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FARMERS' PERCEPTION OF THE EFFECTIVENESS OF FERTILIZER ADVISORY SERVICES ON CROP PRODUCTIVITY AND FARM INCOME: A CASE STUDY OF CENTRAL PUNJAB

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ABSTRACT

This study aims to comprehensively assess farmers' perceptions of the effectiveness of fertilizer advisory services in enhancing crop productivity and improving farm income. A sample of 180 growers from district Sargodha was selected through a multistage simple random sampling technique as a case study of central Punjab. Data were collected using a detailed, validated, and pre-tested interview schedule and analyzed through SPSS. The results indicate that farmers considered the provision of latest information on IPM, irrigation, and pruning techniques ($\bar{x} = 4.04$), and up-to-date content to improve yields and farm profitability ($\bar{x} = 3.84$) as the most important aspects of advisory content quality and relevance. Regarding dissemination modes, farm visits to provide personalized advice ($\bar{x} = 4.06$) and the establishment of demonstration plots to showcase practice efficacy ($\bar{x} = 3.90$) were identified as the most preferred methods. Furthermore, recommendations based on soil analysis reports ($\bar{x} = 4.21$), along with advice perceived to increase crop yields ($\bar{x} = 4.17$) and improve farm income ($\bar{x} = 4.13$), were rated as the most effective aspects of the services. The findings indicate that farmers perceive timely and well-designed advisory services as beneficial for improving their understanding of balanced fertilizer use, boosting input efficiency, and enhancing both yields and profitability. The study recommends that fertilizer companies design advisory content by considering local agro-ecological conditions, soil fertility levels, and specific crop needs. Furthermore, collaboration with universities, research institutes, and government extension departments is essential for developing more credible, effective, and consistent advisories, identifying gaps, ensuring farmer satisfaction, and evaluating long-term impacts on crop productivity and farm income.

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INTRODUCTION

Agriculture is an essential sector of Pakistan's economy, providing employment to a significant portion of the population and serving as a cornerstone for national development, particularly in rural areas (Government of Pakistan, 2025). Agricultural productivity is intrinsically

linked to the efficient use of inputs, notably fertilizers, which are vital for enhancing soil fertility and increasing crop yields (Stewart et al., 2005). In this context, fertilizer advisory services have emerged as a critical intervention for improving on-farm crop and fertilizer management practices, thereby contributing to enhanced productivity

and farmers' incomes (FAO, 2019). In Pakistan, fertilizer companies have increasingly taken on the role of advisors, providing farmers with recommendations on fertilizer selection, application timing, dosage, and crop-specific nutrient requirements to promote sustainable and efficient practices (Aker, 2011). These companies employ a variety of extension methods—including field demonstrations, farmers' meetings, and mobile advisory services—to encourage the adoption of improved nutrient management practices (Ali et al., 2018). However, the mere provision of advice does not guarantee its adoption or impact. A critical, and often under-examined, factor in the success of any advisory service is the farmer's own perception of its value. Farmers' perceptions of advisory services fundamentally shape their intentions and subsequent actions. Their willingness to adopt recommendations is contingent upon their confidence in the service provider, the perceived relevance and precision of the information, and their prior experiences with similar advice (Meena et al., 2020). An advisory service that is not trusted, or that fails to address the specific socio-economic realities and local needs of farmers, is unlikely to be adopted, regardless of its technical merit (Rivera and Alex, 2004). Therefore, understanding farmer perceptions is not a secondary consideration but a primary prerequisite for designing effective and impactful advisory programs.

Previous research in Punjab has established a positive correlation between access to agricultural advisory services and higher crop productivity. For instance, a study in the Sargodha district associated increased wheat productivity with improved access to such services, even as farmers continued to rely on informal sources (Elahi et al., 2018). Similarly, the adoption of advanced agricultural technologies has been positively linked to farm income in central Punjab (Sarfaraz and Javed, 2023), and farm advisory services have been shown to enhance farmers' knowledge and decision-making, potentially lowering production costs and raising incomes (Khan et al., 2020).

Among the various service providers, fertilizer companies are of particular interest. They offer technical advice on nutrient management, product use, and soil health, often embedding these services within their sales models (Abbas, 2020). However, the quality and relevance of this company-led advice remain open to question. Its true value depends on its scientific credibility, its adaptation to local agro-ecological contexts, and its alignment with broader sustainability goals (Anderson and Feder, 2004). While the potential of these services is significant, there is a need to

move beyond assessing their mere availability and instead evaluate how they are received and valued by the farming community themselves.

