Research Article

Farmers' Perception in Boosting Maize Production: The Role of Agricultural Extension in Muzaffarabad AJK

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Abstract | This study was carried out with the aim to evaluate the farmers' perception about the knowledge of agricultural extension workers in improving maize production by using purposive sampling technique in Azad Jammu Kashmir (AJK) District Muzaffarabad and a sample of 120 respondents were interviewed. Results of the study revealed that the majority of the maize growers (67.5 percent) was in the age category of 26 to 45 years where most growers (60 percent) were literate. Among the respondent's, 46.8 percent of the respondents received assistance from the extension workers. Results show that after the advice of extension workers, a significant improvement in farmers' maize yield between 700 and 1000 kg/acre were observed in the research area. The analysis of farmers' perception revealed that knowledge of seed rate for sowing was ranked highest with a mean score (4.26±1.03). Extension workers are highly regarded for their competence in conducting field trips (3.64±1.28). The analysis indicated a positive association between types of help in the form of trainings and field days arranged by extension workers with the production of maize growers was also found. the study concluded that extension services provided by the workers significantly improved maize yield in Muzaffarabad, AJK. Training, field visits, and expert advice from extension workers led to higher yields, with many farmers exceeding 1000 kg/acre. Farmers particularly valued the extension workers' knowledge, especially about seed rates, as key to their success. The study recommended that targeted extension interventions are essential for addressing challenges in maize production. Extension services play a vital role in improving productivity through tailored advice and training, highlighting the importance of education in agricultural development.

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Introduction

Agriculture is essential for environmental health and combating hunger by providing variety of food options (Muddassir *et al.*, 2020). Agricultural development improves practices, technologies, and systems to boost food production, rural livelihoods, and economic growth, fostering productivity and

sustainability to address food insecurity, alleviate poverty, and promote environmental sustainability for present and future generations (Sanaullah *et al.*, 2020). Through innovation, infrastructure enhancement, better market access, and equitable resource distribution, farmers can improve livelihoods, mitigate hunger, and build resilient agricultural sectors (Khan *et al.*, 2019). Maize (*Zea mays L.*), originating from America, is a versatile and significant cereal crop worldwide, with leading producers including India, China, Brazil, the United States, and Pakistan (FAO, 2018). Maize contains about 5.8% fats, 10% proteins, 72% starch, and 3% sugar, which supports many sectors. With global production averaging around 1 billion metric tons each year, it plays a vital role in our diet (Hossain *et al.*, 2016). In Pakistan, maize is essential for both food security and socio-economic growth. It is cultivated on 13.18 million hectares, yielding 4786.3 kg ha^{-1} (Shah *et al.*, 2020). In Muzaffarabad, the capital of AJK, maize is grown widely across diverse agro-ecological zones, even at altitudes of up to 3,656 meters, covering 0.122 million hectares of summer crop area (Shah *et al.*, 2020). However, its production remains low due to several challenges, including pest attacks, diseases, poor water management, soil erosion, a lack of quality seeds and mechanized services, climate change, and limited agricultural knowledge. These issues highlight the urgent need for targeted policy interventions (Pervaiz *et al.*, 2020).

Agricultural extension serves as a communication bridge between farmers and research institutions, addressing farmers' issues and sharing research to boost productivity (Hassan *et al.*, 1998). Extension workers in AJK use individual methods, such as farm visits, and group approaches, like demonstrations, to teach farmers effective decision-making and best practices (Bahua *et al.*, 2020). The Agriculture Extension Department, led by the Director General of Agriculture, organizes services through directorates and district-level officers, but equitable access remains a concern (Javeid and Nawab, 2021). However, poor coordination among research, extension, and farmers particularly in District Muzaffarabad hampers agricultural progress (Pervaiz *et al.*, 2020). A lack of collaboration with academic institutions also limits practical applications of research (Hafeez, 2014). Challenges in AJK's agriculture sector includes inadequate funding, limited personnel, and weak monitoring systems, highlighting the need for sustainable improvement efforts.

