (SPSS). Data were analyzed using Microsoft Excel and SPSS; descriptive statistics were applied for this research including means, frequencies, standard deviation, etc.

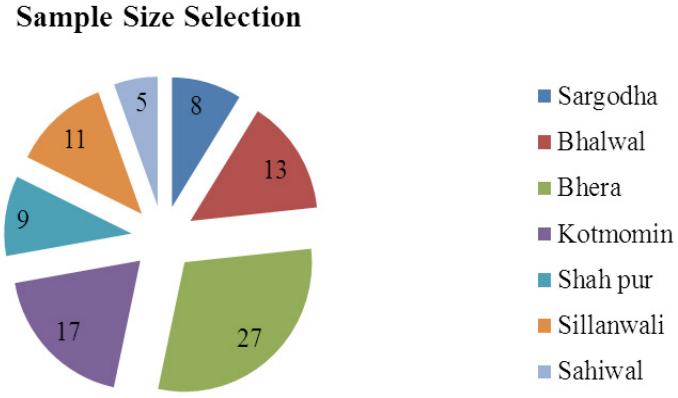

Figure 1: Sample size selection.

3. Results and Discussion

This section carries the facts and figures from the study area. Data was collected, interpreted, and analyzed according to the above-mentioned techniques and formalities. In this section, data are presented in

the form of proper tables for the understanding of viewers, researchers, and academicians. Discussion is a critical part of the study carrying facts and figures. It differentiates the approach of researchers from any other in this global village. For the convenience of the reader, the section has been categorized keeping in mind every objective of the study.

Age is an important factor in making an effective response. A general perception is that the man grows up; there come lots of changes in his behavior, attitudes, responses, and decision making power. This results in the factor of time, experiences, incidents, results, and conclusions from others' perception with many more happenings. Only 7 respondents were below the age of 25 years, which is 7.8 percent of the total sample (Figure 2). We see that results deviate among different age groups based on their life experiences and maturity level. We took the different age groups and we concluded that people age 25-50 years were most interested in participating in the study. 20 respondents were above the age of 50 years, being 22.2 percent of the total sample. Another conclusion we can draw is that the targeted population is mature, sincere, and capable enough to understand the issue. Furthermore, they can show the resilient and able to take action for possible measurements.

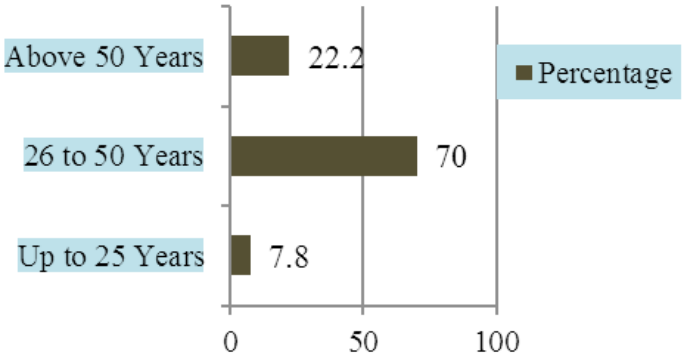

Figure 2: Percentage regarding the age of respondents.

Education is a very important part of an individual's life. It gives sense to the person to think more consciously and understand things from a different perspective. Respondents were categorized according to the education level they have. Levels of education were primary, middle, matric, intermediate, and above. All of the respondents were asked to respond to their level of education. Results show that maximum respondents have a minimum qualification of up to intermediate (Figure 3). This is another positive thing that the majority of the population in the study area knows at least reading and writing.

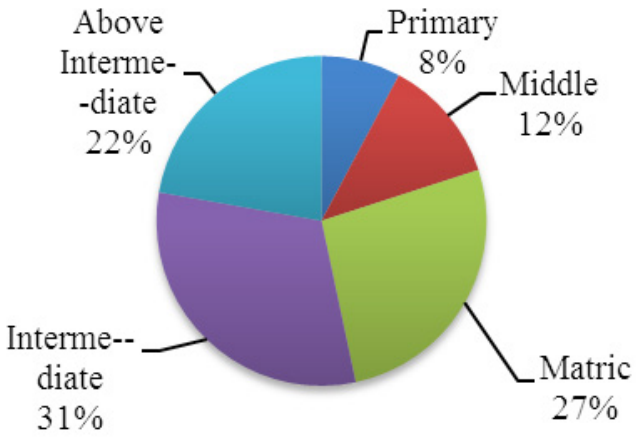

Figure 3: Percentage regarding education level of respondents.