The aim of this research, therefore, is to investigate farmers' perceptions of the effectiveness of fertilizer companies' advisory services in district Sargodha. This study focuses on understanding farmers' views on the quality and relevance of the advice provided and the extent to which they perceive it to influence their crop productivity and farm income. By centering the analysis on farmer perspectives, this research provides crucial insights into the real-world value of these services, offering a necessary foundation for policymakers and industry stakeholders seeking to improve agricultural extension mechanisms.

Problem Statement

Fertilizer companies provide advisory services to guide farmers on the appropriate type, dosage, and timing of fertilizer applications. While these services are intended to improve farmers' technical expertise and input efficiency, thereby raising productivity and income, their practical efficacy remains unclear. Many farmers continue to rely on conventional methods, peer advice, or input dealers rather than these formal advisory channels, raising concerns about the scope, applicability, and real-world impact of company-led advisories. A significant research gap exists due to the absence of empirical evidence on how farmers in the Sargodha district perceive the effectiveness of these services. Without understanding farmer perceptions, policymakers, extension organizations, and fertilizer companies cannot determine whether these services are meeting their objectives or require fundamental restructuring. Thus, it is crucial to investigate farmers' perceptions of the accessibility, reliability, and effectiveness of fertilizer advisory services in enhancing agricultural productivity and improving the financial security of farmers in Sargodha.

Study Objectives

- To describe the demographic attributes of the respondents.
- To assess farmers' perceptions of the quality and relevance of advisory content provided by fertilizer companies.
- To investigate farmers' perceived effectiveness of fertilizer advisory services on their crop productivity and farm income.

METHODOLOGY

Study Area and Population

The current study was conducted in the central Punjab region, focusing on farmers in the Sargodha district. Sargodha was purposively selected due to the strong presence of fertilizer companies and their associated agricultural advisory services, making it an ideal location to investigate farmers' perceptions of these services. The research population comprised all farmers residing in the rural areas of Sargodha district.

Sampling Procedure and Sample Size

A multistage simple random sampling technique was employed for data collection. In the first stage, three tehsils were randomly selected from the district. In the second stage, two union councils were randomly chosen from each selected tehsil. In the third stage, three villages were randomly selected from each chosen union council. Finally, from each selected village, ten farmers were chosen randomly for interviews, yielding a total sample size of 180 respondents. This rigorous random sampling procedure was followed to ensure that the sample was representative of the broader farming population in the study area (Kothari, 2004).

Data Collection Instrument

Data were collected using a structured, pre-tested, and validated interview schedule. The instrument was developed following an extensive review of relevant literature and in-depth consultations with subject matter experts. A panel of experts assessed the schedule for content validity to ensure all relevant constructs were adequately covered. The reliability of the instrument was assessed through a test-retest method with a small group of farmers ($n=20$) not included in the final sample, yielding a strong Cronbach's alpha value of 0.942, indicating excellent internal consistency (George and Mallery, 2003). The final interview schedule was refined based on the pre-testing feedback to ensure clarity and comprehensibility (Sekaran and Bougie, 2016).

Data Analysis

The collected data were analyzed using the Statistical Package for Social Sciences (SPSS). Both descriptive and inferential statistical techniques were employed.

Within descriptive analysis frequencies, percentages, means, and standard deviations were calculated to summarize the demographic attributes of the respondents

and to describe farmers' perceptions of the quality, relevance, and effectiveness of the advisory services. Whereas, a multiple linear regression analysis was conducted to identify the demographic factors influencing farmers' perceived effectiveness of the advisory services.

Dependent Variable: A composite index for "Perceived Effectiveness of Advisory Services" was created by summing the scores of the ten items presented in Table 5 (e.g., advice on soil analysis, contribution to yields, reduction of costs). This composite score served as the dependent variable in the regression model.

Independent Variables: The independent variables included age, education, tenancy status, size of landholding, type of farming, farming experience, and occupation.

Model Diagnostics: The regression model was assessed for its overall fit (R^2 , ANOVA), and the significance of individual predictors (t-tests, p-values) was examined. Multicollinearity among independent variables was checked using Variance Inflation Factor (VIF) and tolerance values. The regression results were interpreted to understand the direction and magnitude of the relationship between demographic characteristics and perceived effectiveness.

