

AN INVESTIGATION INTO THE VARIOUS MEASURES OF CITRUS PRODUCTION IN IMPROVING THE SOCIO ECONOMIC STATUS OF CITRUS GROWERS (A CASE STUDY OF NANGARHAR PROVINCE- AFGHANISTAN)

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ABSTRACT

Agricultural Extension services serves are the main pillars for increasing the production of citrus growers by playing the role in improving the economic status for encouraging the agriculture producers of war affected country of Afghanistan through sustainable agriculture. The current research study was carried out to investigate the yield and income of the citrus producers in Nangarhar Province-Afghanistan. Nangarhar Province was selected as universe of the study where multi stage sampling technique was used for the required study. Nangarhar province is comprised of 22 Districts where District Bati Kot was selected purposively. From 12 villages 5 villages were selected on basis of citrus cultivation. A list of 200 citrus growers was obtained from Agriculture Extension Department. For data collection 60% of the citrus growers were sampled by following proportional allocation technique at villages level gave and 120 respondents were selected. Primary data was collected through pretested interview schedule and analyzed through SPSS and results were presented as counts and percentages. The empirical results shows that 43.3% of citrus growers in the study area were in the joint family system of above 12 members, 66.7% citrus growers had small land holdings of 1 to 6 acres, with 60.8 % of them were owner cultivators where 58.3% were not registered with the extension department. Almost 67.5% were citrus growers were contacting the extension department through phone call for the problem of field management, use of inputs, pest and diseases along with the control of weeds. Information regarding Fruit fly was not received by 63.3% respondents where 51% was advised chemical control. The month of April was advised for fruit fly trap installation to save them from their attack in the month of June as reported by 23.3% citrus growers. About 45.8% citrus growers obtained citrus yield ranging from 3001 to 6000 kg/acre where 40.8% told their net income is from Afghani currency (AFN.) 81,000 to AFN.120, 000 per acre. It is concluded that majority of the citrus growers were illiterate and were not satisfied from agriculture extension staff. The study recommends that extension workers may visit citrus producers' orchards on regular basis to give basic knowledge about new profitable citrus production practices to improve the economic conditions of the citrus growing community by improving their citrus production on sustainable basis.

Keywords: *Investigation, measures, citrus growers, socio-economic status, Nangarhar, Afghanistan*

INTRODUCTION

Agriculture extension serves as the bridge between agriculture researchers and the farming communities by sharing and demonstrating the innovative technologies to the farmers' fields for enhancing their production and income through scientific farming (Suvedi *et al.*, 2017).

Agriculture is the most important part of the world's poorest nations' economy like Afghanistan. Most of Afghans' economic output comes from agriculture, so mostly Afghanistan's economy is based on agriculture sector. Afghanistan's agriculture sector accounted for around 22% of the Gross Domestic Product (GDP) in 2023 and more than 60% of workforce that depend on agricultural sector as well as 70% of rural residents depend on it for their living (Sarwary *et al.*, 2023).

Citrus fruit is an important ever green fruit tree of Rutaceae family which is grown in both tropical and sub-tropical areas of the world. Citrus is cultivated in more than 140 countries and its worldwide production is 105 million tons. After mangos, tomatoes and bananas, citrus fruits are among the most consumed fruits in the world and their species are small to medium-size plants. Despite supplying an abundant number of vitamins, minerals, dietary fibers, and pectin, they have a number of active phytochemicals, such as phyto phenolic, flavones and phenolic acids which is greatly recommended to protect health because of their biological properties, which contain anti atherogenic, anti-inflammatory, and anti-tumor activities (Aruoma *et al.*, 2012).

Human beings are using and collecting citrus fruits for medicinal, herbal and agricultural purposes from centuries. Typically all citrus fruits have sweet and sour taste. They have refreshing juice which is accessible around the year (Sanofar, 2014).

Historically, it has been thought that origination of citrus is from Southeast Asia and the Malay Archipelago, spreading from Northern India to China and in the south through Malaysia, the East Indies, and the Philippines by distant explorers, traders, and church missionaries. In the light of recent evidence it has been suggested that Yunnan Province in the Southwest China might be the center of origin because of the number of species that have been reported here (Gmitter *et al.*, 2007).

China produced 44.6 million tons of citrus fruit which stood 28.07% of the world's total citrus fruit production in 2020 and therefore, China is considered as the world's largest citrus fruit grower around the world. The top five countries account for 59.15% of it, while the other four of them are Brazil, India, Mexico and the USA. In 2020, 158 million tons of citrus fruits were expected to be produced around the world. The output of citrus fruit worldwide was increased significantly between 1971 and 2020, ranging from 42.1 million to 158 million tons, reaching at an increasing annual rate of 10.47% in 1980 and then declined to 0.47% in 2020 (Knoema, 2021).

