POLICY RESEARCH JOURNAL
ISSN (E): 3006-7030 (P) 3006-7022
Volume 2, Issue 4, 2024
Received: 27 October 2024
Accepted: 27 November 2024
Published: 04 December 2024

IMPACT OF AGRICULTURAL EXTENSION SERVICES ON APPLE PRODUCTIVITY IN DISTRICT SWAT.

Junaid Ahmad Farooqi[*1], Dr Muhammad Idress[2], Sahid Zaman[3], Ajmal Khan[4], Muhammad Rafique[5], Dr Ambreen Bhatti[6], Furqan Shafiq[7], Muhammad Amish[8]

[1]M.sc (Hons) Scholar, Department of Agricultural Extension & Communication. The University of Agricultural Peshawar, Pakistan.
[2]Chairman Department of Agricultural Extension & Communication. The University of Agricultural Peshawar, Pakistan.
[3]M.sc (Hons) Scholar, Department of Agricultural Extension & Communication. The University of Agricultural Peshawar, Pakistan.
[4]M.sc (Hons) Scholar. Department Of Soil Sciences & Environmental Sciences, The University of Agricultural Peshawar, Pakistan.
[5]B.sc (Hons), Department of Agricultural Extension. The University of Agricultural Rawalpindi PMAS-ARID, Pakistan.
[6]Deputy Director Horticultural institute of Hydroponics agricultural, PMAS-Arid Agricultural university Rawalpindi.
[7]M.sc (Hons) Scholar, Department of Agricultural Extension & Communication. The University of Agricultural Peshawar, Pakistan.
[8]M.Sc. (Hons) Scholar. Department Of Rural Sociology, The University of Agricultural Peshawar, Pakistan.

[*1]junaidkhan959@gmail.com, [2]dridreesext@gmail.com, [3]sahidzaman43@gmail.com, [4]Ajmalkhn10@gmail.com, [5]mrafiq596@gmail.com, [6]ambreenbhatti@uaar.edu.pk, [7]Furqan750@gmail.com, [8]amishkhattak3@gmail.com

ABSTRACT

The research is carried out in District Swat, a significant area renowned for its fertile soil and favorable climate, ideal for cultivating a diverse range of crops, vegetables, and fruits. Among these, apples and peaches hold particular importance for the local farmers. Apples, in particular, thrive exceptionally well in this region due to the ideal climate conditions. The study encompassed all the apple producers within this area. District Swat comprises seven tehsils, split between two regions: upper and lower Swat. The upper Swat region, specifically chosen for its suitability for apple production, includes three tehsils: Tehsil Matta, Tehsil Khwazakhela, and Tehsil Bahrain. The local extension worker collaborated in compiling a comprehensive list of all apple growers within the chosen villages. The study's sample size was determined to be 40% (128) of the total 320 farmers in the study area through random sampling technique. Data was collected through interview schedule. The variables was analyzed through Chi-square test was applied. This research aims to enhance apple growing by providing targeted extension services in areas where there is a high concentration of apple farming knowledge. Due to their history of productive apple farming, these regions need specialized assistance with pest control, soil fertility, harvesting methods, and marketing. Information gathered from a subset of villages shows

POLICY RESEARCH JOURNAL
ISSN (E): 3006-7030 (P) 3006-7022

that 50.8% of respondents recommend concentrating on pest control, with other crucial areas including post-harvest methods and soil fertility coming in second. The study also shows how extension services affect apple productivity; 41.4% of respondents said their productivity had significantly increased. There is a need for further assistance and customized therapies as 25.8% of the participants reported no improvement. The study's findings on service utilization show that, whereas 21.9% of respondents use extension services frequently, a substantial 57% use them sometimes, and 21.1% do not use them at all. This utilization is influenced by confidence in service providers and cost (44.5%). The research highlights the need of tackling obstacles such as monetary limitations, accessibility of services, and guaranteeing that outreach initiatives correspond with the distinct requirements of every community. Finally, farmers emphasize services like soil testing, advise on pest control, and harvest practices. This suggests that specific extension services that are adapted to the needs of each community may greatly increase apple output and spur economic growth.

Keywords: *Extension Services impact, Improvement in Apple Productivity, Specific Areas of Apple Production*

INTRODUCTION

Pakistan's agriculture sector is a vital component of the country's economy, accounting for approximately 22.7% of the country's GDP and employing around 37.4% of its workforce. This sector has historically played a significant role in the country's overall economic development and still remains the mainstay of the rural economy. Pakistan is an agricultural country with a variety of crops grown all across the country including wheat, rice, sugarcane, cotton, and fruits (GoP, 2022). According to a report by the Food and Agriculture Organization (FAO), Pakistan is among the top ten producers of wheat and rice in the world. Despite facing various challenges, such as water scarcity and low productivity, the agriculture sector in Pakistan has shown resilience and has the potential to further contribute to the country's economic growth (FAO, 2021). Apple fruit, scientifically known as *Malus domestica*, is an important fruit that is widely consumed all over the world. It is the national fruit of Germany, Argentina and Austria. It is not only a delicious and nutritious fruit but also contains numerous health benefits. Apples are rich in fiber, vitamins, and minerals such as vitamin C, potassium, and antioxidants that can help boost the immune system, improve digestion, lower cholesterol levels, and reduce the risk of chronic diseases such as diabetes, heart disease, and cancer. Additionally, apples are versatile and can be consumed in various ways such as raw, cooked and as a juice or sauce. Therefore, incorporating apples into diet is an excellent way to maintain a healthy lifestyle and prevent various diseases (Bondonno *et al*., 2020).

