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Significance Of Information Sources In Adoption Of Best Management Practices For Sustainable Agriculture

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Abstract

In an era marked by growing environmental concerns and the need for efficient, eco-friendly farming methods, access to reliable and up-to-date information plays a pivotal role in shaping the practices of modern farming. Information sources, such as government agricultural extension services, research institutions and online resources provide farmers with essential knowledge about cutting-edge techniques, eco-friendly approaches and sustainable BMPs. This information equips farmers with the tools they need to optimize their crop yields while minimizing environmental impact. Moreover, it fosters a culture of continuous learning and adaptation, enabling the agricultural community to stay ahead of emerging challenges and changes in the industry. Finally, the availability and accessibility of credible information sources are the cornerstone of sustainable agriculture, ensuring that farmers can make informed decisions that benefit both their livelihoods and the planet. Keeping this in view, there exists a dire need to study the adoption status of best management practices (BMPs) for sustainable agriculture development among farmers. The present study w[1]as conducted in Punjab-Pakistan. From Whole province three districts i.e. Sheikhupura, Hafizabad and Gujranwala were selected as purposefully. From each selected district, two tehsils were selected randomly. From each selected tehsil, two union councils were selected at random while two villages were also selected using random sampling procedure from each selected union council. From each selected village, 15 farmers were selected at random, thereby making a total sample size of 360 respondents. The study concluded that fellow farmers and progressive growers were ranked at the top among the various direct contact sources of information helpful in the adoption of BMPs for sustainable agriculture as perceived by the farmers. Agricultural helpline, electronic media (TV/Radio) and social media were the most important mass contact sources of information helpful in the adoption of BMPs for sustainable agriculture as perceived by the farmers. Agricultural extension department, research stations/centers and agricultural banks (ZTBL) were the leading public organizations' sources of information helpful in the adoption of BMPs for sustainable agriculture as perceived by the

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farmers. Pesticide companies, sugar mills and input-supply dealers were ranked at the top among the various private organizations' source of information helpful in the adoption of BMPs for sustainable agriculture as perceived by the farmers. The awareness level of farmers about BMPs was significantly dependent on information sources helpful in the adoption of BMPs. Keeping in view the major findings, it can be recommended to develop and promote mobile applications, online platforms and social media channels dedicated to sustainable agriculture and ensure that these digital tools are user-friendly and accessible even in remote areas with limited internet connectivity. Further, invest in agricultural research to continuously develop and refine BMPs and ensure that findings are promptly translated into practical guidelines and timely disseminated to farmers.

Keywords: *Best management practices, Sustainable agriculture, conservative agriculture, Adoption, information sources.*

1. Introduction

In order to increase input usage efficiency, productivity and sustainability, the agriculture sector has benefited from innovative technologies and solutions brought about by best management practices (BMPs). Such types of practices include: minimum tillage, zero tillage, bed planting, rotary tillage, laser land leveling, surface seeding, pressurized irrigation systems, system of intensification, residue management, crop diversification, site-specific nutrient management, precision farming employing use of modern tools and procedures etc. Adoption of such practices is the very important as these are the techniques of 'low-input agriculture' to minimize the costs and achieve sustainable agriculture (Sharma & Behera, 2011). Characterized by environmentally friendly and economically viable practices, sustainable agriculture has become a necessity in the face of global challenges such as climate change and resource depletion (Smith & Martino, 2007). In the domain of modern agriculture, it is very much important to shift towards sustainable farming practices has become increasingly prominent. In this context, the adoption of BMPs serves as a fundamental pillar in routing agriculture towards a more sustainable path (Pretty & Bharucha, 2014). While farmers embark on this transformative journey, the significance of information sources becomes a crucial element shaping their decision-making processes. As farmers navigate the complex landscape of sustainable agriculture, the importance of information sources in influencing their decision-making processes cannot be overstated (Feder & Umali, 1993). Traditional channels such as agricultural extension services, peer interactions, and printed materials have historically played a pivotal role in disseminating agricultural knowledge and practices (Vanclay, 2004). These established sources continue to be significant, forming the foundation upon which contemporary strategies are built. In the contemporary digital age, the information landscape has evolved to encompass a diverse array of sources, including online platforms, precision agriculture technologies, and scientific publications (Rejesus & Nelson, 2007). The convergence of traditional and modern information sources has introduced new dynamics into the decision-making processes of farmers, reshaping the way they perceive and adopt BMPs. The adoption of BMPs is inherently linked to the socio-economic and environmental context of farming communities, adding a layer of complexity to the decision-making process (Smith & Martino, 2007). As agriculture is a knowledge-intensive endeavor, the role of information sources becomes central to shaping farmers' awareness, perceptions, and ultimately their willingness to adopt sustainable practices. The effectiveness of information dissemination is contingent upon the accessibility, relevance and credibility of the sources (Rejesus & Nelson, 2007). Farmers are more likely to adopt BMPs when information is tailored to their specific needs, and when it is disseminated through trusted channels. Understanding the dynamics of how farmers interact with and prioritize different information sources is crucial for designing targeted communication strategies that resonate with diverse agricultural communities.