Ethical Considerations

- To ensure the integrity and ethical soundness of the research, the following measures were taken prior to data collection:
- All respondents were fully informed about the purpose of the research. Respondents were assured of their freedom to participate and to respond without any external pressure.
- Participation was entirely voluntary. The anonymity and confidentiality of all participants were strictly maintained. The research was conducted in full compliance with the ethical guidelines of the University of Sargodha.

Limitations of the Study

This study provides valuable insights into farmers' perceptions of fertilizer advisory services. However, it is important to acknowledge its limitations. First, the study measures farmers' perceptions of effectiveness, which is a subjective measure and may not always correspond with objective, quantifiable outcomes. While understanding perceptions is a crucial first step, the findings represent

what farmers *believe* about the services' impact, rather than a direct, measured impact. Second, the study is geographically limited to the Sargodha district, which may restrict the generalizability of the findings to other regions with different agro-ecological or socioeconomic contexts. Future research should aim to incorporate objective data on actual yields and farm income to validate these perceptual findings and should consider expanding the

geographical scope to enhance the generalizability of the results.

RESULTS

Demographic Attributes of the Respondents

The demographic profile of the respondents, including age, education, tenancy status, farm size, farm type, farming experience, and occupation, is presented in Table 1.

Table 1. Distribution of respondents according to their demographic attributes (n=180).

Demographic Attributes	Frequency	Percentage
Age Group		
Younger (up to 30 years)	23	12.8
Middle (31-50 years)	150	83.3
Older (above 50 years)	7	3.9
Education Level		
Primary education	25	13.9
Secondary education	146	81.1
Higher secondary education	9	5.0
Tenancy Status		
Owner	165	91.6
Owner-cum-tenant	10	5.6
Tenant	5	2.8
Size of Landholding		
Small scale (up to 5 acres)	21	11.7
Medium scale (5 to 25 acres)	145	80.5
Large scale (above 25 acres)	14	7.8
Type of Farming		
Subsistence farming	146	81.1
Commercial farming	14	7.8
Mixed farming	20	11.1
Farming Experience		
Up to 10 years	23	12.8
11 to 20 years	150	83.3
Above 20 years	7	3.9
Occupation		
Farming only	98	54.4
Farming and business	32	17.8
Farming and job	28	15.6
Farming and labor	22	12.2

Table 1 reveal that the vast majority of respondents (83.3%) were 31–50 years old, while 12.8% were younger (up to 30 years) and only 3.9% were older (above 50 years). Regarding education, 81.1% had completed secondary education, 13.9% had primary education, and only 5.0% had pursued higher secondary education. An overwhelming majority (91.6%) were owners, with only 5.6% being owner-cum-tenants and 2.8% being tenants. In terms of landholding, 80.5% were classified as medium-scale farmers (5 to 25 acres), while 11.7% were small-scale

(up to 5 acres) and 7.8% were large-scale (above 25 acres). A striking 81.1% of farmers described their operation as subsistence farming, 11.1% practiced mixed farming, and only 7.8% were engaged in commercial farming. The farming experience profile showed that 83.3% had 11-20 years of experience, 12.8% had up to 10 years, and 3.9% had more than 20 years. Finally, while over half (54.4%) relied solely on farming for their livelihood, a significant portion supplemented their income through business (17.8%), jobs (15.6%), or labor (12.2%).

Quality and Relevance of Advisory Contents

The relevance and quality of advisory materials are key determinants of their adoption and usefulness. Farmers need site-specific, timely, and scientifically valid

suggestions that are compatible with their cropping systems and resource endowments. The data on farmers' perceptions of content quality and relevance is presented in Table 2.

Table 2. Ranking of various aspects regarding quality and relevance of advisory contents provided by the fertilizer companies.