Table 1 *Position of Afghanistan among Citrus Producing Countries of the World*

Rank	Country	Production (Tons)	Production per Person (Kg)	Acreage (Hectare)	Yield (Kg/Hectare)
1	China	44,063,061	31.612	2,879,238	15,303.7
2	Brazil	19,652,788	93.793	703,337	27,942.2
3	India	14,013,000	10.485	1,073,000	13,059.6
4	Mexico	8,756,488	70.199	641,899	13,641.5
5	United States of America	7,230,854	22.061	278,802	25,935.4
6	Spain	6,010,050	128.807	296,460	20,272.7
7	Egypt	4,638,980	47.581	191,298	24,250
8	Turkey	4,301,415	53.228	174,245	24,686
9	Nigeria	4,160,568	21.077	830,302	5,010.9
10	Iran	4,073,067	49.819	143,460	28,391.7
16	Pakistan	2,289,262	11.34	201,472	11,362.7
81	Afghanistan	43,515	1.378	4,364	9,971

Source: Atlas Big (2021)

Afghanistan Fresh Citrus Market is estimated to be 146828 tons in size, with a total value of \$US 57.2 million. Based on accessible information, it seems that the growers in Afghanistan only shares 0.9 percent of the value market and 1.2 percent of the citrus are produced. The Afghan producers respond to market demand by focusing mostly on the sour oranges product and present consumption of Mandarin and sweet oranges is greater than sour oranges. In 2013 the total quantity of industrial citrus imports was 1139 tons of sweet orange juice and concentrate (grapefruit juice and concentrates were excluded), with a Cost Insurance and Freight (CIF) value of \$US 1.3 million and 66 tons of citrus jams and jellies with a combined value of \$US 0.2 million. At least 2476 tons of fresh citrus volumes are represented by the imported juice and concentrate. This volume is more than twice as large as the entire existing Afghan production (Booyens *et al.*, 2015).



Fig 1: Map of Afghanistan showing the provinces where citrus production is located

In 2020, Afghanistan exported \$1.93M in citrus, making it the 75th largest exporter of citrus in the world. At the same year, citrus was the 32nd most exported product in Afghanistan. The main destinations of citrus exports from Afghanistan are: Pakistan (\$1.56M), Kazakhstan (\$244k), Senegal (\$102k), Tajikistan (\$17.5k), and Canada (\$10.5k). The fastest growing export markets for citrus of Afghanistan between 2019 and 2020 were Pakistan (\$1.16M), Kazakhstan (\$244k), and Senegal (\$74.2k), Afghanistan imported \$56.9M in Citrus, becoming the 47th largest importer of citrus in the world. At the same year, citrus was the 25th most imported product in Afghanistan (OEC, 2020).

Objectives

The study has the following objectives:

- 1- To know the socio-economic characteristics of citrus growers.
- 2- To know the yield and income of citrus production in improving the socio economic status of citrus growers.
- 3- To give policy recommendations for further improvement.

MATERIALS AND METHODS

The universe of the present study was Nangarhar Province-Afghanistan in December, 2022. Multi Stage Sampling Technique MST was utilized to draw the required sample (Cochran, 1977). At stage I, out of twenty two Districts of Nangarhar, Bati Kot was selected purposively based on citrus cultivation. Bati Kot consists of 12 villages, out of these 5 villages were purposively selected due to citrus cultivation at stage II. For selection of respondents at village level, a list of citrus growers was obtained from Agriculture Extension Department, which comprised of 200 citrus growers in the selected villages. Proportionate allocation technique was used to select 60% of the citrus growers for data collection, giving a total of 120 respondents. For collection of data, a well-developed interview schedule was used which was prepared in English but the interviews were conducted in local language "Pashto". Obtained data was analyzed using SPSS, results were presented in frequencies/counts and percentages.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of the Citrus Growers

Household Size of the Citrus Growers

As a result of the world's rapidly growing population, there may be a shortage of food and other basic requirements. The population of the world needs to be controlled in order to resolve all these problems. In the adoption process, the size of the household is crucial (Sanaullah *et al.*, 2020). Table 2 shows that only 9.2% citrus growers fall in the group of household size with four members, 43.3% of citrus growers have household size with 12 or more members. Furthermore, 20% respondents belong to household size of 5-8 members and 27.5% belongs to the house hold

size of 9-12 members. As said earlier, big household size has a rich numbers of members by having sufficient persons and they will not require hiring labor for different field hiring activities. Our findings are similar with Ayat, (2014) who revealed that 38.8% were living in a size of 11-20 members as our results revealed that maximum citrus growers' household size was above 12 members.

Land Holding of the Citrus Growers

The farmers' size of land holding varies significantly because some citrus growers only have a low acreage of land available for growing citrus trees. They rarely sell their harvests due to their low production and they mostly use farm products as per their own needs and requirements. Small landowners have less interaction with extension agents and are less likely to incorporate contemporary cultural practices into their farming. Since they can afford new technologies for improved output while remaining an expensive lifestyle, farmers with larger landholdings are often thought to be more enthusiastic about adopting innovations (Ajayi *et al.*, 2000). They have more access to agricultural knowledge than individuals who own tiny and limited plots of land for cultivation (Chaudhary, 2006). Table 2 illustrates that 66.7% citrus growers in the current study area had small land holdings of 1-6 acres, while minimum 8.3% farmers had 13-18 acres of land holdings. About 11.7% of the respondents had land holdings of more than 18 acres, in contrast to 13.3% of the respondents who owned between 7 and 12 acres of land specified for citrus. These results are in alignment with those of Sanaullah (2020), who found the limited land ownership of the maize growers in the study area. Our findings are in agreement with Safdar (2005), who also reported that most of the growers (60%) had small less than an acre for tomato cultivation in District Malakand, Khyber Pakhtunkhwa- Pakistan. This might be due to diversification in the crop and neighboring country location.