Moreover, the adoption of BMPs is not only influenced by external information sources but is also intertwined with the internal dynamics of farm households, including the socio-demographic characteristics and socio-cultural factors that shape farmers' decision-making (Feder & Umali, 1993). Therefore, a comprehensive understanding of information sources must encompass the socio-economic context in which farmers operate.

By synthesizing findings from empirical studies and theoretical frameworks, this research aims to contribute to the emerging field of sustainable agriculture. Understanding the importance of information sources in shaping farmers' perspectives and behavior is essential for policy makers, agricultural services and researchers (Vanclay, 2004). The findings of this study may inform targeted interventions aimed at increasing the effectiveness of information dissemination strategies, ultimately leading to wider and faster adoption of BMPs in agriculture. This research paper delves into the significance of information sources in adoption of BMPs for sustainable agriculture. By scrutinizing the various channels through which information is disseminated to farmers, this study aims to untie the complex dynamics that shape the adoption patterns of BMPs. This research endeavors to bridge the gap in our understanding of the significance of information sources in the adoption of BMPs for sustainable agriculture. By delving into the interplay between traditional and modern sources of information, socio-economic factors, and decision-making processes, this study aims to provide a holistic perspective. Through an evidence-based approach, we aspire to contribute actionable insights for policymakers, extension services, and practitioners seeking to promote sustainable agricultural practices worldwide.

1.1 Need for the study

Sustainable agriculture is critical for ensuring long-term food security, environmental health, and economic viability. The adoption of best management practices (BMPs) in sustainable agriculture is essential for achieving these goals. However, the effectiveness of BMPs depends significantly on the accessibility and quality of information available to farmers. Understanding the role and impact of various information sources on the adoption of these practices is crucial for developing strategies that can enhance their dissemination and uptake. Sustainable agriculture involves intricate systems that require comprehensive understanding and management of various ecological, economic, and social factors. BMPs are often complex and may require specific knowledge and skills. Reliable and accessible information sources can simplify these complexities, making BMPs more understandable and easier to implement for farmers. There is a noticeable gap in the information available to farmers regarding the latest BMPs and sustainable agriculture techniques. This gap is more pronounced in developing regions where access to educational resources and extension services is limited. Identifying and enhancing effective information sources can help bridge this gap, ensuring that all farmers have the knowledge needed to implement sustainable practices. Farmers' decisions to adopt BMPs are heavily influenced by the sources of information they trust and rely on. These sources can range from personal networks, such as family and community members, to institutional sources, such as agricultural extension services, research institutions, and digital media. Understanding which sources are most influential can help in designing targeted interventions that encourage the adoption of BMPs. Policymakers and agricultural extension services play a pivotal role in promoting sustainable agriculture. By studying the significance of various information sources, policymakers can develop more effective communication strategies and extension programs that address the needs and preferences of farmers, leading to higher adoption rates of BMPs. The adoption of BMPs not only contributes to environmental sustainability but also enhances the socioeconomic conditions of farming communities by improving yields, reducing costs, and increasing resilience to climate change. Understanding

the role of information sources in this process can help ensure that the benefits of sustainable agriculture are equitably distributed, particularly among smallholder and marginalized farmers. This study is essential for enhancing our understanding of how different information sources impact the adoption of BMPs in sustainable agriculture. By identifying and promoting effective information dissemination strategies, we can support farmers in implementing sustainable practices that benefit both the environment and their livelihoods. This research will provide valuable insights for policymakers, extension services, and agricultural stakeholders, contributing to the broader goal of achieving sustainable and resilient agricultural systems.