In Pakistan, maize stands as one of the most important kharif crops, with District Muzaffarabad in AJK being a significant area of cultivation. Despite concerted efforts by the government and related organizations to boost maize productivity and yield per acre, the results have been unsatisfactory. Several issues hinder the potential for optimal maize production, including the significant gap in the provision of extension services essential for disseminating modern agricultural practices and technologies to farmers, and the fragmentation of agricultural lands due to inherited divisions, which makes it challenging to implement large-scale and efficient farming practices. Moreover, many extension agents lack the necessary skills, knowledge and resources to effectively support farmers in adopting advanced agricultural techniques, and there is a pressing requirement for the introduction and dissemination of improved agricultural technologies through efficient extension training programs for increasing production. Therefore, this research is designed with the objectives to assess the role of the agricultural extension department in boosting maize production in District Muzaffarabad, AJK, and explored farmers' perceptions of extension workers' knowledge and effectiveness and to analyze maize production practices, evaluate farmers' views on extension support in the region.

Materials and Methods

Universe of the study and sample design

This research was conducted in District Muzaffarabad, Azad Kashmir during Kharif season of 2024, where the majority of farmers cultivate maize. Proper facilitation of data collection was carried out to validate the reliability of the study. District Muzaffarabad, which consists of two tehsils that are Muzaffarabad and Patika (Naseerabad). Tehsil Muzaffarabad was purposively selected due to its higher maize production. Among the 51 union councils in Tehsil Muzaffarabad, five were chosen based on maximum maize production. A list of maize growers as well as villages was obtained from the Agriculture Extension department, and one village was randomly selected from each chosen union council. Proportionate allocation method was used to select 20 % of these farmers as respondents, calculated using the formula:

$$ni = \frac{Ni}{N} \times n$$

Whereas,
ni = No. of sampled respondents in the village.
Ni = Total No. of farmers in the village.
n = Total sample size.
N = Total No. of farmers in the study area.

Data collection and analysis

This research involved both primary and secondary data. Primary data was obtained through a carefully designed and pre-tested interview questionnaire. While secondary data was gathered from a variety of published and unpublished sources. Statistical Package for the Social Sciences (SPSS v. 20) was used to analyze the data collected. Results were presented using tables, graphs, and frequency distributions to illustrate findings. A Likert scale was utilized to gauge the depth of knowledge among extension workers while, Chi square and t- test were performed to analyze the association between variables according to equation 2 and 3.

$$\chi^2 = \frac{\sum(Oi - Ei)2}{Ei}$$

Where, χ^2 is chi-square statistic having O_i observed frequency and Ei is the expected frequency

$$t = \frac{d}{Sd/\sqrt{n}}$$

Where,
d = the average difference between the two sets of related measurements (like before-and-after).
Sd = how much the differences vary from the average (standard deviation).
n = the number of paired observations (how many items or people were measured twice).

Results and Discussion

Demographic characteristics of farmers

The initial focus of this research study included demographic variables which were selected for their relevance in gathering essential information from maize growers in Muzaffarabad. Drawing on previous studies by Ekanem *et al.* (2006), Agwu *et al.* (2008), Saadi *et al.* (2008) and Jensen *et al.* (2009), it is well-established that demographic factors significantly influence various characteristics and outcomes.

Age of respondents

It is widely acknowledged that younger generations tend to adopt and integrate new technologies more readily than older generations (Agwu *et al.*, 2008; Afsar and Idrees, 2019). In the study region, 34.17 percent of the maize growers were aged between 26-35 and only 12.5 percent were above 40, with 20 percent under 20 (Figure 1). This indicated that 67.5 percent of maize growers were between 26 and 45, a group more likely to adopt modern farming practices than older individuals (Okwu *et al.*, 2007). In our study, we observed a difference from Okwu *et al.* (2007), as the predominant group of 26-45 years old showed varying levels of reluctance in adopting modern technologies in the study area.

Literacy status of the respondents

Literacy greatly influences farmers' adoption of advanced far//ming technologies, as educated farmers can better understand and apply new agricultural practices (De Buck, 2001; Sahito *et al.*, 2021). Studies show that higher education levels correlate with greater openness to innovation.

