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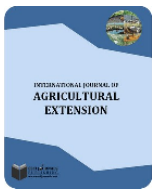

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USE OF INFORMATION SOURCES AMONG FARMERS FOR WEEDS MANAGEMENT IN FOUR CROPPING SYSTEMS OF PUNJAB, PAKISTAN

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ABSTRACT

This study aimed at comparing the use of modern and traditional information sources among farmers in four cropping systems in the Punjab, province. A total of 356 farmers from the district Gujranwala, selected through stratified proportionate sampling participated in the study. Respondents were interviewed on a structured, validated and reliable interview schedule through face-to-face techniques and collected data were analysed using Statistical Package for Social Science (SPSS). This study summarises that the farmers accessed information regarding weeds management through the modern and traditional channels, although the traditional sources were given more preference over the modern information sources. Except for the mobile phone, the rest of the modern gadgets had poor penetration among the public and the extent of information was not as good as it was in the case of most of the traditional information sources like fellow farmers, extension field staff of public and private sector and pesticides dealers. This study concludes that the reliance of farmers on traditional sources like fellow farmers especially in the age of digital tools and Information Communication Technologies (ICTs) is posing questions about the credibility and effective functioning of modern information sources.

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INTRODUCTION

The cropping system is an important component of the agricultural system and represents the cropping pattern used on the farm and their interactions with farm resources, other agricultural resources and the available technology that determines their composition. As shown in Figure 1, Pakistan has eight different farming systems: wheat-cotton, wheat-rice, mixed crops, wheat-legumes, corn-wheat, oilseeds-wheat, wheat-orchards/vegetable-wheat, and peri-urban areas. The rice and wheat systems are particularly important to Pakistan's economy. This scheme provides not only food security for a large portion of the population, but also a substantial source of foreign exchange earnings (FAO, 2004).

Rice-wheat is one of the important cropping systems in Pakistan covering an area of 2.1 million hectares (MINFAL, 2003). A large part (57%) of the rice-wheat area is located in Punjab. The rice-wheat zone of Punjab mainly covers the districts of Gujranwala, Sheikhupura and Sialkot, as well as parts of the districts of Gujrat and Lahore. Farmers in the rice-growing zone have been cultivating rice for centuries and they follow traditional

practices. Basmati rice is cultivated for farm household consumption, domestic market and export. Most of the wheat, the staple food of the country's people, is also produced in the rice-wheat system of Punjab. However, there is a big gap between potential and actual yield. Pertinent to high fertilizer prices, lack of water, and high prices of inputs and herbicides for weed control (Ahmad *et al.*, 2015).

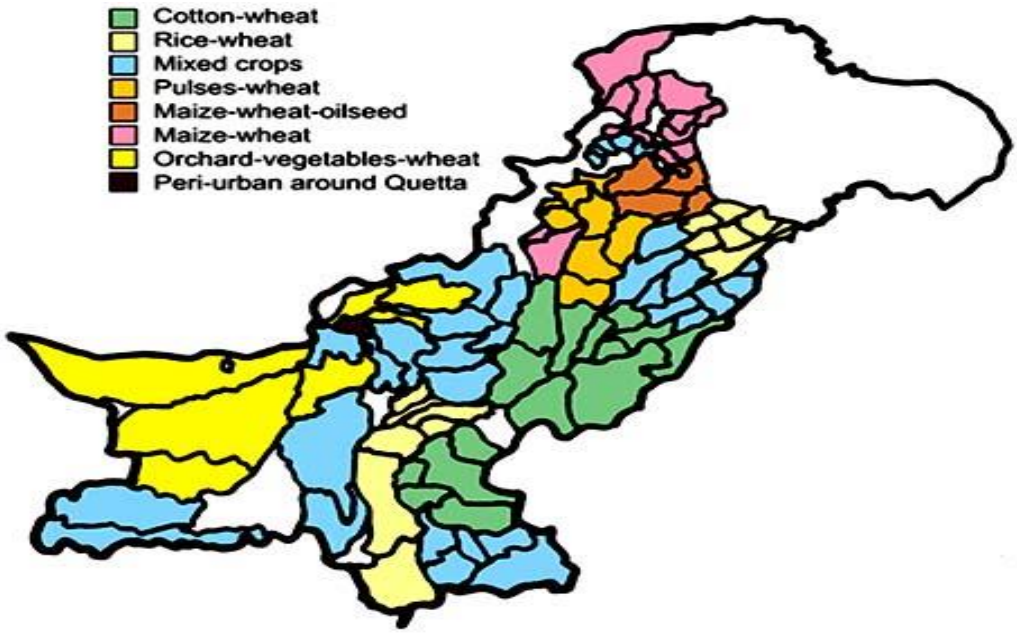

Figure 1. cropping systems in Pakistan.