1.2 Research Objectives

The study was planned based on following major objectives

- To explore different types of information sources available to the farmers about best management practices.
- To assess the farmers awareness level regarding best management practices at farm level. To explore the role of information sources in creating awareness about best management practices.

1.3 Literature Review

Various approaches related to agricultural management like rotation of crops, tillage practices as well as application of organic and inorganic nutrient and supply of nitrogen to maintain soil fertility, microorganisms activities and aggregation of soil (Sharifi et al., 2008; Tan et al., 2007). Deng and Tabatabai (2000) and Ekenler and Tabatabai (2002) also submitted that higher activity of N mineralization as well as β glucosaminidase was observed in oat and corn crop, and also with rotations as compared to continuously growing corn. However, crop rotation also keeps on maintaining the organic matter concentration at normal level through rhizo deposits and crop residues. This will result in increasing the diversity of microbes, quantity of biomass, and rate of their activity. Kolberget al. (1999) observed higher quantity of N mineralization in the soil with wheat-fallow field compared with following wheat–corn-fallow pattern. It was because of higher crop residues as input to the soilin case of wheat-corn-fallow pattern. Supply of N in the soil is usually improved with the inclusion of N-fixing legumes in the crop rotation.

Recent researches on best management practices (BMPs) have provided the agriculture sector with exciting technologies and solutions for improving input-use-efficiency, productivity and sustainability. Such types of practices include: minimum tillage, zero tillage, bed planting, rotary tillage, laser land leveling, surface seeding, pressurized irrigation systems, system of rice intensification, residue management, crop diversification, site-specific nutrient management, precision farming employing use of modern tools and procedures etc. Adoption of such practices is the very important in this age as these are the techniques of 'low-input agriculture' to minimize the costs and achieve sustainable agriculture in the country (Sharma &Behera, 2011).

To put new management practices and ideas into practice has recently become highly important area of study and debate, often under the label of trends in management. However, there has been very limited critical reflection on the variety of theoretical methods adopted and also addressing their problems and possible solutions. Furthermore, as there has been some overlap on broader issues related to management, learning and knowledge, debates and literatures remain largely distinct (Sturdy, 2004).

2. Methodology

2.1 Research design

For the research theme under study, cross sectional research design was seemed to be most suitable. Such types of studies commonly observe variables at a single point in a time. Typically cross-sectional studies cannot establish causality neglecting the possibility of establishing temporal precedence.

2.2 Sample selection

The present study was conducted in Punjab-Pakistan. From Whole province three districts i.e. Sheikhupura, Hafizabad and Gujranwala were selected as purposefully. From each selected district, two tehsils were selected randomly. From each selected tehsil, two union councils were selected at random while two villages were also selected using random sampling procedure from each selected union council. From each selected village, 15 farmers were selected at random, thereby making a total sample size of 360 respondents.

Instrument used in the study was a detailed interview schedule for sampled data. Instrument was prepared under strict supervision of the supervisory committee. A 5-point Likert type scale will be used for recording the answer in quantitative way. The sample of farmers living in rural areas of three districts from central Punjab was asked questions relating to research study.

The district selection from the province was made through random techniques of selecting sample. The researcher personally visited the study area and conducted interviews. Before this, the questionnaire was translated into local language (Saraiki and in Punjabi) to enable the farmers to easy understanding the concept. The required data for research study to be collected through the use of the well designed questionnaire prepared through the thorough discussion with the experts. Quantitative type of data were first coded in Microsoft Excel and then exported into computer statistical software Statistical Package for Social Sciences (SPSS) that is commonly used for analysis in social research.

3. Results and discussion

3.1 Socio-economic characters

The major socio economic factors included age, education, tenancy status and landholding of the respondents. Age was grouped into four categories which included respondents up to 30 years, 31 years to 40 years, 41 to 50 years and respondents above 50 years.