Various aspects regarding advisory content include:	Rank	Mean	SD
Give latest information on IPM, irrigation, pruning techniques	1	4.04	0.77
Upgrade latest contents to improve yields and farm profitability	2	3.84	1.14
Update advisory contents based on research findings	3	3.75	0.83
Give scientific basis information on nutrient needs	4	3.74	0.58
Provide complete contents on organic matter, crop residues	5	3.72	0.86
Report farmers positive results in advisory contents	6	3.71	0.85
Promote BMPs rather than promoting company products	7	3.69	1.16
Provide customized services regarding best crop practices	8	3.67	1.09
Document outcomes showing success stories of farmers	9	3.64	0.82
Confirm equal access to reach all farmers in remote areas	10	3.63	0.74

Scale: very low = 1, low = 2, medium = 3, high = 4, very high = 5

As shown in Table 3, the highest-ranked aspect was "latest information on IPM, irrigation, and pruning techniques" (\bar{x} =4.04), followed by "upgrade latest contents to improve yields and farm profitability" (\bar{x} =3.84) and "update advisory contents based on research findings" (\bar{x} =3.75). Aspects related to providing a scientific basis for nutrient needs (\bar{x} =3.74) and complete contents on organic matter and crop residues (\bar{x} =3.72) were ranked fourth and fifth, respectively. The lowest-ranked items were "confirm equal access to

reach all farmers in remote areas" (\bar{x} =3.63) and "document outcomes showing success stories of farmers" (\bar{x} =3.64).

Modes of Advisory Service Dissemination

Fertilizer companies employ various modes to communicate with farmers, ranging from traditional face-to-face methods to modern digital channels. The perceived effectiveness of these modes is presented in Table 3.

Table 3. Ranking of various modes through which advisory services are disseminated to farmers by the fertilizer companies.

Various modes used by fertilizer companies include:	Rank	Mean	SD
Conduct farm visits to provide personalized advice to farmers	1	4.06	0.76
Establish demonstration plots to show efficacy of practices	2	3.90	0.75
Use mobile apps/SMS to send reminders/tips on weather, fertilizer etc.	3	3.77	0.77
Establish call centers/helplines where farmers can call and get advice	3	3.77	0.71
Support farmer clubs/ associations for knowledge sharing and training	4	3.58	0.89
Conduct joint research trails with Universities/Research centers	5	3.55	0.68
Organize workshops/seminars/field days to educate new techniques	6	3.53	0.61
Print materials on best farming techniques & new company products	7	3.21	1.04
Organize exhibition/shows for new products' updates and farming tips	8	3.16	1.01
Use Facebook, WhatsApp, YouTube to share experiences and updates	9	2.02	0.21

Scale: very low = 1, low = 2, medium = 3, high = 4, very high = 5

The data in Table 4 show that "conduct farm visits to provide personalized advice to farmers" was the most preferred mode (\bar{x} =4.06), followed by "establish demonstration plots

to show efficacy of practices" (\bar{x} =3.90). Two digital modes—"use mobile apps/SMS to send reminders/tips" and "establish call centers/helplines"—were tied for third place,

both with a mean score of 3.77. Other modes, such as supporting farmer clubs (\bar{x} =3.58), conducting joint research trials (\bar{x} =3.55), and organizing workshops (\bar{x} =3.53), received moderate scores. The least preferred mode was the use of social media platforms like Facebook, WhatsApp, and YouTube (\bar{x} =2.02).

Perceived Effectiveness on Crop Productivity and Farm Income

The core of this study is to understand farmers' perceptions of how these advisory services impact their farm outcomes. The data on perceived effectiveness is presented in Table 4.

Table 4. Ranking of various aspects regarding effectiveness of fertilizer advisory services on crop productivity and farm income.

Various aspects about effectiveness of advisory services include:	Rank	Mean	SD
Fertilizer advisory services help to use fertilizer based on soil analysis	1	4.21	0.94
Fertilizer advisory services contribute to increase crop yields	2	4.17	0.91
Fertilizer advisory services contribute to improve the farm income	3	4.13	0.79
Fertilizer advisory services help in the reduction of fertilizer costs	4	3.83	0.84
Fertilizer advisory services assist to use the balanced doze of fertilizer	5	3.81	0.82
Fertilizer advisory services support to adopt best fertilization practices	6	3.64	0.76
Fertilizer advisory services assist in proper nutrient management	7	3.58	0.69
Fertilizer advisory services guide to apply fertilizer at the right time	8	3.20	0.61
Fertilizer advisory services assist to select accurate type of fertilizer	9	3.18	0.54
Fertilizer advisory services help to reduce nutrient loss and wastage	10	2.40	0.58

Scale: no effective = 1, less effective = 2, moderately effective = 3, high effective = 4, very high effective = 5