Weed infestation is a serious issue because weeds compete for nutrients and surface area, reducing yield significantly. Owing to a lack of information about weed varieties, management methods, and farmers' inability to take effective weed control steps, weed control is a time-consuming activity. Without effective weed control, losses cannot be reduced (Smith *et al.*, 2015). Table 1 shows estimated production, potential, and weed losses in four crops around the world. Weeds grow naturally in the cultivated crop, which leads to monetary losses by affecting crop yield. Inadequate biosecurity measures cause disease outbreaks and insect pests, which are other contributing factors. Weeds also affect crop production. Farmers and government officials, on the other hand, often underestimate the role of weeds (Kuan, 1990). Weeds serve as hosts for many invasive insects/pests that further damage plants and reduce yield by up to 15-20% if not properly controlled (Rubiales *et al.*, 2009). In Pakistan, weeds are one of the main causes of reduced crop yield. If weeds are not controlled in the first forty days, they can reduce crop yield by 40-50% (Hafeez, 2011). Weeds can reduce the yield by 20-40% of wheat, 20-63% of rice, 20-55% of cotton, 10-18% of potatoes and up to 45% of corn using various land inputs in the form of water and substances nutrients through the root areas (Maqbool *et al.*, 2006).

Table 1. Estimated Production, Potential and Actual Losses Due to Weeds Worldwide.

Crops	Attainable Production (M tons)	Crop Losses (%) Due to Weeds	
		Potential Loss (M tons)	Actual Loss (M tons)
Wheat	785	23 (18-29)	7.7 (3-13)
Rice	933.1	37.1 (34-47)	10.2 (6-16)
Maize	890.8	40.3 (37-44)	10.5 (5-19)
Potatoes	517.7	30.2 (29-33)	8.3 (4-14)

Figures indicate the average and the range (in brackets) of loss from weeds. Estimation of potential losses due to weeds in 2001-03 (Source: (Oerke, 2005).

Different methods are used to control weeds such as cultural, biological and chemical. Cultural control methods are still used spite being expensive, laborious and time-consuming. Different cultural practices, such as seed rates, irrigation strategies, competitive varieties, row spacing and nutrient management, cause various positive and negative effects on weed competition (Chauhan and Opeña, 2013). Mechanical approaches can minimize dependence on chemical methods due to resistance to weed varieties and can reduce the number of weed seeds in the soil (Vencill *et al.*, 2012). Chemical control involving the use of herbicides is common and has more advantages than cultural methods. The use of herbicides to control weeds is very effective but involves several problems, such as the high cost of herbicides, lack of awareness about their proper use and environmental pollution (Borlaug, 2002). Chemical weed control is the most popular method; reduces labour costs, saves time and facilitates access to the local farmer. Chemical control has many positive results in controlling herbaceous weeds, such as Jungli Rice (Echinochloa spp) (Mahajan and Chauhan, 2013), and Dhumbi Sitti (Phalaris minor Retz) and Jungli Javi (Avena fatua L.) in wheat crops (Rao and Moody, 1988). Biological methods of weed management serve as a natural solution in organic agriculture. Research shows that this method is not best to cover a large number of weeds (Muller-Scharer *et al.*, 2000). Due to the slow process of biological control, this method cannot be combined with others. The advantage of biological weed management is that the target plant can be permanently controlled. Moreover, biological control has no side effects (Kropff and Walter, 2000).