Tenancy Status of the Citrus Growers

The term tenancy refers to a part and parcel of land that has been assigned to farming by the farming community, and it plays a distinctive role in the adoption of new technologies (Idrees, 2000). Land is not only a source of sustenance for farmers, but it is also a symbol of social standing, prestige and economic success along with source of employment for those who work full time in the agricultural industry. The history of land reforms has shown that tenancy is significant impediment to agricultural development, as seen by the fact that agricultural growth remains slow and sluggish. Data in Table 2 revealed that majority of the citrus growers constituting (60.8%) belongs to the group of owner cultivator while 26.7% citrus growers were tenants and only 12.5% citrus growers were found owner-cum-tenant. The adoption of contemporary technology is positively correlated with the size of the land holding (Mirza, 1993). Tenants are less receptive to new ideas than owner-growers. In order to promote agricultural activities in a sustainable manner, extension professionals should increase tenant farmers' enthusiasm for implementing new technology in their farms. Our findings are consistent with those of Aziz *et al.* (2018), who discovered that owner cultivators made up the majority of respondents (70.83%) in the research area.

Table 2 *Socio-Economic Characteristics of Citrus Growers*

Household Size (Members)	Frequency	%	Land Holding Size (in acre)	Frequency	%
1 to 4	11	9.2	1 to 6	80	66.7
5 to 8	24	20.0	7 to 12	16	13.3
9 to 12	33	27.5	13 to 18	10	8.3
Above 12	52	43.3	Above 18	14	11.7
Total	120	100	Total	120	100
Tenancy Status		Frequency	%		
Owner cultivator	73	60.8			
Owner-cum-tenant	15	12.5			
Tenants	32	26.7			
Total	120	100			

Source: Field Survey data 2022

Citrus Growers' Registration with Agriculture Extension Department

The farmers who are registered with the agriculture extension department have great effect on their overall production and ultimately profitability. Farmers who have registered with the department of agriculture extension have better access to extension workers and can acquire assistance in accordance with their needs more quickly and easily than those who are not registered. Moreover, the registered farmers can obtain free seeds, fertilizer, herbicides, and other agricultural supplies from the government. Data presented in Table 3 shows that more than fifty percent (58.3%) citrus producers in the research region were not registered with the agriculture extension department, whereas 41.7% citrus growers were found in registered farmers. The findings indicate that the majority of farmers in the research area were not registered, making it difficult for them to take use of the services offered by the agriculture extension department. Simukanga *et al.*, (2018) discusses a project supported by the National Science and Technology Council (NSTC). Agricultural information system was developed in this project to help farmer for registration and verification with the department of agriculture extension. Furthermore, the technology will allow Ministry of Agriculture authorities to constantly monitor the registered farmers' health and guarantee for keeping the illegal activity up to minimum extent. Our findings are comparable to those of Saddam (2021), whose study revealed that 47.6% farmers were found to have registered with the department of agriculture extension in District Peshawar, Khyber Pakhtunkhwa-Pakistan.

Table 3 *Distribution of the Citrus Growers regarding their Registration with Agriculture Extension Department*

Villages	Citrus Growers Registration with Agriculture Extension Department		
	Yes	No	Total
Ghaze Abad	16(13.3)	14(11.7)	30
Shab Diyani	9(7.5)	15(12.5)	24
Lowarty	11(9.2)	13(10.8)	24
Anbar Khana	8(6.7)	13(10.8)	21
Barekab	6(5)	15(12.5)	21
Total	50(41.7)	70(58.3)	120

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

Contact with Extension Department to Report Problems through Phone Calls

The department of agriculture extension helps and directs the farming community for increasing crop and fruit output to enhance the socio economic circumstances of the particular community. Farmers may also call to the extension workers via phone to report their concern in order to receive a prompt and timely advice when extension employees fail to visit their fields adequately due to their tight and busy schedule of work. Table 4 shows that most of the citrus growers (67.5%) said for problem solution they contact the extension department through telephone, while the remaining 32.5 % citrus growers stated no contact with the extension department for their solution regarding various problems of citrus production. Those citrus growers who contacted the extension department for solution of their various production problems of citrus were also asked about the specific difficulties and problems for contacting the extension department. About 32.5% citrus growers reported pest/disease concerns, while only 7.5% of them contacted the extension department for proper inputs' uses in citrus production. Furthermore, 17.5% citrus growers reported about the contact for weed control and 10% said that they contacted the extension department for field management activities for the better production of citrus. This showed that overwhelming majority of citrus growers were taking interest in the better production of citrus who believed that they can improve their living standard by taking the useful and scientific advice of extension department through bettering their citrus production.