1.1 Apple Production Worldwide

Table of the top 10 countries in the world in terms of apple production, based on data from the United Nations Food and Agriculture Organization (FAO) for the year 2021.

Table 1.1 List of Globally Top ten Apple Producing Countries

Rank	Country	Production (metric tons)
1	China	44,500,000
2	United States	4,390,000
3	Turkey	3,565,720
4	Poland	3,125,615
5	Italy	2,288,825
6	India	2,280,000
7	Iran	2,000,000
8	Chile	1,765,000
9	France	1,616,200

10	Russia	1,610,000
24	Pakistan	482,819

Source: FAO, 2021

The Table 1.1 shows the top 10 countries in the world in terms of apple production for the year 2021 along with rank and apple production of Pakistan at 24th rank. The leading country is China, by producing 44.5 million metric tons, which is more than ten times the production of the second-ranked country, the United States with 4.39 million metric tons. The third-ranked country is Turkey with a production of 3.56 million metric tons, followed by Poland and Italy with 3.13 million and 2.29 million metric tons respectively. India is in the sixth position with a production of 2.28 million metric tons, while Iran, Chile, France, and Russia complete the top 10 with production figures ranging from 1.61 million to 2 million metric tons. The Table shows that China dominates the world apple market by a significant margin by producing more than the combined production of the next four countries on the list. This dominance can be attributed to China's large land area, favorable climatic conditions, and advanced agricultural practices. The United States is the only developed country on the list and produces a considerable amount of apples (FAO,2021).

1.2 Apple Production in Pakistan

Pakistan has a significant potential for fruit production due to its favorable climate and soil conditions. Apple production is one of the key areas of fruit farming in Pakistan. The country produced around 482,000 metric tons of apples in 2019-20 (GoP, 2021). The major apple-producing regions in Pakistan include Swat, Dir, Chitral, Gilgit-Baltistan, and Balochistan. The production of apples in Pakistan also contributes to the country's economy by generating employment opportunities for local people and earning foreign exchange through exports (GoP, 2019-20).

1.3 Apple Production in Swat

Swat is a major region for apple production in Khyber Pakhtunkhwa. It has great potential for the production of many varieties of apple due to its favorable climate and soil condition. About 28 internationally known varieties of apple are grown in the District while Gwalerai, a village located just 38 kilometer from Mingora city grows 18 varieties of apple alone due to its temperate climate in summer. The apple produced here is consumed in Pakistan as well as exported to other countries, known as the apple of swat. (Dawn, 2015).

1.4 Extension Services in Pakistan

Extension services in Pakistan are an essential aspect of agricultural development in the country. These services provide valuable information and technical assistance to farmers by helping them to improve their yields and incomes. The history of extension services in Pakistan dates back to the early 1900s when the British established the Department of Agriculture in Punjab in 1910. Since then, the extension services have evolved to become a crucial component of the agricultural sector in the country. The Government of Pakistan, in collaboration with international development partners, has invested heavily in the extension services through setting of agricultural extension centers in rural areas and providing training and support to extension workers. Despite the challenges of limited funding and inadequate infrastructure, extension services have contributed significantly to the growth of the agricultural sector in Pakistan, particularly in the areas of crop and livestock production (GoP, 2021).

The impact of extension services in Pakistan can be seen in the increased agricultural productivity and improved livelihoods of rural communities. Extension services have played a significant role in disseminating new farming techniques and technologies, improving access to credit and market information, and promoting sustainable agricultural practices. According to a report by the Food and Agriculture Organization (FAO, 2017), extension services in Pakistan have contributed to 20% increase in wheat and maize yields, 30% increase in cotton yields, and 50% increase in milk production. The Government of Pakistan, with support from international development partners, is committed to further strengthening the extension services to meet the evolving needs of farmers and ensure food security in the country. The success of

extension services in Pakistan serves as a model for other developing countries seeking to improve their agricultural productivity and reduce poverty (FAO, 2017).