In Pakistan, farmers use several techniques under the Integrated Weeds Management umbrella to control weeds. They use cultural measures (manual mixing, crop rotation, burning and grazing), chemical control (use of herbicides), biological method (use of allelopathy and predator), mechanical measures (plough or plantations) and protection measures (use of clean seeds and tools, clean tillage machines, water channel cleaning) (Riaz *et al.*, 2006). The high cost and lack of labour, as well as the cost-effective and timely control of weeds, have increased the use of herbicides to control weeds in almost all crops (Rao *et al.*, 2014). Maximum use of herbicides to control the weeds is responsible for developing common herbicide resistance, growing environmental concerns and a growing public interest in environmental conservation. Efforts are needed to identify IWM components that have minimal negative effects on the environment. In this process, information is augmented important. Unless the farmers have adequate access to the right information through a specific channel, adoption of different weeds management techniques.

METHODOLOGY

We conducted this study in the District Gujranwala of the Punjab province of Pakistan. The Gujranwala district is famous for its potential in agriculture and four types of cropping systems such as rice-wheat, rice-berseem, rice-maize, and rice-potato are widespread across the district. The district has a total of five tehsils (Sub-districts) such as Gujranwala city, Gujranwala Sadar, Wazirabad, Kamuke and Nowshera Virkan. Considering the time and resources, the study was further downsized to three sub-districts. Of the total five tehsils, three such as Wazirabad, Kamuke and Nowshera Virkan were selected purposively. The Gujranwala Sadar and Gujranwala city had the lowest number of farmers; therefore, both were not selected as study areas.

Regarding sample selection, it was decided to adopt a proportionate sampling technique. The list of farmers was obtained from the office of the Deputy Director of Agriculture (Extension), Gujranwala. The list contained 4782 farmers practising farming under different cropping systems. Of the total farmers in the list, 1645 farmers were from the rice-wheat cropping system, 1360 from rice-maize, 935 from rice-potato and 842 from the rice-peas cropping system. The online software www.surveysystem.com was used to generate the sample size taking 4782 farmers as the known population for the study at a 95 % confidence level and confidence interval of 5%.

The total sample size for the study was 356 respondents. Through the proportionate sampling technique, 122 from rice-wheat, 101 from rice-maize, 70 from rice-potato and 63 respondents from the rice-peas cropping system were selected as respondents.

We used a structured questionnaire for data collection. The questionnaire was prepared in line with to study objectives. The questionnaire was administered through a face-to-face interview technique. The questionnaire was quantitative followed by observations and a few informal questions to validate the quantitative answers. The researcher itself collected the data and data

collection lasted for a year. The Likert scale used for this study to measure the level of awareness and adoption was 1 = Very Low, 2 = Low, 3 = Medium, 4 = High, 5 = Very High. The collected data were coded to excel and the Statistical Package for Social Sciences (SPSS) was used for the analysis of techniques. Both descriptive and inferential statistical techniques were applied to the data.

Table 1. Population and sample size from four cropping systems.

Cropping systems	Population	Sample size
Rice-wheat	1645	122
Rice-maize	1360	101
Rice-potato	935	70
Rice-peas	842	63
Total	4782	356

RESULTS AND DISCUSSION

Demographic profile of the respondents

This section includes age, education, annual income, farm size, tenancy status, sources of income, household size and farming experience. Socio-economic attributes of the respondents have a close association with the awareness and the adoption of the agricultural technologies developed for the farmers (Ashraf *et al.*, 2015).

Fadare *et al.* (2014) augmented that the socio-economic attributes had a great influence on farmers' behavioural developments motivating them for adoption. A detailed description of the socio-economic attributes is given in Table 2.

Table 2. Demographic profile of respondents.

Attributes	Rice Wheat		Rice-Potato		Rice Maize		Rice-Pease		Total
	F	%	F	%	F	%	F	%	F (%)
Age									
Young	32	26.2	19	27.1	25	24.8	28	44.4	104(29.2)
Middle	53	43.4	36	51.4	40	39.6	17	27.0	146(41.0)
Old	37	30.3	15	21.4	36	35.6	18	28.6	106(29.8)
Education									
Illiterate	23	18.9	17	24.3	25	24.8	14	22.2	79(22.2)
Primary-Middle	57	46.7	27	38.6	38	37.6	15	23.8	137(38.5)
Matric	25	20.5	19	27.1	33	32.7	15	23.8	92(25.8)
Above Matric	17	13.9	7	10.0	5	5.0	19	30.2	48(13.5)
Tenancy Status									
Owner	81	66.4	46	65.7	72	71.3	32	50.8	231(64.9)
Owner-cum-tenant	37	30.3	18	25.7	22	21.8	20	31.7	97(27.2)
Tenant	4	3.3	6	8.6	7	6.9	11	17.5	28(7.9)
Farming experience									
Low (Up to 10)	31	25.4	22	31.4	19	18.8	32	50.8	104(29.2)
Medium (>11-20)	34	27.9	30	42.9	33	32.7	17	27.0	114(32.0)
>20	57	46.7	18	25.7	49	48.5	14	22.2	138(38.8)
Income sources									
Farming only	47	38.5	56	80.0	69	68.3	47	74.6	219(61.5)
Farming + non-farming	75	61.5	14	20	32	31.7	16	25.4	137(38.5)