Experience matters a lot in working; if a person has previous knowledge and practice in doing some work then definitely he can show better performance as compare to the new people in the field. It makes an individual confident if he/ she had experience in the field makes an individual confident about the actions, he or she performs willingly. We categorized the people into different groups based on their experience frame. The groups were up to 10 years of experience, 11 to 20 years of experience, 21 to 30 years of experience as well. Respondents do have a meaningful experience in farming. This makes them capable enough to work effectively. There were the respondents who have 3 years, 5 years, and 7 years of experience (Figure 4). Even that is quite enough to prove them as relevant as they should be.

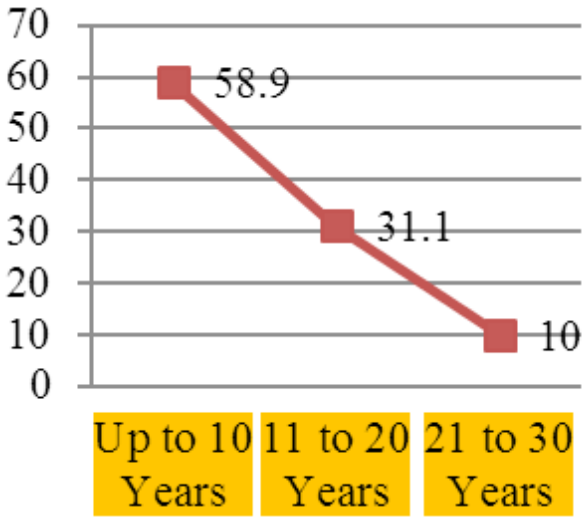

Figure 4: Percentage regarding the farming experience.

This study was based on the production of vegetable, without their respective season. Vegetable production has been ignored since the first day. Although the sector of vegetables has its meaningful contribution aside from the other fruits and crops. The land is considered to be the most important part of agriculture production and suitable land keeps the importance of the backbone. In this study, up to 5 acres of land was produced 90% of the total and another area is 5.1 to 10 acres under which the vegetables are produced (Figure 5). Moreover, Figure 6 also endorses this stance of results that maximum tunnel growers of the study area were falling into the category of small farmers. Due to the unavailability of desired profit, income, and market value, farmers do not risk their season by growing vegetables.

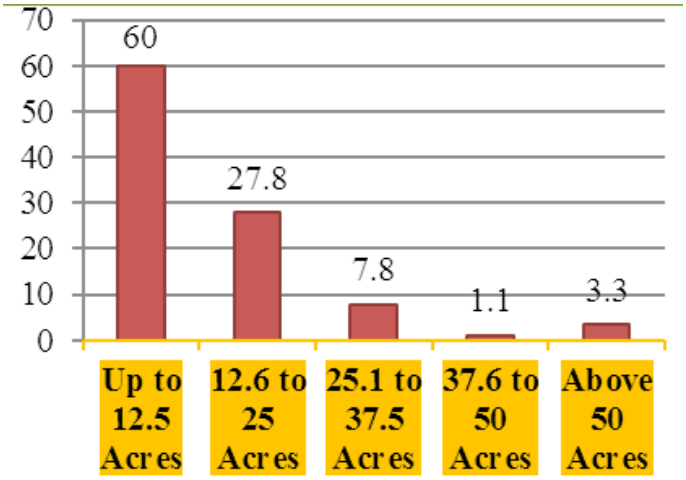

Figure 5: Percentage of respondents regarding landholding.

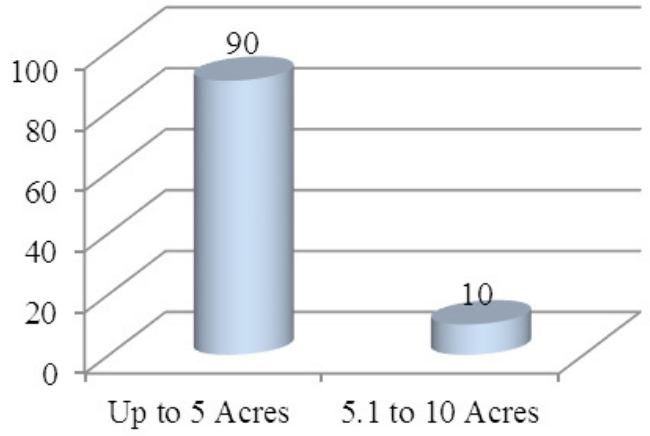

Figure 6: Ppercentage regarding the area under vegetable production.