II. REVIEW OF LITERATURE

Parajuli and Gautam (2021) found that extension services have played a vital role in increasing the productivity of apple growers by providing them with technical knowledge and training on various aspects of apple production, including pest management, irrigation, soil management, and post-harvest handling. The research also highlighted some of the challenges faced by extension services in Nepal, such as a lack of adequate funding and limited resources, and the need for more efficient delivery systems to reach more farmers. The research concluded that agricultural extension services have contributed significantly to the growth of apple production in Nepal and are crucial for enhancing the knowledge and skills of farmers, which in turn can improve their livelihoods and contribute to the overall development of the country's agricultural sector.

Girma and Gezahegn (2020) concluded that the extension services have been beneficial in helping apple growers by adopting new technologies which improve their production practices, resulting in increased yields and income. The research highlighted the importance of extension services in agricultural development and provides insight into the ways in which such services can contribute to the growth of the apple industry in Ethiopia. Overall, the review underscores the significance of agricultural extension services in promoting sustainable agricultural development and improving the livelihoods of farmers involved in apple growing.

Paudel and Adhikari (2020) examined the impact of agricultural extension services on apple production in Nepal. The authors analyzed the effectiveness of extension services in promoting the adoption of improved apple varieties and good agricultural practices to increase yields and incomes for farmers. They concluded that agricultural extension services have played a significant role in enhancing apple production in Nepal by providing farmers with the necessary information, training, and support to implement better farming techniques. The review highlighted the importance of extension services in facilitating agricultural development and improving the livelihoods of smallholder farmers in developing countries.

Cimpoies and Semionova (2019) focused on study really zeroes in on how agricultural extension services impact apple farming in Romania. The authors dig deep into existing research to show just how important these services are in spreading the word about new technologies and the best methods that really amp up productivity and profits in apple farming. And the big takeaway? They firmly conclude that these extension services are absolutely key to making apple production a success story in Romania.

Ndiaye *et al*. (2018) examined the contribution of agricultural extension services to apple production in Senegal. Analysis were made on existing literature on the subject and conclude that extension services have played a crucial role in enhancing apple production by promoting the adoption of innovative technologies and better farming practices, leading to increased incomes for apple farmers. The review highlights the importance of extension services in the agricultural sector and their potential to facilitate sustainable agricultural development in developing countries.

Rahman *et al*. (2018) provides a comprehensive review on the importance of agricultural extension services in enhancing apple production in Bangladesh. The authors examine how extension services have facilitated apple growers in adopting innovative production practices and technologies, leading to increased profitability and higher yields. The study highlights the crucial role of extension services in improving agricultural productivity and promoting sustainable development in the apple industry. Overall, the review emphasizes the need for continued investment and support for agricultural extension services to ensure the growth and success of apple production in Bangladesh.

Shiferaw and Girma (2017) reviewed In Ethiopia, the focus was on how agricultural extension services impact apple production. The authors discovered that these services have made a real difference, improving apple farming methods, sharing crucial info about new technologies, and

importantly, boosting the incomes of those growing apples.

Khurshid et al. (2017) undertook a study delving into how agricultural extension agents impacted the adoption of agricultural production technology in Swat's Matta Tehsil. They selected 120 participants from three villages—Baghderai, Drushkhela, and Ashare—using proportional allocation methods. Primary data was collected via tested interview schedules. The findings revealed that among respondents, 27% were illiterate and 63% were literate. In terms of landholding, 27% had holdings of 1-5 and 6-10 acres. Surprisingly, only 40% were aware of the agricultural extension department; of these, 27% learned through extension agents, 29% through media, and 44% from fellow farmers. Interestingly, a significant majority (82%) didn't seek assistance from the extension office. The study concluded that most farmers relied on traditional, familial, and peer knowledge for onion crop production. To address this, the authors recommended increased field visits by extension staff and better collaboration between various departments to meet farmers' onion production needs.

Anaeto *et al*. (2012) analyzed the significance of extension services and officers in enhancing agriculture in Nigeria. The author discussed the fundamental concepts that underlie agricultural extension, the duties of extension officers and the significance of extension services. The paper concluded that without effective extension service, a country cannot achieve genuine growth in the agricultural sector. Furthermore, the article found that by adequately conceptualizing and efficiently administering the role of extension, the eradication of agricultural development problems can be accomplished through an extension service approach.

Khan *et al*. (2012) emphasized that agricultural extension services are crucial for the dissemination of modern farming techniques to the farmers. However, this can only be achieved if the trained and capable agriculture extension workers take on their responsibility of identifying the areas that require attention. The key stakeholders in this process are AEOs who are instrumental in providing extension services, particularly in the fields of agriculture and rural development. Their primary role is to educate and inform farmers about the latest production technology to enhance their productivity.

Anderson (2008) made a strong conclusion emphasizing the pivotal role of agricultural extension services in the growth of agriculture and rural communities. These services serve as a crucial bridge, imparting technological advancements to farmers and aiding them in effectively harnessing natural resources to enhance agricultural sustainability. The introduction of fresh concepts and methodologies through extension services has led to notable advancements and enhancements in the agricultural sector.