Table 4 indicates that the highest perceived effectiveness was associated with advice based on soil analysis (\bar{x} =4.21), followed by advice that contributes to increased crop yields (\bar{x} =4.17) and improved farm income (\bar{x} =4.13). Aspects related to cost reduction (\bar{x} =3.83), balanced fertilizer use (\bar{x} =3.81), and adoption of best practices (\bar{x} =3.64) were ranked 4th, 5th, and 6th, respectively. The lowest-ranked aspects were assisted to select accurate type of fertilizer (\bar{x} =3.18), guide to apply fertilizer at the right time (\bar{x} =3.20), and, notably, help to reduce nutrient loss and wastage (\bar{x} =2.40), which fell into the 'less effective' category.

Regression Analysis: Factors Influencing Perceived Effectiveness

To understand which farmer characteristics, influence their overall perception of advisory service effectiveness, a multiple linear regression was conducted. The dependent variable was a composite index of perceived effectiveness, created by summing the scores of the ten items in Table 4. The independent variables were age, education, tenancy status, size of landholding, type of farming, farming experience, and occupation.

Table 5. Regression Model Summary.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.808a	.652	.638	6.064

a. Predictors: (Constant), Age, Education, Tenancy Status, Size of Landholding, Type of Farming, Farming Experience, Occupation

Table 6. ANOVA.

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	11858.638	7	1694.091	46.072	.000b
	Residual	6324.562	172	36.771		
	Total	18183.200	179			

a. Dependent Variable: Perceived Effectiveness of Advisory Services

b. Predictors: (Constant), Age, Education, Tenancy Status, Size of Landholding, Type of Farming, Farming Experience, Occupation

Table 8. Coefficients.

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	62.026	.452		137.166	.000		
Age	-1.124	.724	-.112	-1.552	.122	.392	2.553
Education	-1.618	.596	-.159	-2.717	.007	.588	1.699
Tenancy status	-.101	.464	-.010	-.218	.828	.961	1.040
Size of landholding	-.500	.453	-.050	-1.105	.271	.999	1.001
Type of farming	7.438	.802	.738	9.272	.000	.319	3.132
Farming experience	10.184	.978	1.010	10.410	.000	.215	4.659
Occupation	-7.737	.970	-.764	-7.975	.000	.220	4.540

a. Dependent Variable: Perceived Effectiveness of Advisory Services

The model summary (Table 5) shows an R^2 value of 0.652, indicating that the included demographic variables explain 65.2% of the variance in perceived effectiveness. This is a very strong explanatory power, suggesting that a farmer's background is deeply intertwined with how they evaluate advisory services.

The ANOVA results (Table 7) confirm that the regression model is statistically significant ($F=46.072$, $p<.001$), meaning the independent variables, as a group, reliably predict the perceived effectiveness score.

The coefficients table (Table 8) reveals that four variables are statistically significant predictors of perceived effectiveness. Farming experience ($B = 10.184$, $p < .001$) and type of farming ($B = 7.438$, $p < .001$) are strong positive predictors. In contrast, education ($B = -1.618$, $p = .007$) and occupation ($B = -7.737$, $p < .001$) are significant negative predictors. The remaining variables—age, tenancy status, and size of landholding—were not statistically significant. All Variance Inflation Factor (VIF) values were below 5, indicating that multicollinearity was not a concern.

DISCUSSION

Demographic Profile and Its Implications

The demographic profile of the respondents, dominated by middle-aged, owner-cultivators with moderate education and substantial farming experience, is typical of Pakistan's central Punjab (Elahi et al., 2018). The predominance of subsistence farming (81.1%) is a critical finding, as it shapes farmers' risk perceptions and their evaluation of advisory services. For subsistence-oriented farmers, the primary value of advice is its reliability and direct contribution to household food security, rather than profit maximization. This context is essential for interpreting

their preferences and perceptions throughout this study. The significant proportion of farmers with off-farm incomes (45.6%) also highlights the importance of designing flexible advisory services that can accommodate part-time farmers' limited availability.

Quality and Relevance of Advisory Content

Farmers' high valuation of "latest information on IPM, irrigation, and pruning techniques" ($\bar{x}=4.04$) and "up-to-date content to improve yields and farm profitability" ($\bar{x}=3.84$) indicates a demand for holistic, actionable knowledge. This finding supports the work of Ali and Khan (2014), who emphasized that investing in skilled agronomists capable of providing comprehensive advice leads to greater impact. Farmers are not merely seeking prescriptions but want to understand the underlying principles of crop management.