The economic status of any individual is very important which is based on the income source and his income describes the individual's status in society. People with high incomes are more satisfied with their job regarding fiend. For the current study, the total income was categorized into five ranges of income level. Which included the up to 5 lacs, 5 lacs one to 10 lacs, 10 lacs one to 15 lacs, 15 lacs one to 20 lacs, and above 20 lacs. Results conclude that the majority of farmers have incomes, which could satisfy their capacity, which means their household and expenses of inputs (Figure 7). Only 7.8% and 4.5% respondents consecutively represented their income level to more than a sufficient level.

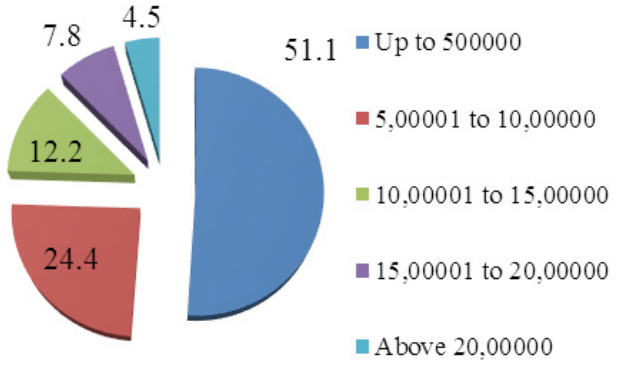

Figure 7: Percentage regarding the income of respondents.

The source of income is very important in the economic status of the country. According to this study, 84.4% source of income is agriculture for which the farmers work hard but can earn a pretty good living (Figure 8). Farmers earned annual median wages; crop prices and crop failures mean that a farmer's income varies dramatically from one year to the next. 15.6% of the source of income is business and others. Sometimes the expectation comes true. As in the case of this study, it is a good thing that most of the population in rural areas is still practicing agriculture and consider it as their priority business. These days the trend of urbanization and industrialization is rapidly overwhelming the rural population. Anyway, the results are quite satisfactory that most of the respondents are associated with the agriculture sector. Some case was observed that the household is settled in the urban area but practice agriculture as their source of income.

Figure 9 showed the results of vegetables grown by the tunnel practitioners. 94.4% Tomato, 70% cucumber, 80% Pepper, 52.2% squash, 33.3% Melon, and 30% gourds were grown according to this study. During the study, it was known that their selection of vegetables is based on profit, production, and

consumption of that specific vegetable. If we see very few respondents practice the melons and gourds. It means that the general perception is that both are not productive enough to attract the attention of growers (*Multiple responses).

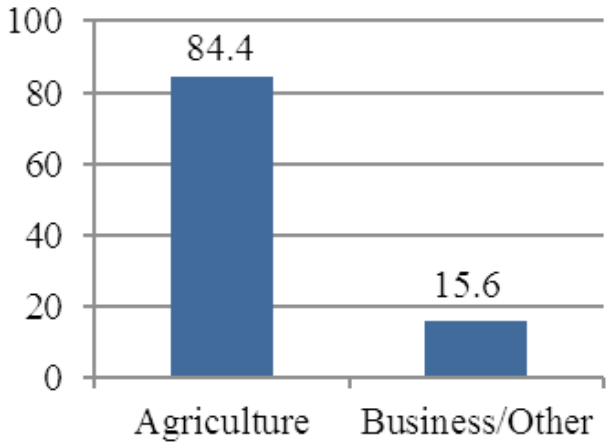

Figure 8: Percentage regarding the source of income of the respondents.

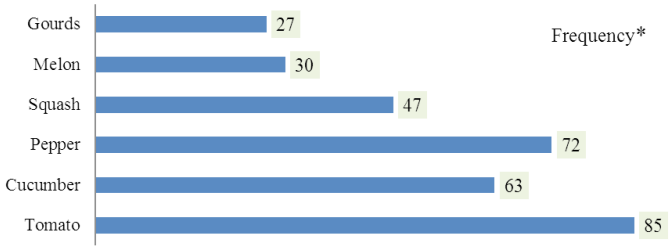

Figure 9: Vegetables grown under tunnel technology.