Table 4 *Distribution of Citrus Growers regarding their Contacts through Phone Call with Extension Department for their Problems*

Villages	Citrus Growers' contact through Phone Call with Agriculture Extension Department for their Citrus Production Problems							Total
	Yes	No	Total	If Yes, What type of problems				
				Field Management	Inputs Usage	Pest/diseases	Weed Control	
Ghaze Abad	26(21.7)	4(3.3)	30	4(3.3)	1(0.8)	15(12.5)	6(5)	26
Shab Diyani	14(11.7)	10(8.3)	24	3(2.5)	0(0)	6(5)	5(4.2)	14
Lowarty	16(13.3)	8(6.7)	24	3(2.5)	3(2.5)	7(5.8)	3(2.5)	16
Anbar Khana	12(10)	9(7.5)	21	0(0)	2(1.7)	6(5)	4(3.3)	12
Barekab	13(10.8)	8(6.7)	21	2(1.7)	3(2.5)	5(4.2)	3(2.5)	10
Total	81(67.5)	39(32.5)	120	12(10)	9(7.5)	39(32.5)	21(17.5)	81

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

Information regarding Fruit Flies Control by Extension Workers

Fruit flies can be both beneficial and harmful to citrus trees. While some species of fruit flies can help to pollinate citrus trees while, others can damage the fruit plant of citrus by laying their eggs inside, which can lead to spoilage and reduced yields of citrus. The data given in Table 5 shows that the majority (63.3%) citrus growers didn't receive any information about fruit fly control in their citrus orchards from extension department while 36.7% of the total citrus growers replied about getting information from extension department regarding fruit fly control in their citrus orchards. It is evident from the table that fruit fly problem was of great concern for citrus growers and they could not bother to ask for their control from extension department as they were able to control by themselves by knowing various methods of control already in practice while some who were more interested in the better production of citrus were found more interested to ask about the fruit fly control in their orchards of citrus from extension department by taking their fresh and knowledgeable advice.

Table 5 *Distribution of Citrus Growers regarding Information about Fruit Flies Control by Agriculture Extension Department*

Villages	Extension workers' information about Fruit fly control		Total
	Yes	No	
Ghaze Abad	12(10)	18(15)	30
Shab Diyani	10(8.3)	14(11.7)	24
Lowarty	5(4.2)	19(15.8)	24

Anbar Khana	6(5)	15(12.5)	21
Barekab	11(9.2)	10(8.3)	21
Total	44(36.7)	76(63.3)	120

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

Methods of Fruit Fly Control in Citrus Orchard by Citrus Growers

After asking about information regarding fruit fly control another question was also asked from the citrus growers' about how they control the fruit fly in their citrus orchards. The data depicted in Table 6 shows that most of the citrus growers (50.8%) used chemicals for controlling the fruit fly in their citrus orchards, while 10% of the citrus growers' used cultural techniques for controlling the fruit fly in the citrus orchards. Furthermore, 21.7% of them answered that they control fruit fly by burying the infected fruits in the soil and 17.5% citrus growers reported the use of pheromone traps for controlling the fruit flies in their citrus orchards. This shows that chemical control of fruit flies are in the common practice of citrus growers showing encouraging results in maximizing the production of citrus in the study area, however, more studies need to be conducted of the day for confirmation of these scientific control through chemicals of fruit flies by not compromising the taste and quality of citrus fruits used for various purposes of home use products.

Table 6 *Distribution of Citrus Growers on the basis of Methods of Fruit Fly Control in the Citrus Orchards*

Villages	Methods of Control of Fruit Fly				Total
	Pheromone Traps	Buried the Infected Fruits	Cultural Control	Chemically Control	
Ghaze Abad	6(5.0)	6(5)	4(3.3)	14(11.7)	30(25)
Shab Diyani	4(3.3)	4(3.3)	1(0.8)	15(12.5)	24(20)
Lowarty	5(4.2)	2(1.7)	1(0.8)	16(13.3)	24(20)
Anbar Khana	2(1.7)	9(7.5)	6(5)	4(3.3)	21(17.5)
Barekab	4(3.3)	5(4.2)	0(0)	12(10)	21(17.5)
Total	21(17.5)	26(21.7)	12(10)	61(50.8)	120(100)

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

Information regarding the Month of the year about Fruit Fly Traps Installation

Citrus fruit fly traps are effective tools used in agriculture to monitor and control the population of these pests, helping to protect citrus crops from infestation. These traps utilize attractants that lure the fruit flies, leading to capture them and preventing the damage to the citrus fruit. If pheromone traps are installed between the month of April and September for trapping the males, so their females lay sterile eggs leading to reduced fly population. For preparation of the trap, 5 drops of methyl eugenol and 5 drops of Malathion 50% EC onto a piece of cotton is sufficient.

These traps should be placed throughout the citrus trees in spring season to control citrus fruit fly in the emerging time before they increased. The data presented in Table 7 shows that majority (82.5%) citrus growers did not know the installation months of fruit fly traps, while remaining 17.5% citrus growers knew about the installation months of fruit fly traps and reported the month of April in the spring season for trapping the males with the purpose to lay sterile eggs by the female. This shows that extension department is not effective for educating the citrus growers about the proper time of traps to control fruit fly in the citrus orchards effectively and efficiently. If the extension department takes proper measures for the uplift of citrus growers, dream of self-sufficiency can be easily full filled in the study area through the better production of citrus which can improve the socio-economic condition of the area under study.