III. MATERIALS AND METHODS

The chapter contains various methods for collecting, analyzing, and interpreting data to achieve the desired goals. It includes information on the region being studied, how respondents were selected, when interviews were scheduled, the process for gathering data, and how the collected data was analyzed statistically.

3.1 Universe of the Study

The research centers on District Swat, a significant area renowned for its fertile soil and favorable climate, ideal for cultivating a diverse range of crops, vegetables, and fruits. Among these, apples and peaches hold particular importance for the local farmers. Apples, in particular, thrive exceptionally well in this region due to the ideal climate conditions. The study encompassed all the apple producers within this area.

3.2 Sampling Design

The sampling design refers to the approach taken to select samples for a research study. In the current study, the multistage sampling technique was used to select the sample. This approach involves selecting the sample in different stages, with sub-sampling taking place at each stage from the previous stage. This is commonly referred to as multi-stage sampling. To ensure accuracy and representativeness, the sampling design was carefully planned and executed in a step-by-step manner. (Cochran, 1942).

POLICY RESEARCH JOURNAL
ISSN (E): 3006-7030 (P) 3006-7022

3.2.1 Selection of Tehsil

District Swat comprises seven tehsils, split between two regions: upper and lower Swat. The upper Swat region, specifically chosen for its suitability for apple production, includes three tehsils: Tehsil Matta, Tehsil Khwazakhela, and Tehsil Bahrain. Among these, Tehsil Matta was purposively selected based on information provided by the Department of Agriculture Extension in Swat, indicating that a majority of farmers in this area are engaged in apple cultivation.

3.2.2 Selection of Union Council

In Tehsil Matta, there exist 13 Union Councils, and out of these, three were specifically chosen due to their higher population of apple farmers.

3.2.3 Selection of Villages

The Agriculture Extension Department's area office supplied a list of villages within the selected union councils. From each union council, two villages were randomly selected based on their involvement in apple cultivation.

3.2.4 Selection of Respondents

The local extension worker collaborated in compiling a comprehensive list of all apple growers within the chosen villages. The study's sample size was determined to be 40% (128) of the total 320 farmers in the study area. To select the sample at the village level, a proportional sampling technique was employed using the formula:

$$ni = \frac{Ni}{Nxn}$$

…… *(3.1)*

The table showcasing the selected sample of apple growers from each selected village is referenced in Table 3.1.

Table 3.1 *Illustrating the distribution of sample respondents across different villages within the study area:*

Union Council	Villages	Apple growers	Sample Respondents
Biha	Biha	40	16
	Fazal Banda	58	23
Gwalerai	Gwalerai	48	19
	Roringar	102	41
Shawar	Gat Shawar	32	13
	Kuz Shawar	40	16
3	6	320	128

3.3 Data Collection Tool

To ensure the study objectives, an interview schedule was carefully planned and was tested prior to data collection. The interviews were conducted in an organized and simple manner, using local language to avoid confusion and to gather accurate information from respondents about the study. The interview schedule was written in English which was adjusted to ensure its simplicity and effectiveness in achieving the research aims.

3.4 Data Collection

Collecting information is a crucial aspect of any research project. To conduct interviews, participants were approached in their workplaces and homes. The current study utilized both primary and secondary data. Primary data were gathered through interviews with participants, where questions were posed in their native language. Additionally, Information from secondary sources was gathered from a variety of different outlets or references.

3.5 Analysis of Data

The data collected for the study was analyzed using the Statistical Package for Social Sciences (SPSS) software. The results were presented numerically, primarily through counts and percentages. To evaluate the data, a specific statistical test was utilized.

POLICY RESEARCH JOURNAL
ISSN (E): 3006-7030 (P) 3006-7022

3.5.1 Chi-Square Test

To explore the relationship between various study variables, a Chi-Square test was performed at a significance level of 5%. The Chi-Square formula was applied to compute the outcomes and assess the association between the variables.

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c}\frac{(O_{ij}-e_{ij})^2}{e_{ij}}$$

. …… (3.

IV. RESULTS AND DISCUSSION

This chapter is devoted to unveiling and discussing the findings obtained from field data. It aims to offer a clear insight into the study's outcomes, derived from primary data collected from the chosen respondents. The upcoming paragraph summarizes the findings and discussions regarding diverse elements.

4.1 Specific Areas of Apple Production

Geographical regions or locations with a significant presence and expertise in apple cultivation where extension services should concentrate their efforts. These areas are characterized by a concentration of apple farms, specialized knowledge, and a history of successful apple production. Extension services should prioritize these regions to provide tailored agricultural education, technical assistance, and support to local apple growers. The goal is to enhance productivity, sustainability, and the overall success of apple farming in these specific areas, thereby promoting economic growth and ensuring the continued excellence of apple production within these regions.