In the Table 1, the respondents were asked about different preparations, which are made before the actual plantation of crops in the tunnel. Most of them showed that they are aware of all the preparations at the best of it. Technically, it could be drawn that this response is due to their confidence or they do not rely much on the information sources. Only high tunnel and appropriate timing for the sowing got the minimum percentage in case of very high knowledge about them. Their response showed that they aware of all three types of tunnel. Variables of site selection, land preparation, and sowing of seeds got a quite satisfactory response. Replantation of nursery and distance between plants and rows of plants were also answered quite satisfactorily.

The response of the tunnel farmers shows that they were aware of every step according to their perception. In reality, there lie lots of technical aspects. In the case of cultural practices, they have shown that except for the knowledge of controlling the protection from insects, pests, and diseases they are well aware of all the cultural practices to have good production.

The Table 1 elaborated on the frequency and percentage of knowledge and adoption level of respondents about the practices after harvesting. Here are some options of response rate from very little to very high and we concluded that the entire variable has the highest response rate on very high and people are less responsive on very little. In contrast to this, there should be a proper check and balance at the state level. Market level, transportation, and cost of the products are the aspects, to which the state can have the check and balance.

Tunnel farming practices of "land preparation and growing techniques" and "plant-plant and row-row distance" possess maximum and the same mean value of 4.82 (with same SD value of 1.05) which is inclined towards a very high level. Whereas, "picking/harvesting in tunnels", "seed selection (local, hybrid and GM seed)" and "preparation of seed beds" contain mean values of 4.54, 4.48, and 4.41 (SD values of 3.33, 0.77, and 0.85) respectively. While "tunnel types (low, walk-in, and high tunnel)", and "appropriate nursery transplanting time" both have a minimum mean value of 2.98 that indicates a moderate level of knowledge possessed by vegetable growers regarding tunnel farming.

Table 2 showed the frequency and percentage against the training and information sources of tunnel practitioners. Here are some options never available to always. This study concluded that all the variables have the lowest response rate on always which means respondents remain less responsive on this option. A point to ponder is that there have been pointed out that there is less number of educated as well as contact farmers who have proper knowledge of technical aspects.

Table 3 elaborated the frequency and percentage of the IPM technique adaption by the tunnel practitioners. There were some options from strongly disagree to strongly agree on which the response was required by the respondents on vulnerability factors. The results explained that most respondents were strongly agreed on these variables. Applications of different inputs, changing environments, and epidemic diseases have even made their way to tunnel farming as well.

Table 1: Knowledge level of respondents regarding tunnel farming.

Tunnel farming practices	Very little	Little	Moderate	High	Very high	Mean	SD
	%	%	%	%	%		
Tunnel types (low, walk-in, and high tunnel)	12.2	28.9	25.6	15.6	17.7	2.98	1.29
Site selection for tunnels	02.2	08.9	10.0	22.2	56.7	4.22	1.09
Land preparation and growing techniques	01.1	08.9	11.1	20.0	58.9	4.82	1.05
Nursery raising for tunnel vegetables	02.2	07.8	15.6	21.1	53.3	4.17	1.09
Seed selection (local, hybrid and GM seed)	00.0	02.2	10.0	25.6	62.2	4.48	0.77
Preparation of seed beds	00.0	04.4	10.0	25.6	60.0	4.41	0.85
Re-plantation of nursery	01.1	14.5	23.3	22.2	38.9	3.83	1.13
Appropriate nursery transplanting time	12.2	28.9	25.6	15.6	17.7	2.98	1.29
Selection of vegetable's verities	02.2	08.9	10.0	22.2	56.7	4.22	1.09
Plant-plant and row-row distance	01.1	08.9	11.1	20.0	58.9	4.82	1.05
Mulching material and plastic sheet	02.2	07.8	14.4	21.1	54.5	4.17	1.09
Polythene plastic use (0.04,0.06 or 0.08 mm)	02.2	05.6	15.6	26.6	50.0	4.17	1.03
Temperature requirements for vegetables	04.4	07.8	10.0	24.5	53.3	4.14	1.16
Maintaining moisture in tunnels	03.3	05.6	15.6	22.2	53.3	4.17	1.09
Using drip irrigation in tunnel	05.5	04.4	14.4	21.3	54.4	4.18	1.12
Use of fertilizer	01.1	08.9	13.3	15.6	61.1	4.27	1.07
Fungicide and pesticides application	03.3	11.1	12.2	16.7	56.7	4.12	1.20
Plant trimming in tunnels	10.0	15.6	20.0	30.0	24.4	3.43	1.29
Climbing material i.e. net, strip and rope	01.1	12.3	12.2	21.1	53.3	4.13	1.11
Integrated Pest Management in tunnels	03.3	08.9	08.9	15.6	63.3	4.27	1.15
Picking/harvesting in tunnels	02.2	06.7	14.4	22.2	54.5	4.54	3.33
Crop harvesting in tunnels	03.3	10.0	07.8	21.1	57.8	4.20	1.16
Transportation to the markets	01.1	14.4	10.0	20.0	54.5	4.12	1.15
Cost-benefit ratio of tunnel vegetables	03.3	08.9	13.3	17.8	56.7	4.16	1.16