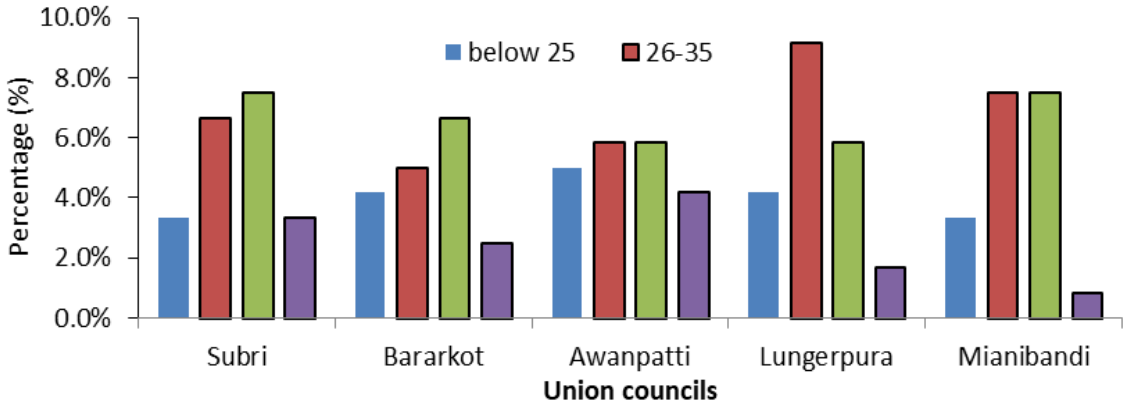

Figure 1: *Distribution of respondents based on their age*

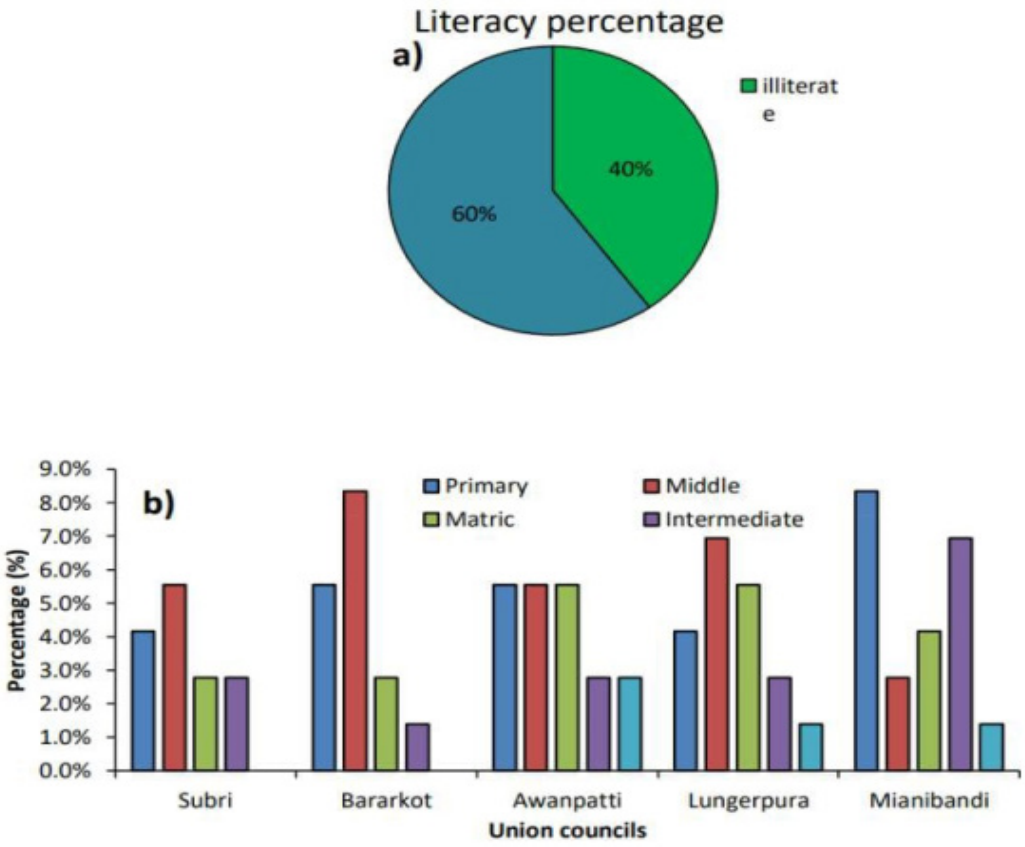

Figure 2: *Disrtibution of respondents according to their literacy status and education level in AJK*