Table 7 *Distribution of Citrus Growers regarding the Month of the year about Fruit Fly Traps Installation*

Villages	Information about Fruit fly Traps Installation Months			Total
	Yes	No	If Yes Mention the month	
			April	
Ghaze Abad	6(5)	24(20)	6(5)	30
Shab Diyani	4(3.3)	20(16.7)	4(3.3)	24
Lowarty	5(4.2)	19(15.8)	5(4.2)	24
Anbar Khana	2(1.7)	19(15.8)	2(1.7)	21
Barekab	4(3.3)	17(14.2)	4(3.3)	21
Total	21(17.5)	99(82.5)	21(17.5)	120

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

Information about the months of the year of Fruit flies Attack

Citrus fruit fly attack is a significant concern for citrus growers worldwide. This pest can cause significant damage to citrus trees, leading to reduced yields and fruit quality. The peak season for citrus fruit fly attacks varies depending on the region, but generally occurs during the warmer months of the year when temperatures are between 20-30 degrees Celsius. In many areas, the month of June is a critical time for citrus growers to monitor their crops and take action to prevent or control fruit fly infestations. These fruit flies can be a problem throughout the year but are common specifically during late summer/ fall because they are attracted to ripen of fermenting fruits and vegetables. Their life cycle takes 28-34 days in summer to complete and 60-115 days in winter. Data in Table 8 indicates that majority (68.3%) citrus grower in the research region did not know about fruit fly attack months while 31.7 % citrus growers knew about fruit fly attack months where 23.3% citrus growers told the month of June and 8.3% citrus growers told the month of May. This shows the concerns of citrus growers regarding the attack of fruit fly on their citrus orchards but negligence is reported and revealed on the part of extension department as per cry of the day. Extension department made be responsible for proper

education to advise them about active months of fruit fly attack to minimize the losses of citrus growers.

Table 8 *Distribution of Citrus Growers regarding the Information about the months of year of Fruit Fly Attack*

Villages	Information about Fruit fly Attack Months				Total
	Yes	No	If Yes Mention the Month		
			May	June	
Ghaze Abad	11(9.2)	19(15.8)	2(1.7)	9(7.5)	30(25)
Shab Diyani	6(5)	18(15)	3(2.5)	3(2.5)	24(20)
Lowarty	6(5)	18(15)	2(1.7)	4(3.3)	24(20)
Anbar Khana	6(5)	15(12.5)	1(0.8)	5(4.2)	21(17.5)
Barekab	9(7.5)	12(10)	2(1.7)	7(5.8)	21(17.5)
Total	38(31.7)	82(68.3)	10(8.3)	28(23.3)	120(100)

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

Information about Dispose-off of Infected Drop Fruits

It is important to properly dispose of infected drop fruits in order to prevent the spread of disease and pests in fruit trees. Infected drop fruits can attract insects and rodents that can carry and transmit the diseases to healthy trees. It is recommended to remove infected drop fruits from the ground and place them in a sealed bag or container. This will prevent pests and disease from spreading to other areas of the orchard or garden and trees. In addition, it is important to clean up the area around the infected drop fruits to prevent any remaining debris or contaminated soil from becoming a breeding ground for pests and disease. Proper disposal of infected drop fruits is an essential step in maintaining the health and productivity of fruit trees. Table 9 shows that majority citrus growers' (68.3%) know about dispose-off the infected dropped fruit while 31.7% of the study participants have no information regarding dispose-off of the infected dropped fruits. Furthermore, 21.7% of the respondents were buried the infected dropped fruits, 15% feed them to their animals and 25% citrus growers were throwing away these infected dropped fruits. Only 7.5% citrus growers have shown no action on infected dropped fruits as revealed by them. This shows a very good sign of taking interests in the infected dropped fruits to control the damages of the infected fruits by showing their sensitivity and concern regarding citrus production. Such sensitivity may lead to better earnings of exchange on the part of citrus growers.

Table 9 *Distribution of Citrus Growers regarding Knowledge of Dispose-off about the Infected Dropped Fruits*

Villages	Knowledge of the Citrus Growers of dispose-off about the infected dropped fruits							Total
	Yes	No	Total	If Yes				
				Buried the infected fruits	Feed to Animal	Throwing away	No Action	
Ghaze Abad	22(18.3)	8(6.7)	30	7(5.8)	3(2.5)	10(8.3)	2(1.7)	22
Shab Diyani	20(16.7)	4(3.3)	24	3(2.5)	5(4.2)	9(7.5)	3(2.5)	20
Lowarty	17(14.2)	7(5.8)	24	7(5.8)	3(2.5)	5(4.2)	2(1.7)	17
Anbar Khana	14(11.7)	7(5.8)	21	6(5)	4(3.3)	3(2.5)	1(0.8)	14
Barekab	9(7.5)	12(10)	21	3(2.5)	2(1.7)	3(2.5)	1(0.8)	9
Total	82(68.3)	38(31.7)	120	26(21.7)	17(14.2)	30(25)	9(7.5)	82

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

Information regarding Number of Plants per Acre

The number of citrus trees per acre depends on several factors, including the variety of citrus, the spacing of the trees, and the irrigation and fertilization practices. Typically, a range of 80 to 250 trees per acre is common for commercial citrus production (Spren and Zansler, 2016). The data in Table 10 indicates that majority of citrus growers (71.7%) have cultivated 134 trees per Acre, while 28.3% of respondents have cultivated 115 trees per acre. This shows a very positive and creative development in the study area showing their interests in the cultivation of citrus which can be sensitized more with the passage of time and more people will be attracted towards cultivation of citrus by having a positive and healthy impact of climate which is the most burning issue of many nations.