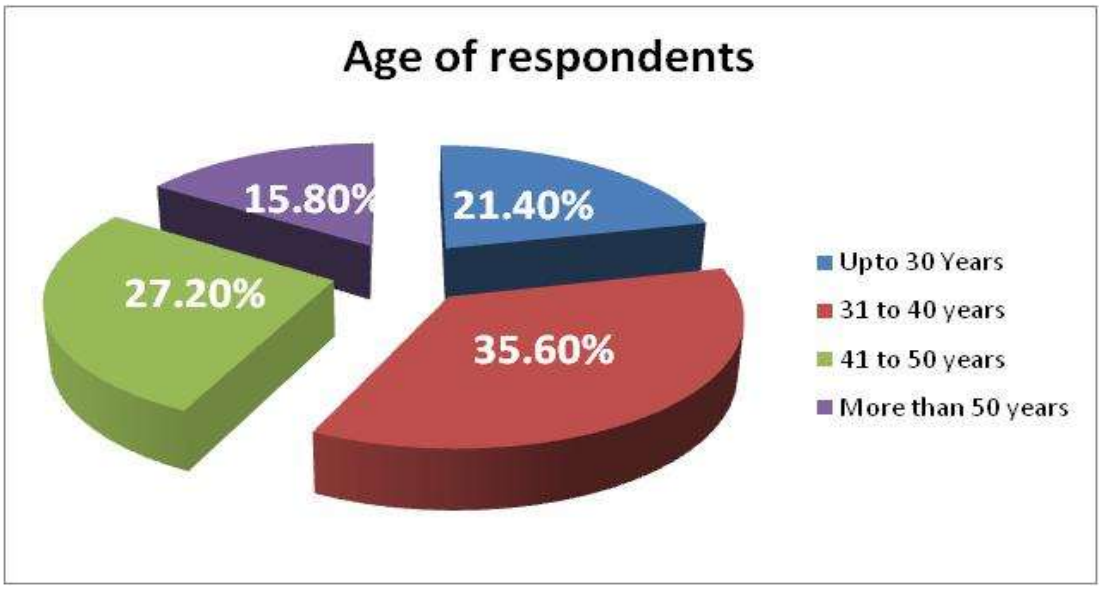

Figure 1: Pie chart showing age categories of respondent farmers

The results show that nearly one-third (35.6%) of the farmers were quiet mature and were between 30 to 40 years of age. Similarly, more than one-fourth (27.2%) of the respondents had age between 41 to 50 years while, about one-fifth (21.4%) of the farmers were up to 30 years of age whereas, some (15.8%) farmers were more than 50 years old.

The education of respondents was grouped into seven categories which included illiterate, primary, middle, matric, intermediate, graduation and masters level.