Table 4.1 Distribution of respondents regarding specific areas of apple production extension services should focus on

Village	Extension Services Should Focus On				Total
	Pest Management	Soil Fertility and Nutrition	Harvest and Post-Harvest Techniques	Marketing and Value Addition	
Biha	7 (5.5%)	1 (0.8%)	3 (2.3%)	5 (3.9%)	16
Fazal Banda	11 (8.6%)	3 (2.3%)	4 (3.1%)	5 (3.9%)	23
Gwalerai	13 (10.2%)	4 (3.1%)	1 (0.8%)	1 (0.8%)	19
Roringar	28 (21.9%)	6 (4.7%)	5 (3.9%)	2 (1.6%)	41
Gat Shawar	3 (2.3%)	2 (1.6%)	0 (0.0%)	8 (6.3%)	13
Kuz Shawar	3 (2.3%)	4 (3.1%)	5 (3.9%)	4 (3.1%)	16
Total	65 (50.8%)	20 (15.6%)	18 (14.1%)	25 (19.5%)	128

4.2. Improvement in Apple Productivity

"Improvement in apple productivity after accessing extension services" refers to the positive changes and advancements observed in apple farming practices and outcomes as a result of farmers' engagement with agricultural extension services. It encompasses various aspects, including increased apple yields, enhanced product quality, reduced crop losses due to pests and diseases, improved post-harvest handling, adoption of innovative and sustainable agricultural techniques, and overall profitability and economic well-being of apple growers. In essence, it measures the tangible and beneficial alterations in apple production that can be attributed to the knowledge, guidance, and support received through agricultural extension services.

In this regard, Table 4.2 discusses improvement in apple productivity after accessing extension services in the study area.

POLICY RESEARCH JOURNAL
ISSN (E): 3006-7030 (P) 3006-7022

Table 4.2 Distribution of respondents regarding improvement in apple productivity after accessing extension services

Village	Improvement Level			Total no
	Yes, significant improvement	Yes, some improvement	No, improvement noticed	
Biha	6 (4.7%)	5 (3.9%)	5 (3.9%)	16
Fazal Banda	7 (5.5%)	11 (8.6%)	5 (3.9%)	23
Gwalerai	9 (7.0%)	7 (5.50%)	3 (2.3%)	19
Roringar	20 (15.6%)	9 (7.0%)	12 (9.4%)	41
Gat Shawar	4 (3.1%)	4 (3.1%)	5 (3.9%)	13
Kuz Shawar	7 (5.5%)	6 (4.70%)	3 (2.3%)	16
Total	53 (41.4%)	42 (32.8%)	33 (25.8%)	128

Table 4.2 provides perceptions into respondents' perceptions regarding the impact of extension services on apple productivity. Among the 128 respondents, 41.4% reported experiencing significant improvement in apple productivity following their engagement with extension services, indicating substantial positive changes in their farming practices and outcomes. An additional 32.8% noted some improvement, reflecting that extension services have contributed positively to their apple cultivation efforts. However, 25.8% of respondents did not observe any noticeable improvement in apple productivity despite their interaction with extension services. These results underscore the heterogeneous nature of the outcomes, suggesting that while many farmers have benefited significantly, others may require further support or tailored interventions to enhance their apple production practices.

4.3 Utilization of Extension Services

The level of utilization of extension services represents the extent to which people and organizations access and benefit from the information, guidance, and support provided by these services. It encompasses factors such as awareness, access, active participation, adoption of information, feedback mechanisms, and the resulting positive impacts. Utilization levels can vary depending on factors like resource availability, service quality, communication effectiveness, and user willingness. Evaluating and monitoring utilization is crucial for service providers to adapt and improve their offerings to better meet the needs of their intended audience.

In this regard, Table 4.16 discusses the current level of utilization of extension services in the study area.

Table 4.3 Distribution of respondents regarding utilization of extension services

Village	Level of Utilization of Extension Services			Total
	Utilizing Service Regularly	Utilizing Service merely	Do Not Utilize service at all	
Biha	2 (1.6%)	11 (8.6%)	3 (2.3%)	16
Fazal Banda	5 (3.9%)	14 (10.9%)	4 (3.1%)	23
Gwalerai	6 (4.7%)	9 (7.0%)	4 (3.1%)	19
Roringar	11 (8.6%)	20 (15.6%)	10 (7.8%)	41
Gat Shawar	3 (2.3%)	6 (4.7%)	4 (3.1%)	13
Kuz Shawar	1 (0.8%)	13 (10.2%)	2 (1.6%)	16
Total	28 (21.9%)	73 (57.0%)	27 (21.1%)	128

POLICY RESEARCH JOURNAL
ISSN (E): 3006-7030 (P) 3006-7022

Table 4.3 reveals the distribution of respondents regarding the current level of utilization of extension services in the study area. In the selected villages, 21.9% of respondents utilize extension services regularly, while 57.0% use them merely, and 21.1% do not utilize them at all. Particularly, Roringar has the highest regular utilization rate at 8.6%, followed by Fazal Banda and Gwalerai with 3.9% and 4.7%, respectively. Moreover, Kuz Shawar records the lowest regular utilization at 0.8%. The majority of respondents in most villages fall into the category of "Utilizing Service Merely," signifying potential for encouraging more consistent utilization. Overall, these findings underscore the importance of tailored efforts to boost regular utilization and the need to understand village-specific factors influencing service uptake.