In this study, 60 percent of the 120 respondents were literate, with educational levels detailed in Figure 2. The results highlight that 29.17 percent had middle school education, 27.78 percent primary, 21 percent matric, 17 percent intermediate, and only 5.56 percent above intermediate. These findings were aligned with Obidike (2011), who highlighted that education enhances openness to new practices, crucial for adopting modern agricultural technologies. High illiteracy remains a barrier, as Alant and Bakare, (2021) noted that illiterate individuals often resist new technologies.

Table 1: *Sampled farmers from each village.*

Union council	Villages	Total no. of maize grower farmers	20% of the respondent
Muzaffarabad	Miani bandi	125	25
Gojra	Bararkot	110	22
Lunger pura	Lungerpura	125	25
Chater domel	Subri	125	25
Hattian du-patta	Awanpatti	115	23
Total		600	120

Source: Survey

Help from agriculture extension office

Agricultural authorities can identify underserved communities by analyzing the distribution of respondents receiving extension support (Khan *et al.*, 2022). In this study, 79.17 percent of respondents reported receiving assistance from agricultural extension services, with Awanpatti and Mianibandi having the highest proportion (16.67 percent) of supported farmers. The most common assistance included attending field days (41.49 percent) and training programs (46.81 percent), while only 11.7 percent received inputs like seeds or fertilizers (Table 2). Engagement with extension services is attributed to active outreach by extension workers, valued by farmers for enhancing skills and resources. Extension supports fosters resilience by promoting knowledge transfer and technology adoption (Feder *et al.*, 2001; Jayne *et al.*, 2021).

Distribution of respondents on the basis of extension office visit and satisfaction level of farmers for agriculture extension agents

To improve extension programs, it is important to understand why some farmers visit while others do not (Norton and Alwang, 2020). The study

Table 2: *Distribution of respondents on the basis of help from agriculture extension office*

Villages	Yes	No	Total	Field days	Trainings	Inputs	Total
Subri	17(14.17)	8(6.67)	25	5(5.32)	11(11.70)	1(1.06)	17
Bararkot	19(15.83)	3(2.50)	22	8(8.51)	9(9.57)	2(2.13)	19
Awanpatti	20(16.67)	5(4.17)	25	9(9.57)	7(7.45)	4(4.26)	20
Lungerpura	19(15.83)	6(5.00)	25	9(9.57)	8(8.51)	2(2.13)	19
Mianibandi	20(16.67)	3(2.50)	23	8(8.51)	9(9.57)	2(2.13)	19
Grand Total	95(79.17)	25(20.83)	120	39(41.49)	44(46.81)	11(11.70)	94

Source: Field survey 2024
Note: values in parentheses are percentages.