Table 2 shows, that 29.2% of the respondents were young followed by 41% of respondent who was in the middle of the age. Almost 30% of respondents were old. In Table 2, 22.2% were illiterate and 77.8% of respondents had formal education. Among the participating farmers, 38.5% had an educational level of

primary to middle followed by one fourth (25%) of respondents who qualified for matric level. Of the total respondents, 13.5% had a qualification level of more than matriculation. The majority of respondents (64.9%) were owners of their lands. Greater than one fourth (27.2%) of respondents were owner-cum-tenants and 7.9% of respondents were tenants. This implies that owners outnumber the owner-cum-tenants and tenants. Table 2 further shows that 29.2% of the participating farmers (219 farmers) had farming experience of less than 10 years. Very close to one-third of respondents (32%) had experience in farming between 11 to 20 years. Of the total respondents, 38.8% (138 farmers) were highly experienced farmers entailing an experience of over two decades. For 61.6% of respondents, farming was the sole and key income source. Of the total respondents, 38.5% of respondents had an emphasis on multiple income sources to generate income for their sustainable livelihoods. Income sources had a statistically insignificant difference regarding the adoption of weed management techniques under different cropping systems.

Table 3. Status of information received from different information sources in four cropping systems.

Information Sources	Information Received			
	Rice-Wheat	Rice-Potato	Rice-Maize	Rice-Peas
Modern				
Radio	6(4.9)	4(5.7)	6(5.9)	3(4.8)
T V	82(67.2)	60(85.7)	80(79.2)	55(87.3)
Internet	16(13.1)	7(10.0)	10(9.9)	11(17.5)
Mobile phone (cell)	36(29.5)	55(78.6)	60(59.4)	52(82.5)
Help lines	16(13.1)	14(20.0)	12(11.9)	14(22.2)
Traditional				
Fellow farmers	122(100.0)	70(100)	101(100.0)	63(100.0)
EFS Public sector	122(100.0)	58(82.9)	90(89.1)	58(92.1)
EFS Private sector	82(67.2)	62(88.6)	101(100.0)	60(95.2)
Pesticide dealers	122(100.0)	55(78.6)	95(94.1)	55(87.3)
Exhibitions	5(4.1)	3(4.3)	5(5.0)	4(6.3)
Campaigns	16(13.1)	4(5.7)	7(6.9)	6(9.5)
Farmer days	3(0.0)	10(14.3)	4(4.0)	4(6.3)

Note: Figures in the parenthesis are percentages.

Table 3 indicates that among the modern information sources TV was the most used information source across the four cropping systems with the usage reported by 67.2, 85.7, 79.2 and 87.3% of farmers in R-W, R-P, R-M and R-Peas cropping systems, respectively. The mobile phone was another prominent information source in modern gadgets, and 29.5, 786.6, 59.4 and 82.5% of respondents reported the use of mobile to receive information regarding weeds management in R-W, R-P, R-M and R-Peas cropping systems, respectively. These results are endorsed by those of Khan *et al.* (2019) as they found that 92.1% of farmers had mobile phones pointing towards the likely high level of access to information. In the Rice-peas cropping system majority of the farmers reported the use of mobile phones while in rice-wheat cropping systems use of mobile was the least. Th use of radio, helplines and radio was just nominal across the four cropping systems, indicating a kind of concern that farmers are still away from the use of the internet and accessing information through the internet. Among different modern gadgets, only Tv and mobile were infrequent use. Although, TV was having an edge over the mobile phone.