Table 10 *Distribution of Citrus Growers regarding Number of Trees (Acre)*

Villages	Trees (Acre)		Total
	134 Trees	115 Trees	
Ghaze Abad	10(8.3)	20(16.7)	30(25)
Shab Diyani	19(15.8)	5(4.2)	24(20)
Lowarty	18(15.)	6(5)	24(20)
Anbar Khana	18(15)	3(2.5)	21(17.5)

Barekab	21(17.5)	0(0)	21(17.5)
Total	86(71.7)	34(28.3)	120(100)

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

Information regarding the Average Yield of Citrus

Citrus is one of the widely grown fruit of district Bati Kot. It is one of the major sources of income of the farming community in the target area of study. For this purpose growers of citrus were interviewed about their average yield of citrus in kg per acre. Analysis in Table 11 shows the data on farmers' average yield of citrus which was categorized into 4 categories i.e. up to 3000 kg/acre, 3001-6000 kg/acre, 6001-8000 kg/acre and above 8000 kg/acre. The result showed that most (45.8%) citrus growers were obtaining yield of 3001-6000 kg/acre and less number (11.7%) of citrus growers were achieving more than 8000 kg/acre average yield. The data further indicated that 25 percent of the citrus growers had been receiving only 3000 kg/acre and 17.5 % percent growers were obtaining average yield of citrus from 6001-8000 kg/acre. Our results are at par with Ullah (2018) who revealed about maize that only 6.6% maize growers were getting 12001-16000 kg of maize production which may be due to the reason that only minor number of farmers are using improved technologies in their field because of their sincere devotion to their lands in the field of agriculture enabling them for higher production of their agriculture produce.

Table 11 *Distribution of the Citrus Growers regarding their Average Yield of Citrus Fruits*

Villages	Average yield of Citrus Fruits (Kg/Acre)				Total
	Up to 3000	3001-6000	6001-8000	above 8000	
Ghaze Abad	8(6.7)	12(10)	7(5.8)	3(2.5)	30
Shab Diyani	4(3.3)	14(11.7)	4(3.3)	2(1.7)	24
Lowarty	6(5)	8(6.7)	6(5)	4(3.3)	24
Anbar Khana	5(4.2)	11(9.2)	3(2.5)	2(1.7)	21
Barekab	7(5.8)	10(8.3)	1(0.8)	3(2.5)	21
Total	30(25)	55(45.8)	21(17.5)	14(11.7)	120

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

Income of Citrus Growers from Citrus Fruits

Citrus is a valuable cash crop because of diversified uses. When crops yield an effective team exchange, all input expenses are reimbursed to the farmers through crop sales. In addition to recovering their costs, farmers gain extra money through the sale of their crops. Weather and unpredictability of market prices may influence farmers' income. According to the data in Table

12 indicates the income from citrus of 40.8% citrus growers were between AFN. 81000-120000, and minimum (16.7%) citrus growers were getting above 160000 Afghanis. The income of 23.3% citrus growers were up to 80000 and 19.2% respondents were getting the income of 121000-160000 from citrus trees. Our results are at par with Ijaz *et al.*, (2014) who did his research on kinnow crop in District Toba Tek Singh, Pakistan and depicted that average profit from kinnow crop per acre was PKR.121436 which look like a good income from specific fruit as they managed it in a good way by applying the maximum improved practices. It is obvious that proper practices are employed in citrus fruit, we may get fruitful or high income as reported already by practical field research.

Table 12 *Distribution of the Citrus Growers regarding Income from Citrus Fruits*

Villages	Income from citrus crop per Acre/season (Afg)				
	Up to 80000	81000-120000	121000-160000	Above 160000	Total
Ghaze Abad	6(5)	11(9.2)	7(5.8)	6(5)	30
Shab Diyani	6(5)	10(8.3)	6(5)	2(1.7)	24
Lowarty	6(5)	7(5.8)	6(5)	5(4.2)	24
Anbar Khana	5(4.2)	11(9.2)	1(0.8)	4(3.3)	21
Barekab	5(4.2)	10(8.3)	3(2.5)	3(2.5)	21
Total	28(23.3)	49(40.8)	23(19.2)	20(16.7)	120

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

Information regarding the Age of the Citrus Orchard

Citrus trees are commonly grown for their fruits, which include oranges, lemons, limes, grapefruits and mandarins. These orchards require a warm climate and adequate sunlight, as well as fertile soil with proper drainage. Citrus orchards are usually planted in rows, with trees spaced out to allow for sufficient sunlight and airflow. Once the trees are mature and begin to produce fruit, they require regular maintenance, including pruning, fertilization and pest control. The fruits harvested from citrus orchards are used for a wide variety of purposes, including fresh consumption, juice production, and cooking. Table 13 shows that majority (53.3%) citrus growers reported that the age of their orchards were above 7 years while 9.2% respondents told that the age of their citrus orchards were only 3-4 years and 21.7% citrus growers reported that the age of their orchards were 5-7 years. Moreover, 15.8% citrus growers told the interviewer that the age of their orchards were 4-5 years. It is concluded that more than fifty percent citrus growers had citrus orchards from more than 7 years which was encouraging factor in the study area as they were getting handsome produce and income from their respective orchards and living happily by attracting others to switch to the citrus production.