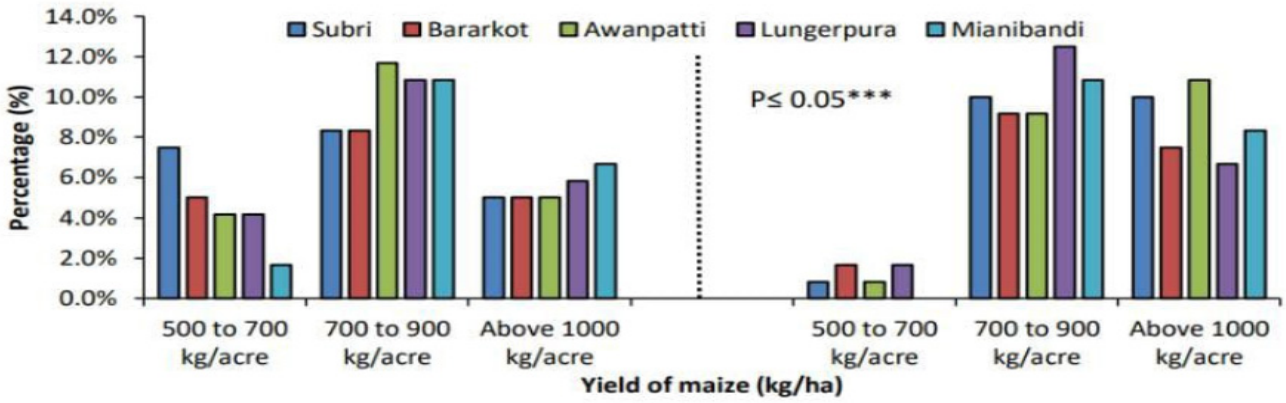

Figure 3: *Percent disrtibution of respondents on the basis of maize yield (kg /Acre) before and after advice of extension egents*

examined the distribution of respondents visiting the Agriculture Extension office across five villages. Out of 120 respondents, 15.00 percent from Subri and 13.34 percent from Bararkot visited the office, while 15.83 percent of respondents in Awanpatti and 15.00 percent in Lungerpura visited the agriculture offices. Factors such as logistical constraints, lack of transportation, and time limitations may explain the disparities in visits. Additionally, inadequate awareness of services highlights the need for better communication and ou treach (Krishna and Po, 2021; Antwi-Agyei and Stringer, 2021).

Assessing farmers' satisfaction with extension workers is essential for improving agricultural outreach and tailoring programs (Singh *et al.*, 2018). Analysis shows that 80.00 percent of respondents were satisfied with the extension services, while 20.00 percent were dissatisfied (Table 3). Satisfaction levels varied across villages: 16.67 percent in Subri, 15.00 percent in Bararkot, 14.17 percent in Awanpatti, 19.17 percent in Lungerpura, and 15.00percent in Mianibandi. The high satisfaction rates suggest that extension workers effectively meet farmers' needs, and personalized assistance has fostered trust and confidence in their expertise (Ashraf and Hassan, 2021).

Table 3: *Distribution of respondents on the basis of extension office visit and satisfaction level of farmers for agriculture extension agents*

Villages	Farmers' extension office visit		Satisfaction from extension agents	
	Yes	No	Yes	No
Subri	18(15.00)	16(13.34)	20(16.67)	5(4.17)
Bararkot	16(13.34)	6(5.00)	18(15.00)	4(3.33)
Awanpatti	19(15.83)	7(5.83)	17(14.17)	6(5.00)
Lungerpura	18(15.00)	6(5.00)	23(19.17)	2(1.67)
Mianibandi	7(5.83)	7(5.83)	18(15.00)	7(5.83)
Total	78(65.00)	42(35.00)	96(90.00)	24(20.00)

Source: Field survey 2024
Note: values in parentheses are percentages

Yield of maize (kg/acre) obtained by farmers before and after the advice of extension agents

Following extension workers' recommendations can increase maize production (Haruna *et al.*, 2023), income (Onwuka *et al.*, 2017), and help farmers cope with challenges such as weather and pests. Among 120 respondents, 50 percent reported yields between

700-900 kg/acre, 27.5 percent had over 1000 kg/acre, and 22.5 percent had yields between 500-700 kg/acre (Figure 3). Climate change has led to a 3.8 percent global decline in maize production, with extreme weather causing a 2.3 percent decline in Ethiopia (Malhi *et al.*, 2021). Factors like outdated practices and limited resources contribute to yield variation (Yagaso *et al.*, 2024). After receiving advice, 51.67percent of respondents reported yields between 700-900 kg/acre, and 43.33 percent achieved yields over 1000 kg/acre, reflecting significant improvement. The lowest yield (500-700 kg/acre) dropped to 5.00 percent. A T-test confirmed that maize yields significantly increased, with a decrease in growers reporting yields between 500-700 kg/acre and an increase in those reporting yields above 1000 kg/acre (sig ≤ 0.05).

These results highlighted the positive impact of extension advice on maize yields, particularly in the 700-900 kg/acre range. Studies from Malawi (Jolex, 2022), Kenya (Cheruiyot *et al.*, 2022), South Africa (Bruwer and Khwidzhili, 2022), Ethiopia (Mengistu, 2019), and Nigeria (Oyelami *et al.*, 2018) support the findings, showing that extension services improve technical efficiency, productivity, and knowledge.