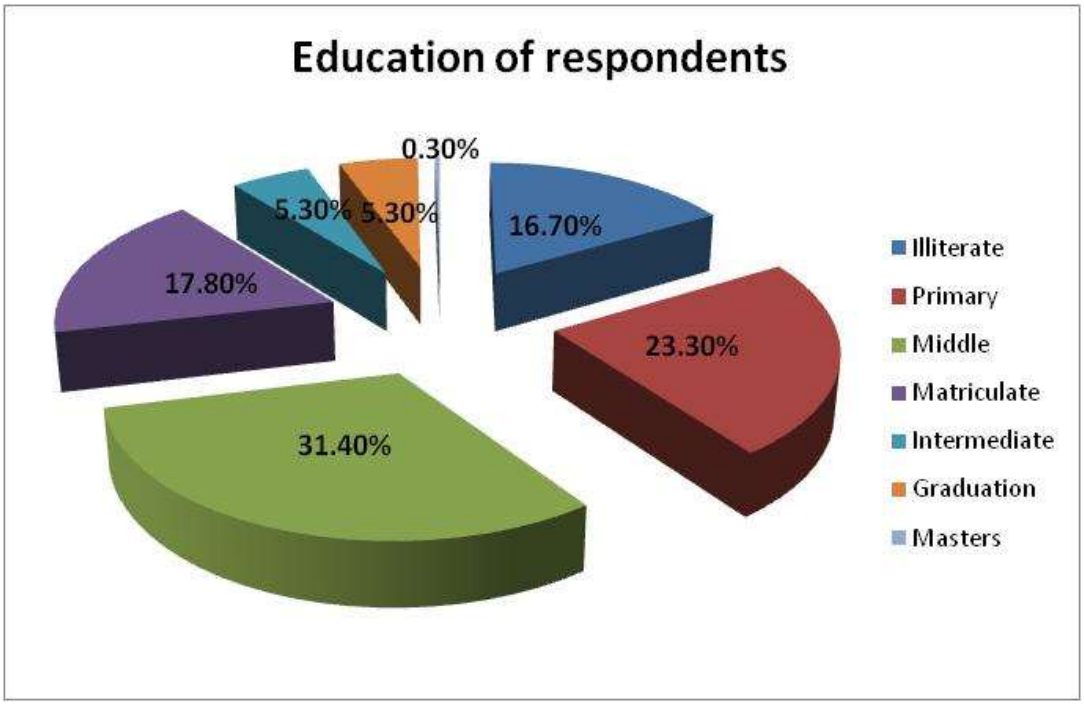

Figure 2: Pie chart showing education level of respondent farmers

Slightly less than one-fourth (23.3%) of the respondents were educated only to primary level which means that these people had completed their basic education whereas, nearly one-third (31.4%) of the farmers were educated to middle level. Similarly, little less than one-fifth (17.8%) of the farmers were matriculate while, some (5.3%) farmers were qualified to intermediate and graduate level whereas, only one of the respondent was completed his education at master level.

The next factor was related to tenancy status of the respondents. Tenancy was grouped into three categories which included owner, owner-cum-tenant and tenant.

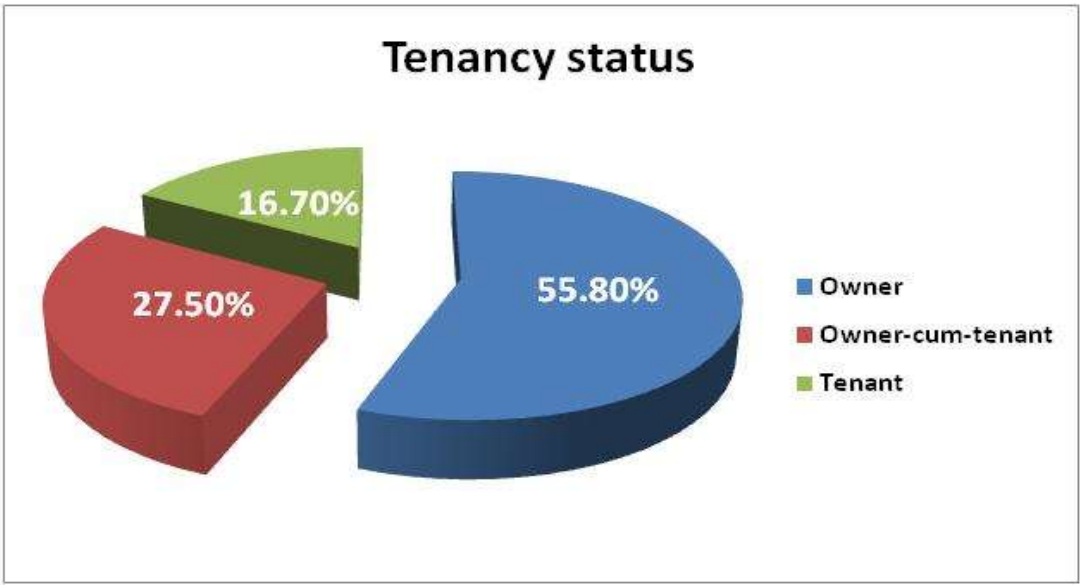

Figure 3: Pie chart showing tenancy status of respondent farmers

More than half (55.8%) of the farmers were owner of their agricultural land. This shows that majority of the farmers in the sample had their own land and were doing agricultural practices on their own land. Similarly, little more than one-fourth (27.5%) of the farmers were owner-cum-tenants whereas 16.7% of the farmers were tenants.