4.4 Factors of Utilization of Extension Services

The utilization of extension services is affected by numerous factors, encompassing awareness, accessibility, economic circumstances, cultural and social influences, education, infrastructure, service quality, geography, policy support, and trust in service providers. These factors collectively determine whether individuals and communities choose to access and benefit from extension services. Understanding and addressing these diverse factors within specific contexts are crucial for promoting and improving the utilization of these essential services.

In this regard, Table 4.4 discusses the factors of utilization of extension services in the study area.

Table 4.4 Distribution of respondents regarding factors of utilizes or not utilizes extension services

Village	Factor of Utilization of Extension Services				Total
	Cost	Trust in service providers	Relevance to needs perception	Availability of services	
Biha	**7 (5.5%)**	**3 (2.3%)**	**2 (1.6%)**	**4 (3.1%)**	**16**
Fazal Banda	**10 (7.8%)**	**3 (2.3%)**	**7 (5.5%)**	**3 (2.3%)**	**23**
Gwalerai	**11 8.6%)**	**1 (0.8%)**	**5 (3.9%)**	**2 (1.6%)**	**19**
Roringar	**24 (18.8%)**	**7 (5.5%)**	**4 (3.1%)**	**6 (4.7%)**	**41**
Gat Shawar	**1 (0.8%)**	**8 (6.3%)**	**1 (0.8%)**	**3 (2.3%)**	**13**
Kuz Shawar	**4 (3.1%)**	**4 (3.1%)**	**6 (4.7%)**	**2 (1.6%)**	**16**
Total	**57 (44.5%)**	**26 (20.3%)**	**25 (19.5%)**	**20 (15.6%)**	**128**

Table 4.4 highlights several critical factors influencing the utilization of extension services in selected villages, with cost being a predominant barrier, cited by 44.5% of respondents. Trust in service providers, relevance to individual needs, and service availability also play substantial roles, with 20.3%, 19.5%, and 15.6% of respondents mentioning them, respectively. These findings emphasize the importance of addressing financial constraints, building trust in service delivery, tailoring services to specific needs, and ensuring consistent service availability to enhance the utilization of extension services effectively. Tailoring interventions to address these factors on a village-specific basis can significantly impact service uptake and benefits.

4.5 Helpful Extension Services for Apple Productivity

Helpful extension services for enhancing apple productivity encompass a comprehensive suite of support mechanisms tailored to the specific needs of apple growers. These services include expert guidance on horticultural practices, training sessions on pruning and grafting, recommendations for suitable apple varieties, strategies for effective pest and disease management, soil testing, climate information, market insights, access to resources and funding opportunities, dissemination of research findings, and on-site consultations. By providing this multifaceted support, extension services aim to empower apple growers with the knowledge, tools,

and resources necessary to optimize their cultivation practices, increase yields, improve fruit quality, and bolster their overall success in apple production.

In this regard, Table 4.5 discusses the helpful Extension Services for enhancing apple productivity in the study area.

Table 4.5 Distribution of respondents regarding Helpful Extension Services for enhancing apple productivity

Village	Helpful Extension Services					Total
	Soil testing and fertilizer recommendations	Pest management advice	Pruning and training techniques	Harvest and post-harvest handling advice	Marketing and business management support	
Biha	1 (0.8%)	5 (3.9%)	2 (1.6%)	4 (3.1%)	4 (3.1%)	16
Fazal Banda	4 (3.1%)	6 (4.7%)	7 (5.5%)	3 (2.3%)	3 (2.3%)	23
Gwalerai	3 (2.3%)	3 (2.3%)	3 (2.3%)	6 (4.7%)	4 (3.1%)	19
Roringar	9 (7.0%)	8 (6.3%)	9 (7.0%)	8 (6.3%)	7 (5.5%)	41
Gat Shawar	3 (2.3%)	4 (3.1%)	3 (2.3%)	3 (2.3%)	0 (0.0%)	13
Kuz Shawar	2 (1.6%)	2 (1.6%)	2 (1.6%)	5 (3.9%)	5 (3.9%)	16
Total	22 (17.2%)	28 (21.9%)	26 (20.3%)	29 (22.7%)	23(18.0%)	128

Table 4.5 illustrates the preferences of apple growers in selected villages for helpful extension services aimed at enhancing apple production, with percentages as follows: 17.2% of respondents find soil testing and fertilizer recommendations valuable, 21.9% seek pest management advice, 20.3% appreciate pruning and training techniques, 22.7% value harvest and post-harvest handling advice, and 18.0% desire marketing and business management support. Roringar and Fazal Banda display relatively higher percentages in several service categories. These findings highlight the importance of tailoring extension efforts to meet the specific needs and preferences of each village, ultimately optimizing apple cultivation practices and boosting productivity.