Table 13 *Distribution of Citrus Growers regarding their Age of Orchards*

Villages	Age of their Orchards (Years)				Total
	3 to 4	4 to 5	5 to 7	Above 7	
Ghaze Abad	2(1.7)	5(4.2)	5(4.2)	18(15)	30
Shab Diyani	3(2.5)	4(3.3)	5(4.2)	12(10)	24
Lowarty	2(1.7)	1(0.8)	8(6.7)	13(10.8)	24
Anbar Khana	2(1.7)	5(4.2)	3(2.5)	11(9.2)	21
Barekab	2(1.7)	4(3.3)	5(4.2)	10(8.3)	21
Total	11(9.2)	19(15.8)	26(21.7)	64(53.3)	120

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

Information regarding their Average Production Practices Cost

Citrus production is a complex and costly endeavor that requires careful planning and management. The average cost of production for citrus crops can vary depending on several factors such as location, type of citrus, and production method. Citrus growers must consider costs associated with land preparation, irrigation, pest and disease control, fertilizer application, pruning, harvesting, and transportation. They also need to invest in equipment, labor, and infrastructure such as packing houses and storage facilities. In addition, citrus production requires a significant amount of water, which can increase costs in regions with limited water resources. Overall, citrus production can be a profitable venture, but growers must carefully manage costs to maximize returns. Findings in Table 14 showed the average production practices cost of citrus in Afghanis. Average cost on land preparation was AFN.1689.42, while average cost on nursery purchase was AFN.11205.45. Moreover, average cost on sowing was reported by citrus growers as AFN.1620.92 and average cost on pruning was reported as AFN.3140.25. Average cost on weeding was 2995.10 Afghanis. Furthermore, average cost on Ploughing was 1552.33 Afghanis and average cost on fertilizers was 13396.17 Afghanis. Average cost on pesticide was AFN.3829.67, while average cost on picking was 4021.00. Average cost on crates was 3013.25 and average cost on transportation was AFN.3072.92, while average cost on commission was 1490.33 Afghanis and average other costs (scissors, spraying materials) was reported AFN.2169.75.

Table 14 *Distribution of Citrus Growers of 134/ 115 Trees per Acre regarding their Average Production Practices Cost (Afghanis)*

Production Practices	Villages (Cost in Afghanis)					Average Cost
	Anbar Khana	Barekab	Ghazi Abad	Lowarty	Shab Diyani	
Land preparation	1696.67	1571.90	1603.00	1788.33	1795.00	1689.42
Nursery	10976.19	11514.48	10804.67	11423.75	11418.33	11205.45

purchase						
Sowing cost	1644.29	1640.00	1575.20	1650.50	1611.33	1620.92
Pruning cost	3116.67	3064.76	2780.40	3094.58	2996.67	2995.10
Hoeing/ weeding	3200.00	2947.62	2946.67	3264.58	3374.17	3140.25
Ploughing	1559.52	1547.62	1465.33	1592.50	1618.75	1552.33
Fertilizers	12959.52	11863.33	13387.33	14294.17	14232.50	13396.17
Pesticides	3257.14	3126.19	4055.33	4833.33	3660.42	3829.67
Picking	3642.86	3185.71	4415.33	4281.67	4329.17	4021.00
Crates/Material	2966.67	2685.71	3040.00	3132.92	3187.50	3013.25
Transportation	3085.71	2990.48	3043.33	3231.25	3012.50	3072.92
Commission	1471.43	1338.10	1533.33	1541.25	1535.42	1490.33
Others Costs	1995.24	1853.33	2375.00	2454.17	2058.33	2169.75
Total	51571.91	49329.23	53024.92	56583	54830.09	53196.56

Information regarding their Yearly Cost on Citrus Plant of 134/ 115 Trees per Acre

The yearly cost is based on the size of land used for citrus farming, the input expenses such as irrigation cost, fertilizers, pruning, pesticides, labor and picking, cost of transportation as well as the distance from the market and other factors. Each of these factor on which cost of production is based, differs from farmer to farmer. The expense and cost of the citrus fruit was asked from the citrus growers. Data in Table 15 shows that 44.2% citrus growers cost on citrus fruit plant of 134/115 plants per acre was between 31,000 to 50,000 AFN while 19.2% of citrus growers reported high cost on citrus plant and indicated more than 70,000 AFN. Moreover, 11.7% of the farmers told the interviewer that their cost on citrus fruits was between AFN 51,000 to 70,000 while 25% citrus growers reported the low cost that is up to AFN 30,000 on citrus fruit.