The landholding was the last demographic factor which was grouped into four categories including, up to 5 acres, 5 to 12.5 acres, 13 to 25 acres and above 25 acres of land.

Figure 4: Pie chart showing landholding of respondent farmers

More than one-fifth (22.8%) of the farmers had their landholding up to 5 acres while, one-third (32.2%) of the farmers had their land between 5 to 12.5 acres which clearly shows that these farmers were small landowners. Similarly, more than one-fourth (29.2%) were owner of 13 to 25 acres of their ,land whereas some (15.8%) farmers were having more than 25 acres of their land.

3.2 Sources of information helpful in the adoption of BMPs for sustainable agriculture

The information sources include direct contact sources, mass contact sources, public organizations' sources and private organizations' sources of information helpful in the adoption of best management practices for sustainable agriculture.

Table 1. Direct contact sources of information helpful in the adoption of BMPs for sustainable agriculture

Direct contact sources include:	Mean	SD	Rank
Personal experience	3.00	1.09	3
Family/parents	2.99	1.16	4
Fellow farmers	3.51	0.93	1
Village leaders	2.56	1.01	5
Progressive growers	3.38	1.28	2

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

The above table gives a complete picture of the data about the direct contact information sources helpful in the adoption of best management practices for sustainable agriculture. The data shows that fellow farmers, progressive growers and personal experience were ranked at 1st, 2nd and 3rd positions with mean values of 3.51, 3.38 and 3.00 respectively. The mean values in this regard indicate that these direct contact sources of information fell between medium to high tending towards high categories. On the other hand, family/parents and village leaders were ranked at 4th and 5th positions with mean values of 2.99 and 2.56 respectively. The mean values in this regard indicate that these sources of information fell between low to medium tending towards medium categories.

Table 2. Mass media sources of information helpful in the adoption of BMPs for sustainable agriculture

Mass contact sources include:	Mean	SD	Rank
Electronic media (radio/TV)	3.30	1.12	2
Print media (printed material)	2.42	1.13	4
Social media	3.21	1.12	3
Agricultural helpline	3.53	1.14	1
Libraries and information centers	2.19	1.06	7
Cell phone	2.32	1.07	5
Internet	2.31	1.04	6

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

This table shows the data about the mass contact sources of information helpful in the adoption of best management practices for sustainable agriculture. Among the various mass contact sources, agricultural helpline, electronic media (radio/TV) and social media were ranked at 1st, 2nd and 3rd positions with mean values of 3.53, 3.30 and 3.21 respectively. The mean values in this regard indicate that these mass contact sources of information fell between medium to high tending towards high categories. On the other hand, print media (printed material), cell phone, internet and libraries and information centers were ranked at 4th, 5th, 6th and 7th positions with mean values of 2.42, 2.32, 2.31 and 2.19 respectively. The mean values in this regard indicate that these sources of information fell between low to medium tending towards medium categories.

Table 3. Public organizations' sources of information helpful in the adoption of BMPs for sustainable agriculture

Public organizations' sources include:	Mean	SD	Rank
Agricultural extension department	3.62	1.04	1
Plant protection department	2.59	1.10	5
Water management department	2.50	1.19	6
Research stations/centers	3.14	1.10	2
Agricultural colleges/universities	2.82	0.98	4
Agricultural banks (ZTBL etc.)	2.99	1.05	3

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

This above table indicates the ranking of various public organizations' sources of information helpful in the adoption of best management practices for sustainable agriculture. The data shows that agriculture extension department and research stations/centers were ranked at 1st and 2nd positions with mean values of 3.62 and 3.14 respectively. The mean values in this regard indicate that these public organizations' sources of information fell between medium to high tending towards high categories. Among the other sources of information, print media (printed material), cell phone, internet and libraries and information centers were ranked at 3rd, 4th, 5th and 6th positions with mean values of 2.99, 2.82, 2.59 and 2.50 respectively. The mean values in this regard indicate that these sources of information fell between low to medium tending towards medium categories.