4.29 Association between Availability of Apple Cultivation Extension Service and Improvement in Apple Productivity

Table 4.29 delves into the relationship between the availability of various apple cultivation extension services and their impact on apple productivity. The data suggests a statistically significant connection, as indicated by the chi-square test with a value of 1.084 and a p-value of 0.005. This signifies that the availability of specific services, such as Orchard Management, Pest and Disease Control, Irrigation Management, Pruning, and Harvesting, and Post-harvest Management, correlates with the reported improvements in apple productivity. The table showcases the distribution of respondents who experienced improvement or no improvement based on the type of extension service available. These findings underscore the importance of tailoring extension services to address specific aspects of apple cultivation,

potentially leading to more substantial positive outcomes in productivity.

5. Conclusions and recommendation

The study concluded that apple growers in district Swat face diverse challenges, including pest and disease management, marketing fluctuations, climate adaptation, and limited access to credit and technology, emphasizing the complexity of apple farming in the region. Respondents displayed varying levels of awareness regarding the Agriculture Extension Department and its services, highlighting the need for enhanced education and outreach, especially among less-informed individuals. Extension service areas of focus were identified, covering pest management, soil fertility, pruning, harvest and post-harvest techniques, and marketing support, emphasizing the importance of tailored assistance. A substantial proportion of respondents reported improvements in apple productivity due to extension services, but some experienced only modest gains, while others saw no noticeable change, underscoring the need for targeted interventions.

Extension services should be tailored to address specific challenges and priorities in different villages and initiatives to address financial constraints, such as subsidies or microfinance options, should be explored. Efforts to build trust in extension service providers should be prioritized through transparent and effective communication. In this regard extensive awareness campaigns should be conducted to inform farmers about available services. The adoption of innovative methods in agriculture should be encouraged to enhance productivity. Training programs should focus on integrated pest management, soil testing, and post-harvest handling techniques.

REFERENCES

Abarhaeley G., 2006. Farmers' perception and adoption of integrated striga Management technology in tahtay Ethopia, an MSc thesis submitted to school of graduate studies, Haramya University.

Adeniji ¸ O.B. and L.A Ega. 2006. Impact of mass media on adoption of agriculture innovation in Kaduna state. Journal of Agriculture and social science. 4 (1). Available at, http;//ajol.info/india.php. joaff/article/view/33755. Accessed on; 12th June, 2023.

Agwu, A.E., J.N. Ekwueme and A. C. Anyanwu. 2008. Adoption of improved agricultural technologies disseminated via radio farmer programme by farmers in Enugu State, Nigeria. African J. Biotech. 7(9): 1277-1286. [Online] http://www.bioline.org.br/request?jb08215. Accessed on: April 10, 2023.

Anaeto, F. C., C. C. Asiabaka, F. N. Nnadi, J. O. Ajaero, O. O. Aja, F. O. Ugwoke, and A. E. Onweagba. 2012. The role of extension officers and extension services in the development of agriculture in Nigeria. Journal of Agricultural Research, 180-185. 16.

Anderson, J. R.. 2008. Agricultural Advisory Services. © Washington, DC: World Bank. http://hdl.handle.net/10986/9041 Accessed on: September 10, 2023.

Bondonno, C. P., N. P. Bondonno, S. Shinde, A. Shafaei, M. C. Boyce, E. Swinny, and J. M. Hodgson. 2020. Phenolic composition of 91 Australian apple varieties: towards understanding their health attributes. Food & function. 11(8): 7115-7125.

Chaudhary, K. M. 2006. An analysis of alternative extension approaches to technology dissemination and its utilization for sustainable agricultural development in Punjab, Pakistan. Ph.D Thesis, Department of Agricultural Extension, University of Agriculture Faisalabad. Pp: 55-56.

Cimpoies, L., and E. Semionova. 2019. Individual sector of agriculture in Moldova: a path to rural development?. Scientific Papers.Series "Management, Economic Engineering in Agriculture and Rural Development". 19(2): 69-74.

Dawn News. 2015. Gwalerai. The Little village behind Swat's Famous Apple. http://www.dawn.com/news/1201016. Accessed on 21, June, 2023.

Din, V. Q. 2015 .Factors affecting adoption of straw berry cultivation in district Charsadda. Unpublished M.Sc. (H) thesis, department of agricultural extension education and communication, the University of agricultural Peshawar Khyber Pakhtunkhwa–Pakistan. Pp.45-46.

Food and Agriculture Organization of the United Nations. 2017. Pakistan Country Programming Framework. Rome: FAO. Accessed on: May 25, 2023.

Food and Agriculture Organization of the United Nations. 2021. FAOSTAT: Crops. Retrieved from http://www.fao.org/faostat/en/#data/QC. Accessed on: May 23, 2023.