Farmers' perception regarding the knowledge of extension workers from sowing to harvesting of maize crop

Farmers' perceptions of extension workers' knowledge on pre- and post-harvest maize practices are influenced by factors such as accessibility, effectiveness, and relevance. Evaluating these perceptions helps improve extension programs. When extension workers possess comprehensive knowledge of maize cultivation, farmers can make informed decisions, adopt best practices, and overcome challenges, resulting in higher yields and more sustainable agriculture (Drexler, 2021). An analysis of farmers' perceptions regarding basic maize cultivation knowledge revealed significant findings (Table 4). "Knowledge of seed rate for sowing" ranked highest with a mean score of 4.26 (SD = 1.03), followed by "Knowledge of proper storage" with a mean score of 4.05 (SD = 0.77). "Knowledge of seed bed for maize sowing" ranked third (mean = 3.97, SD = 0.93), and "Knowledge of proper harvesting time" ranked fourth (mean = 3.94, SD = 0.96). Other rankings included "Proper sowing time" (mean = 3.83, SD = 0.95) in fifth, "Irrigation time and number of irrigations" (mean = 3.79, SD = 0.98) in sixth, and "Fertilizer/organic time and dose" (mean = 3.09, SD = 1.15) in seventh. "Knowledge of IPM" scored the lowest with a mean value of 2.77 (SD = 0.94), placing it at the bottom rank (VIII).

Farmers perception regarding the knowledge of extension workers in extension program for maize crops

Extension programs are crucial for supporting farmers by providing information, resources, and guidance to improve agricultural practices. They help farmers enhance skills in crop management, pest control, and soil conservation, and foster collaboration to overcome challenges (Chowdhury *et al.*, 2014). Methods like field trips, evaluations, and demonstration plots contribute to increased productivity and sustainable development. Extension workers received the highest rating for conducting field trips (mean = 3.64, SD = 1.28), followed by program evaluations (mean = 3.26, SD = 0.88) in third place. Preparing demonstration plots ranked second (mean = 3.35, SD = 1.16), while identifying needs and implementing work plans ranked fourth and fifth (mean scores of 3.05 and 3.03).

Table 4: *Farmers' perception regarding the knowledge of extension workers from sowing to harvesting of maize crop*

Knowledge	1	2	3	4	5	Mean	S.D	Rank
Knowledge of seed rate of maize for sowing	5(4.2)	4(3.3)	10(8.3)	37(30.8)	64(53.4)	4.26	1.03	I
Knowledge of seed bed for maize crop sowing	2(1.7)	6(5.0)	24(20.0)	50(41.7)	38(31.6)	3.97	0.93	III
Proper sowing time	2(1.7)	12(10.0)	19(15.8)	59(49.2)	28(23.3)	3.83	0.95	V
Fertilizer / organic time and dose to crops	12(10.0)	28(23.3)	27(22.5)	43(35.9)	10(8.3)	3.09	1.15	VII
Irrigation time and no of irrigation to maize crop	1(0.8)	13(10.8)	28(23.4)	46(38.3)	32(26.7)	3.79	0.98	VI
Knowledge of IPM	10(8.3)	37(30.8)	47(39.2)	23(19.2)	3(2.5)	2.77	0.94	VIII
Knowledge of proper harvesting time of Maize	1(0.8)	8(6.6)	29(24.2)	41(34.2)	41(34.2)	3.94	0.96	IV
Knowledge of proper storage	0(0.0)	3(2.5)	24(20.0)	57(47.5)	36(30.0)	4.05	0.77	II

Note= 1= Very low, 2= Low, 3= Medium, 4= High, 5 = Very high SD= Standard deviation

Table 5: *Farmers' perception regarding the knowledge of extension workers in extension program for maize crops.*