Conversely, the relatively lower ranking of "promote BMPs rather than promoting company products" ($\bar{x}=3.69$, rank 7) is noteworthy. While still in the 'high' category, its position lends credence to concerns raised by Feder et al. (2011) and Meena et al. (2020) that private-sector advisories can be perceived as biased towards product sales. This perception, even if subtle, has the potential to erode trust over time. The lowest-ranked items—ensuring equal access to remote areas and documenting success stories—suggest that farmers perceive gaps in outreach and in the use of peer examples as a validation tool, areas where companies could improve their engagement strategies.

Preferences for Dissemination Modes

The strong preference for traditional, high-touch methods like farm visits ($\bar{x}=4.06$) and demonstration plots ($\bar{x}=3.90$) highlights the enduring importance of

personalized, trust-based relationships and experiential learning in agricultural extension (Ali & Khan, 2014). Farmers need to see and trust the source of information before adopting new practices. The moderate acceptance of mobile apps/SMS and helplines ($\bar{x}=3.77$) indicates a growing openness to digital tools for timely, specific information, aligning with Meena et al. (2020). However, the very low preference for social media ($\bar{x}=2.02$) is a critical finding. It likely reflects a combination of limited digital literacy among the predominantly middle-aged sample and a strong preference for the perceived credibility of formal, face-to-face interactions over informal online sources. This serves as a reminder that technology adoption in extension must be sensitive to the socio-digital context of the target population.

Perceived Effectiveness on Productivity and Income

The finding that advice based on soil analysis is perceived as most effective ($\bar{x}=4.21$) underscores the value farmers place on scientific credibility and customization. This aligns with Feder et al. (2011), who noted that linking advice to soil test reports adds validity and usefulness. The high rankings for advice that increases yields ($\bar{x}=4.17$) and income ($\bar{x}=4.13$) confirm that the core value proposition of advisory services is being effectively communicated and resonates with farmers, consistent with the broader literature linking advisory interventions to positive outcomes (Aker, 2011; Fabregas et al., 2019).

However, the low score for "reduce nutrient loss and wastage" ($\bar{x}=2.40$) reveals a critical gap. While farmers understand *what* and *how much* to apply (e.g., from soil tests), the practical *how*—precise application techniques to minimize losses—is not being effectively conveyed. This suggests that current advisory content may be strong on principles but weak on operational details. Similarly, the lower scores for advice on selecting the right fertilizer type and application timing suggest that these fundamental aspects may be taken for granted or not communicated with sufficient practical clarity.

Factors Influencing Perceived Effectiveness

The regression analysis provides the most nuanced insights. The strong positive effect of farming experience suggests that experienced farmers possess a knowledge base that allows them to effectively evaluate and integrate new advice, viewing services as a complement to their own expertise (Dockès et al., 2019).

The positive effect of commercial/mixed farming indicates that farmers oriented towards markets are more receptive to advice that can provide a competitive edge, whereas subsistence farmers, focused on risk minimization, may judge advice by a more conservative metric (Šūmane et al., 2018).

The negative coefficient for education is a critical and counter-intuitive finding. It suggests that more educated farmers are more critical of the advisory services. This may be because education raises expectations and provides access to alternative information sources (e.g., internet, agricultural media), enabling them to detect potential biases, such as the product promotion orientation hinted at in Table 3. They may find company advice too generic compared to more sophisticated information available elsewhere. This finding directly supports the recommendation for companies to collaborate with universities and research institutes to develop more scientifically rigorous and data-backed content for this discerning segment.

Finally, the negative coefficient for occupation highlights the structural constraints faced by part-time farmers. Their perception of ineffectiveness likely stems not from the quality of the advice itself, but from their limited time and capacity to engage with it fully. This points to a need for more flexible, easily accessible advisory formats tailored to this group.

In summary, the findings demonstrate that while farmers generally perceive fertilizer advisory services positively, this perception is mediated by their individual characteristics (Hamilton and Hudson, 2017). The services are most valued by experienced, commercially-oriented, full-time farmers but are viewed more critically by educated farmers (who expect more) and part-time farmers (who struggle to engage). These differentiated perceptions provide a clear roadmap for improving advisory services through targeted content, flexible delivery, and stronger partnerships with research institutions.