Table 4. Private organizations' sources of information helpful in the adoption of BMPs for sustainable agriculture

Private organizations' sources include:	Mean	SD	Rank
Pesticide companies	3.26	1.10	1
Fertilizer companies	2.80	1.08	4
Seed companies	2.65	1.02	7
Farm implements industries	2.30	1.15	10
Sugar mills	3.00	1.09	2
Rice mills	2.71	0.99	6
Fruit factories	2.35	1.17	9
Cotton factories	2.56	1.49	8
Input-supply dealers	2.89	1.04	3
NGOs	2.77	0.98	5

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

The above table indicates the ranking of various private organizations' sources of information helpful in the adoption of best management practices for sustainable agriculture. The data shows that pesticide companies and sugar mills were ranked at 1st and 2nd positions with mean values of 3.26 and 3.00 respectively. The mean values in this regard indicate that these private organizations' sources of information fell between medium to high tending towards high categories. Among the other private organizations' sources of information, input-supply dealers, fertilizer companies, NGOs and rice mills were ranked at 3rd, 4th, 5th and 6th positions with mean values of 2.89, 2.80, 2.77 and 2.71 respectively. On the other hand, seed companies, cotton factories, fruit factories and farm implements industries were ranked at 7th, 8th, 9th and 10th positions with mean values of 2.65, 2.56, 2.35 and 2.30 respectively. The mean values in this regard indicate that these private organizations' sources of information fell between low to medium tending towards medium categories.

3.3 Regression analysis

Table 5. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.528[a]	.278	.274	1.0229

a. Predictors: (Constant), SOIa, SOIb

The model summary table indicates variation in dependent variable which can be predicted due to independent variables. Hence as the value of adjusted R square is calculated to be 0.274 which shows very low variation dependent variable which can be predicted due to independent variables.

Table 6. ANOVA[a]

Model	Sum of Squares	df	Mean Square	F	Sig.

1	Regression	144.125	2	72.063	68.872	.000[b]
	Residual	373.538	357	1.046		
	Total	517.664	359			

a. Dependent Variable: level of aware BMP
b. Predictors: (Constant), SOIa, SOIb

The ANOVA table depicts that as the p-value is far less than alpha level hence it shows that independent variables can predict the dependent variables with quiet significant reliability. In short awareness level about best agricultural management practices (dependent variable) show significant relation with the information sources helpful in the adoption of best management practices and preference level of information sources.

Table 7. Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	T	Sig.
1	(Constant)	-1.683	.383		-4.388	.000
	SOIb	.028	.004	.370	6.680	.000
	SOIa	.022	.006	.217	3.913	.000

a. Dependent Variable: level aware BMP

The coefficients table depicts the p-value as significant results. It is because information sources helpful in the adoption of best management practices and preference level of information sources both have p-value less than 0.05. This shows that awareness level of farmers about best agricultural management practices was significantly dependent on information sources helpful in the adoption of best management practices and preference level of information sources.

3.4 Conclusions and recommendations

Fellow farmers and progressive growers were ranked at the top among the various direct contact sources of information helpful in the adoption of BMPs for sustainable agriculture as perceived by the farmers. Agricultural helpline, electronic media (TV/Radio) and social media were the most preferred mass contact sources of information helpful in the adoption of BMPs for sustainable agriculture as perceived by the farmers. Agricultural extension department, research stations/centers and agricultural banks (ZTBL) were the leading public organizations sources of information helpful in the adoption of BMPs for sustainable agriculture as perceived by the farmers. Pesticide companies, sugar mills and input-supply dealers were ranked at the top among the various private organizations as the source of information helpful in the adoption of BMPs for sustainable agriculture as perceived by the farmers. The awareness level of farmers about best agricultural management practices was significantly dependent on information sources helpful in the adoption of best management practices and preference level of information sources.

Keeping in view the major findings, it can be recommended to organize farmer field schools, workshops, and demonstration plots where farmers can learn from each other's experiences because peer learning can be a powerful motivator for adoption of BMPs. It is also suggested to develop and promote mobile applications, online platforms and social media channels dedicated to sustainable agriculture and ensure that these digital tools are user-friendly and accessible even in remote areas with limited internet connectivity. Further, Invest in agricultural research to continuously develop and refine BMPs and ensure that findings are promptly translated into practical guidelines and disseminated to farmers.

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