Among traditional sources of information, the fellow farmer appeared as the most significant source as all respondents across the four cropping systems had contact with the fellow farmer to access the information. All farmers had contact with EFS of the public sector to access information in the R-W cropping system followed by 82.9, 89.1 and 91.2% of respondents in the Rice-Potato, Rice-maize and Rice-Peas cropping systems, respectively. Findings are similar to those of Khan *et al.*

(2019) as they found that 87.2% of farmers have accessed information from private extension field staff. The majority of farmers such as 67.2, 88.6, 110 and 95.2% of farmers had the used information accessed from the EFS of the private sector. Pesticide use has become common to save the crop from the attack of insects, pests, diseases and weeds; therefore, farmers have frequent contact with the pesticide dealers. All farmers in the Rice-Wheat cropping system whereas, 78.6, 94.1 and 87.3% of farmers had used pesticide dealers to access information in R-P, R-M and R-peas cropping system, receptively. Exhibitions, campaigns and farmer days were the least used information sources. Despite recent developments in digital platforms and internet-based services, fellow farmers were still the vibrant information medium in study area.

Table 4. The extent of information received from different information sources in four cropping systems.

Information Sources	The extent of Information Received			
	Mean ± SD			
	Rice-Wheat	Rice-Potato	Rice-Maize	Rice-Peas
Modern				
Radio	3.19±0.98	1.67±1.02	2.0±0.42	2.33±1.22
T V	1.67±1.02	3.00±1.12	2.85±0.98	3.29±1.01
Internet	3.00±1.12	3.19±0.98	2.20±0.55	2.45±1.04
Mobile phone (cell)	3.25±0.95	3.25±0.95	2.63±0.97	3.21±1.23
Help lines	2.63±1.03	2.63±1.03	2.50±0.96	2.29±0.99
Traditional				
Fellow farmers	3.36±0.95	3.27±0.92	3.64±0.95	3.32±1.09
EFS Public sector	3.36±0.95	3.37±1.06	3.74±0.84	3.55±1.23
EFS Private sector	3.37±1.06	3.56±0.92	3.84±0.80	3.63±1.21
Pesticide dealers	3.56±0.92	3.36±0.90	3.61±0.96	3.53±1.10
Exhibitions	1.36±1.90	1.80±1.01	2.20±0.54	2.25±1.03
Campaigns	1.80±1.01	2.44±0.97	2.29±0.62	2.33±1.11
Farmer days	2.10 (0.93)	1.33±0.80	1.50±0.36	2.00±0.95

Table 4 indicates that the extent of information received through the radio was higher in the Rice-Wheat cropping system ($\bar{x}$=3.19) as compared to Rice-Potato ($\bar{x}$=1.67), Rice-Maize ($\bar{x}$=2.0) and Rice-Peas cropping system ($\bar{x}$=2.33). The extent of information received in the R-W cropping system was slightly more than medium level whereas the extent in the other three cropping systems was more or less of low level.

As for as Tv was concerned, farmers in Rice-Peas and Rice-Potato cropping system received information indicating the medium extent ($\bar{x}$ =3.29: $\bar{x}$=3.00) on a five-point scale. Internet and mobile were widely used for accessing information across the cropping systems being studied. The extent of accessing information through the internet was higher in rice-potato ($\bar{x}$=3.19) and rice-wheat ($\bar{x}$ =3.00) cropping systems as compared to rice-maize and rice-peas cropping systems. The mobile phone was the most prominently used information source as slightly more than medium level ($\bar{x}$=3.25) of information was accessed by farmers through mobile phones in rice-wheat and rice-potato ($\bar{x}$=3.25) and rice-peas ($\bar{x}$=3.21) cropping system. The extent of information accessed through the helplines appeared to range between low and medium levels. This implies that farmers had a partial reliance on helplines to access the information across the four cropping systems. In the context of traditional information sources, fellow farmers were the key information source widely used in the four cropping systems viz Rice-Wheat ($\bar{x}$=3.36), Rice-Potato ($\bar{x}$=3.27), Rice-maize ($\bar{x}$=3.64) and Rice-peas ($\bar{x}$=3.32) showing the extent of information received higher than the medium level. The extent was more inclined towards a high level in R-W and R-M cropping systems in particular. Findings are endorsed by those Yaseen *et al.* (2016) as they found that fellow farmers were the most effective information source for the farmers due to increased access and established level of trust on the farmers' level. Adomi *et al.* (2003) stated that farmers had trusted their friends and fellow farmers in accessing required information.