Table 15 *Distribution of the Citrus Growers regarding their Yearly Cost on Citrus Orchard*

Villages	Per Year Cost on citrus of 134/115 plant per Acre orchard (AFN/Acre)				Total
	Up to 30000	31000 to 50000	51000 to 70000	Above 70000	
Ghaze Abad	8(6.7)	12(10)	4(3.3)	6(5)	30
Shab Diyani	4(3.3)	12(10)	4(3.3)	4(3.3)	24
Lowarty	6(5)	8(6.7)	3(2.5)	7(5.8)	24
Anbar Khana	5(4.2)	11(9.2)	2(1.7)	3(2.5)	21
Barekab	7(5.8)	10(8.3)	1(0.8)	3(2.5)	21
Total	30(25)	53(44.2)	14(11.7)	23(19.2)	120

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

Information regarding Pruning of Citrus Trees

Pruning citrus trees is an important maintenance practice that involves removing dead or diseased and damaged branches, promoting new growth, and improving fruit quality. Pruning should be done during the dormant season and care should be taken to avoid excessive cutting by not damaging the tree and reduce fruit production. The data in Table 16 shows that majority (76.7%) of the citrus growers prune citrus trees, while 23.3% of them replied that they not prune citrus trees. These results are consistent with those of (Poudel *et al.*, 2022) who found that the majority (84%) of farmers practiced pruning. It reveals that most of the citrus growers were taking keen interest in pruning their citrus trees during dormant season as per improved practice for getting their higher production while minimum of them were enjoying their laziness due to their other economic engagements and taking least interest in citrus production.

Table 16 *Distribution of the Citrus Growers regarding Pruning of Citrus Trees*

Villages	Pruning of Citrus Trees		Total
	Yes	No	
Ghaze Abad	23(19.2)	7(5.8)	30
Shab Diyani	20(16.7)	4(3.3)	24
Lowarty	18(15)	6(5)	24
Anbar Khana	15(12.5)	6(5)	21
Barekab	16(13.3)	5(4.2)	21
Total	92(76.7)	28(23.3)	120

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

Whitening of Citrus Trees' Stems

Whitening of trees is important for the health and productivity of the citrus trees, as it helps to protect it from sunburn, pests, and diseases. By reflecting sunlight, the whitewash coating can also help to regulate the temperature around the tree and prevent stress caused by excessive heat. It is important to use the right concentration of the solution and to apply it evenly to avoid damage to the tree. Table 18 revealed that out of 120 respondents, 72.5% citrus growers were involved to provide white coat to their trees for protecting them from sunburn and pests, while only 27.5% citrus growers could not find time to provide white cover to the lower trunk of their citrus trees which may be due to least interest of the citrus growers as they were earning from other sources of business opportunities.

Table 17 *Distribution of the Citrus Growers regarding Whitening of Citrus Trees*

Villages	Whitening of Citrus Trees' Stems		Total
	Yes	No	
Ghaze Abad	21(17.5)	9(7.5)	30
Shab Diyani	15(12.5)	9(7.5)	24
Lowarty	19(15.8)	5(4.2)	24
Anbar Khana	17(14.2)	4(3.3)	21
Barekab	15(12.5)	6(5)	21
Total	87(72.5)	33(27.5)	120

Source: Field Survey data 2022

Note: Parentheses values showing the percentages

CONCLUSIONS AND RECOMMENDATIONS

It is concluded that maximum citrus growers were living jointly in a household size of more than 12 members and easily overcome labor shortage problem for control of weeds, picking/ pruning of fruits for 1-6 Acres of land as possessed by overwhelming majority. Maximum citrus growers were owners where minimum were registered with the Agriculture Extension Department and majority of them contacted the Extension Department through phone calls for citrus production problems regarding field management, input usage, pest/ diseases and weed control problems whose maximum concern was about pest/ diseases problems. Maximum cost of fertilizers and nursery purchase was reported. Majority was found deprived from fruit fly control information, where half of the percentage was advised chemical control by the extension department along with fruit fly trap installation month in April as the critical month of attack was June. Majority were aware about the dispose- off about infected drop fruits where most of the citrus growers were throwing away and burring the infected fruits. Majority citrus growers were planting 134 trees per acre minimum were planting 115 trees per acre in their orchards of citrus. Maximum citrus growers were getting 3001-6000 Kg/Acre where income of 81,000 to 1, 20,000 AFN was reported by maximum citrus growers. Majority were actively involved in pruning and whitening of their citrus orchards showing their interest and commitment with the citrus orchards. The recommendations derived from this research can guide policymakers and stakeholders in implementing measures for promoting the sustainable citrus production and elevate the overall socioeconomic status of citrus growers in the region.

It is recommended that:

- Extension workers may visit citrus producers' orchard on regular basis for improving their basic knowledge about better citrus production practices to solve the problems.
- Citrus is a highly cash fruit, so youth should be trained for provision of job facilities in citrus production to control them to spent their life fruitfully and efficiently and control them from illegal immigration. More formal trainings regarding different aspects of citrus cultivation and production may be arranged by Extension Department for motivation of more farmers towards citrus farming on large scale and sustainable basis.

- Interest free credit facilities may encourage citrus growers for buying inputs such as nursery purchase, fertilizers, pesticide, and insecticide and so on financial assistance is also required to repair the citrus orchards which were damaged by war.
- More area should be devoted to citrus orchards by providing cold storage facilities to citrus growers to prevent the citrus fruit from destroying and save the economy of the citrus growers.

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