Table 2: Information sources for vegetable production under tunnel technology

Sources	Never	Rarely	Sometimes	Often	Always	Mean	SD
	%	%	%	%	%		
Trainings	05.6	20.0	22.2	26.7	25.6	3.47	1.23
Workshops	14.4	23.3	20.0	24.4	17.8	3.08	1.33
Seminars	24.4	30.0	24.4	15.6	05.6	2.48	1.83
Progressive farmers	45.6	30.0	13.3	06.7	04.4	1.94	1.13
Farmer Field Schools	33.3	38.9	16.7	06.7	04.4	2.1	1.08
Extension Field Staff	37.8	33.3	15.6	08.9	04.4	2.09	1.14
Private sector	07.8	16.7	21.1	34.4	20.0	3.42	1.21
NGOs	62.2	27.8	08.9	00.0	01.1	1.50	0.75
Electronic and Print Media	04.4	13.3	20.0	24.4	37.8	3.78	1.22
Family, friends and relatives	01.1	06.7	16.7	21.1	54.4	4.21	1.02

Table 3: Integrated pest management for vegetables in the tunnel.

Insect/pest	Strongly disagree		Disagree		Neutral		Agree		Strongly Agree	
	f	%	f	%	f	%	f	%	f	%
Rodents	01	01.1	06	06.7	12	13.3	36	40.0	35	38.9
White fly	02	02.2	08	08.9	14	15.6	17	18.9	49	54.4
Thrips	03	03.3	09	10.0	09	10.0	20	22.2	49	54.4
Aphid and jassid	01	01.1	07	07.8	14	15.6	15	16.7	53	58.9
Leaf miner	02	02.2	13	14.4	12	13.3	14	15.6	49	54.4
Fruit fly	04	04.4	07	07.8	10	11.1	16	17.8	53	58.9
Army and cut worm	03	03.3	10	11.1	15	16.7	19	21.1	43	47.8
Beetle	07	07.8	10	11.1	23	25.6	19	21.1	31	34.4
Mites	06	06.7	13	14.4	26	28.9	20	22.2	25	27.8
Borer	07	07.8	05	05.6	07	07.8	16	17.8	55	61.1

Conclusions and Recommendations

Educated farmers mostly practice vegetable production, they continuously try to be established, sustainable and they are used to be sensible. They have diversity in their growing habit when it comes to vegetables. Their confidence in the knowledge they have is rare. It does not found so common in any state of this globe. From independence, it's been seventy years that this sector of the country is delivering with a promising attitude. Now it needs attention and consideration, at last, this state also owes something to these hardworking individuals. Their issues that require great consideration include; site selection for tunnels, material for tunnel and mulching, seed availability and selection, and integrated pest management in tunnel farming. The special focus of extension field staff and horticultural specialists is not in line with the requirement in the concerned field. Insect attack in tunnel production of vegetables is making growers vulnerable. Farmers do not know how to overcome the increasing attack of insects, pests, and diseases in tunnel farming. Some areas identified above, which require the attention of responsible authorities for the relevant knowledge.

Novelty Statement

Tunnel farming for vegetables is becoming popular across the country as it boosts per-acre yield, cuts the cost of production, and helps in off-season production. This manuscript highlights the need to provide information and knowledge to the tunnel farmers regarding vegetable production with a special focus on IPM practices.

Author's Contribution

Muhammad Yaseen: Conceived the basic idea of research and principal author.
Muhammad Luqman: Designed research instrument and Reviewed relevant literature.
Zahoor Hussain: Prepared initial draft of paper.
Usman Saleem: Data analysis.
Tahir Munir Butt: Edited initial draft and prepared final draft of paper.
Asif Nawaz: Data collection from field during survey.
Muhammad Umer Mehmood: Data collection from field during survey.

Conflict of interest

The authors have declared no conflict of interest.

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