CONCLUSION

This study reveals that while farmers in the Sargodha district hold a generally positive perception of fertilizer company advisory services, this perceived effectiveness is not uniform across the farming population. It is significantly and positively shaped by farming experience and a commercial orientation, yet, notably, it is negatively associated with a farmer's level of

education and engagement in off-farm occupations. This nuanced finding suggests that a one-size-fits-all advisory approach is insufficient and that providers must tailor their content and delivery methods to meet the diverse needs and expectations of different farmer segments.

The demographic profile of the respondents—predominantly middle-aged, owner-cultivators with secondary education, engaged in medium-scale subsistence farming—provides essential context for interpreting their perceptions. Regarding content quality and relevance, farmers most valued practical, outcome-oriented information, ranking "latest information on IPM, irrigation, and pruning techniques" and "up-to-date content to improve yields and farm profitability" as the most important. This underscores a demand for actionable knowledge that directly contributes to their primary goals of production and household sustenance.

In terms of service delivery, traditional, high-trust methods were overwhelmingly preferred. Personalized farm visits and demonstration plots were ranked as the most effective dissemination modes, highlighting the enduring importance of face-to-face interaction and experiential learning. While digital tools like mobile apps and helplines were accepted, the very low preference for social media channels signals a potential digital divide or a preference for the credibility of formal, in-person advice.

Most importantly, the study found that farmers perceive the services as most effective when they are seen as scientific and results-oriented. Advice based on soil analysis was ranked highest, followed closely by advice perceived to increase crop yields and farm income. However, a critical gap was identified: farmers rated the services as least effective in helping them reduce nutrient loss and wastage, pointing to a need for more practical guidance on application techniques. The regression analysis provided the deepest insights, revealing that farming experience and a commercial/mixed farming orientation are strong positive predictors of perceived effectiveness. Conversely, higher education is a negative predictor, suggesting that more educated farmers may be more critical and have higher expectations. Similarly, off-farm occupations negatively predict perceived effectiveness, likely due to part-time farmers having less time and capacity to fully engage with advisory services.

Based on these findings, the following recommendations are proposed:

- Fertilizer companies should move beyond generic advice. For their core clientele of experienced, full-time farmers, they should continue to provide detailed, science-based recommendations. However, to address the critical perspective of more educated farmers, companies must collaborate with universities and research institutes to develop and deliver more sophisticated, data-driven, and verifiable advisory content. This collaboration can enhance the scientific credibility and depth of the information provided, meeting the expectations of this discerning group.
- Recognizing that a significant portion of farmers have off-farm occupations, companies should design flexible engagement strategies. This could include developing simple, easy-to-follow printed or video guides, scheduling farm visits or workshops at convenient times, and leveraging the moderately popular mobile app/SMS channels to deliver concise, actionable tips that can be easily accessed and implemented by farmers with limited time.
- In response to the identified gap in reducing nutrient loss and wastage, advisory content should place greater emphasis on the "how" of fertilizer application. Demonstration plots are already a preferred mode; they should be used to explicitly teach precise application techniques, the use of different applicators, and methods to minimize environmental loss, thereby translating the theory of balanced fertilization into practical, on-farm action.
- Given that farmers perceive soil-analysis-based recommendations as the most effective, companies should expand access to affordable and reliable soil testing services. Linking every major recommendation to a soil test report would significantly enhance the credibility and perceived value of the advice, fostering greater trust and adoption.

Limitations and Future Research

This study provides valuable insights into farmers' perceptions but is not without limitations. First, its reliance on perceptual data, while essential for understanding farmer attitudes, means the findings represent what farmers *believe* about the services'

impact, rather than an objective, measured impact on yields and income. Second, the study is geographically confined to the Sargodha district, which may limit the generalizability of the findings to other regions with different agro-ecological or socioeconomic profiles.

Future research should address these limitations by incorporating objective data on actual crop productivity and farm income to validate and build upon these perceptual findings. A longitudinal study design could track changes in farmer practices and outcomes over time, providing stronger evidence of causality. Finally, expanding this research to other districts and provinces would allow for valuable comparative analyses and help determine the extent to which these findings are context-specific or broadly applicable across Pakistan's diverse agricultural landscapes

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