Clients' needs	1	2	3	4	5	Mean	S.D	Rank
Identify the client's needs	17(14.2)	22(18.3)	34(28.3)	32(26.7)	15(12.5)	3.05	1.24	IV
Implement the work plan	7(5.8)	27(22.5)	48(40.0)	32(26.7)	6(5.0)	3.03	0.97	V
Evaluate an extension program	4(3.3)	17(14.2)	49(40.8)	44(36.7)	6(5.0)	3.26	0.88	III
Conduct a field trip	14(11.7)	11(9.2)	10(8.3)	54(45.0)	31(25.8)	3.64	1.28	I
Prepare demonstration plots	9(7.5)	16(13.2)	42(35.0)	30(25.0)	23(19.3)	3.35	1.16	II

Note= 1= Very low, 2= Low, 3= Medium, 4= High, 5 = Very high SD= Standard deviation

Table 7: *Association between types of help from extension workers with production of maize growers*

Type of help from extension workers	Production (tons)			
	15 to 20 (tons)	20 to 30 (tons)	Above 30 (tons)	Total
Field days	0(0.0)	27(28.7)	12(12.8)	39
Training	0(0.0)	15(16.0)	29(30.8)	44
Inputs	5(5.3)	6(6.4)	0(0.0)	11
Total	5(5.3)	48(51.1)	41(43.6)	94
x^2 = 59.622			P value =0.0000***	

Note: values in parentheses are percentages

Association between education levels of respondents with use of inputs recommended by extension workers

Data regarding association between education levels of respondents with use of inputs are illustrated in Table 6. The chi-square test revealed a statistically significant association between the education level of respondents and the use of inputs recommended by extension workers (χ^2 = 27.724, p < 0.0001). The significance of these results explained that educated people are more open to using new technologies and inputs as compared to those who has no educational background i.e. Illiterate respondents and those who have very low level of education i.e. primary education level.

Table 6: *Association between education levels of respondents with use of inputs recommended by extension workers*

Education level	Use of recommended inputs		
	No	Yes	**Total**
Illiterate	37(30.8)	11(9.2)	48
Primary	13(10.8)	7(5.8)	20
Middle	7(5.8)	14(11.7)	21
Matric	3(2.5)	12(10.0)	15
Intermediate	2(1.7)	10(8.3)	12
Graduate	1(0.8)	3(2.5)	4
Total	63(52.5)	57(47.5)	120
X^2=27.724		P value =0.0000***	

Note: values in parentheses are percentages

Association between types of help from extension workers with production of maize growers

Data related to association between types of help from extension workers with production of maize growers are illustrated in Table 7. A significant association between types of help from extension workers with production of maize growers (χ^2 = 59.622, p < 0.0001) meaning that when farmers get helps from extension worker regarding important maize cultivation issues their production per unit area increases. Specifically, farmers having 20 to30 tons production often participate in field days while those who took special training under the supervision of extension workers had a production above 30 tons.

Conclusions and Recommendations

This research underscored the significant impact of demographic factors, literacy levels, and agricultural extension services on maize production in Muzaffarabad. The results revealed that younger, literate farmers are more open to adopting modern agricultural practices, particularly with effective extension support. The study demonstrated a notable improvement in maize yields following intervention, emphasizing the critical role of extension agents in offering tailored guidance. Farmers expressed high satisfaction with extension services, indicating their effectiveness in addressing agricultural challenges and boosting productivity. Based on these findings, it is

recommended to strengthen agricultural extension programs to provide timely support, implement targeted training for younger and literate farmers to encourage innovative practices, collaborate with educational institutions to enhance literacy and agricultural education, and develop a robust monitoring and evaluation system to assess and improve the effectiveness of agricultural interventions.

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Novelty Statement

This study explores farmers' perceptions of agricultural extension in improving maize production in Muzaffarabad, AJK.

Author's Contribution

Muhammad Zafarullah khan: Designed and supervised the study.
Hamza Khalid: Collected the data and performed the research work.
Urooba Pervaiz: Wrote the manuscript.
Uzair Ahmed: Wrote the manuscript.
Irfan Ullah: Reviewed the manuscript.

Generative AI or AI assisted technology statement
The authors declare that no genrative AI was used in the creation of this manuscript.

Conflict of interest
The authors have no conflict of interest.

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