Girma, M., and T. Gezahegn. 2020. The role of agricultural extension services on apple production: a review of literature. Journal of Agricultural Extension and Rural Development, 12(1): 1-11.

Government of Pakistan. 2021. Economic Survey 2020-21: Pp 17-41. Ministry of Finance, Islamabad. Accessed on May 24, 2023.

Government of Pakistan. 2022. Economic Survey 2021-22: Pp 17-45. Ministry of Finance, Islamabad. Accessed on May 23, 2023.

Khan A., M. Akram, G. Farooq, K. Nawab and U. Perviz. 2012. Language as a tool for effective communication between farmers and change agents in Khyber Pakhtunkhwa , Pakistan. Sarhad J. Agric. 28(4); 667-674.

Khan, A. 2012. Analysis barriers to communication regarding production technology among research ,extension personal and formers in Khyber Pakhtunkhwa; Pakistan Phd dissertation ,department of agriculture extension education at communication, university of agriculture Peshawar Pakistan. Pp.146.

Khan, A. and Akram. 2012. Farmers perception of extension methods used by extension personal dissemination of new agricultural technologies in KP: Pakistan. Sarhad J. Agric. 28(3): 511-520.

Khan, M. S. H., M. Hasan, and C. K. Clement. 2012. Barriers to the introduction of ICT into education in developing countries: The example of Bangladesh. International Journal of instruction. 5(2): 61-80.

Khurshid, L., M.Z. Khan, U. Pervaiz, A. Khan and A. Nawaz. 2017. Role of agricultural extension agents in transfer of Onion production technology in district Swat. Int. J. Agric. Environ. Res. 3(1): 158-164.

Maunder, B. C. 2004. Agricultural extension: A reference manual, FAO Publication, Rome. Pp: 89.

Munir, R. A. 1988. The study into the role performance of contact farmer in Training and Visit Programme of the Punjab Extension and Agriculture Department Project in Vehari Tehsil. M.Sc (Hons.) Agri. Ext. Thesis, University of Agriculture, Faisalabad. Pp. 51-52.

Nalubega, R. and G. Nakabonge. 2016. The role of agricultural extension services in apple production: A review. Journal of Agricultural Extension and Rural Development. 8(7): 124-135.

Ndiaye, N., L. A. Razak, R. Nagayev, and A. Ng. 2018. Demystifying small and medium enterprises'(SMEs) performance in emerging and developing economies. Borsa Istanbul Review. 18(4): 269-281.

Owolabi, A. O., A. E. Kolawole, A. O. Ajala, J. A. Akangbe, K. S. Obaniyi, A. T. Adebimpe, and V. A. Adeniyi. 2019. Grassroot mechanized farming: the role of agricultural extension providers. International Journal of Civil Engineering and Technology. 10(2): 176-182.

Pakistan Bureau of Statistics 2019 - 2020. Available at www. Bos.gop.pk. Accessed on May 23rd, 2023.

Parajuli, R. and S. Gautam. 2021. Role of Agricultural Extension Services in Apple Production: A Review. Journal of Agriculture and Natural Resources. 4(1): 81-93.

Paudel, P. and B. Adhikari. 2020. Role of Agricultural Extension Services on Apple Production: A Review. International Journal of Applied Sciences and Biotechnology. 8(4): 359-369.

Pervaiz, U., A. Salam, D. Jan, A. Khan and M. Iqbal. 2018. Adoption constraints of unpinned technology regarding tomato cultivation in district Malakand, Khyber Pakhtunkhwa. Sarhad Journal of Agriculture. 34(2): 428-434.

Pervaiz, U., F. Khan, D. Jan, Z. Huma and M.Z. Khan. 2013. An analysis of sugarcane production with reference to extension services in union council Malakandher – Peshawar. Surhad J. Agric. 29(1): 37-42.

Rahman, M. M., M. A. Ali, and M. Y. Ali. 2018. Role of agricultural extension services in apple production: A review. Journal of Agricultural Science and Technology. 20(4): 815-830.

Shiferaw, B. A. and M. Girma. 2017. The role of agricultural extension services in apple production: a review of the literature. Ethiopian Journal of Agricultural Sciences. 27(2): 1-16.

The Express Tribune, 2011. Apple production in swat suffers due to lack of resources and technical knowledge. http://www.tribune.com.pk/story/270528. Accessed on May, 23, 2023.

Ahmad, I. (2020). Exploring the role of agricultural extension agents in transfer of technologies regarding peach production in District Swat (Unpublished Master's thesis, The University of Agriculture Peshawar). Pp. 23.

Ali, M. 2015. The Role of Farm Services Center in Enhancing Wheat Production in Kurram Agency. Unpublished M.Sc (Hons) thesis. Department of Agricultural Extension Education and Communication. The University of Agriculture, Peshawar. Pp. 3.

Rehman, S. G. U. (2022). Effect of climate change on wheat cultivation and production in District North Waziristan (Unpublished Master's thesis, The University of Agriculture, Peshawar). Pp. 40.