The extent of information received from the Extension Field Staff of the public and private sector was higher than the medium level following the same trend almost around the four cropping systems. Interestingly,

comparing the public and private sectors it is clear that EFS of the private sector were accessed more by the farmers for information as compared to the public sector. Abbas *et al.* (2021) found that the private extension field staff was more effective for the farmers as compared to public sector EFS for many reasons including frequent contact with farmers for the dissemination of information. Ali *et al.* (2011) was of the view that private extension field staff was more effective in convincing farmers towards getting more awareness and adopting the latest innovations. Pesticide dealers were found as a promising information source as the extent of information was higher in all the four cropping systems.

Around the four cropping systems the extent of accessing information from pesticide dealers was heading towards the high level on a five-point Likert scale. Findings are dissimilar to those of Arfan *et al.* (2013) as they found that pesticide companies, pesticides and seeds dealers were ranked lowest among different information sources. This implies that the information provided to the farmers by these companies and dealers was not much effective. Exhibitions, campaigns and farmer days were inadequately accessed by the farmers as the extent of information received ranged between the very low and low levels.

This is clear from the data that information was being accessed through the modern and traditional channels, although the traditional sources had more preference over the modern information sources. Except for the mobile phone, the rest of the modern gadgets had poor penetration among the public and the extent of information is not as good as it was in the case of most of the traditional information sources like fellow farmers, extension field staff of public and private sector and pesticides dealers.

Table 5. Factors affecting the awareness level of respondents.

Factors	R-W	R-P	R-M	R-Peas
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Lack of knowledge	3.30±1.25	3.46±1.25	3.67±1.25	3.27±1.23
Conservative behaviour	2.86±1.20	3.14±1.28	3.17±1.26	3.11±1.25
Lack of interest	3.15±1.23	3.43±1.23	3.30±1.33	2.89±1.26
Lack of motivation	3.01±1.29	3.36±1.26	3.15±1.22	3.22±1.30
Lack of resources	3.40±1.25	3.17±1.23	3.47±1.28	3.16±1.26
Less exposure to information sources	2.98±1.22	3.39±1.12	3.57±1.27	3.51±1.28

Scale: 1 = Strongly disagree, 2 = disagree, 3 = undecided, 4 = Agree, 5 = Strongly agree

Table 5 shows that lack of knowledge, conservative behaviour, lack of interest, lack of motivation, lack of resources and less exposure to information sources were the key obstacles hindering the awareness level of farmers regarding four cropping systems. The level of agreement of the farmers varied across the cropping systems, implying that the constraints were different for the farmers in four cropping systems. In the R-W cropping system, lack of resources ($\bar{x}$=3.40), was leading while conservative behaviour ($\bar{x}$=2.98), was the least constraint as agreed by the farmers. In the R-P cropping system, lack of knowledge among farmers ($\bar{x}$=3.46) was the first and conservative behaviour ($\bar{x}$=3.36), was the least constraint for the farmers. Lack of knowledge ($\bar{x}$=3.67) was the top constraint for the farmers in R-M cropping systems and farmers in the R-peas cropping system, less exposure to information sources was the prominent and highly ranked constraint. Moreover, lack of interest as the constraint ranked least on the list of constraints.

CONCLUSION AND RECOMMENDATIONS

This study aimed to explore and compare the modern and traditional information sources with special reference to weeds management in district Gujranwala. Total of 356 interviews were conducted with the respondents chosen through a proportionate sampling technique. This study summarizes that among farmers information was being accessed through the modern and traditional channels, although the traditional sources obtained more preference over the modern information sources.

Except for the mobile phone, the rest of the modern gadgets had poor penetration among the public and the extent of information was not as good as it was in the case of most of the traditional information sources like

fellow farmers, extension field staff of public and private sector and pesticides dealers. Lack of knowledge, conservative behaviour, lack of interest, lack of motivation, lack of resources and less exposure to information sources were the key obstacles hindering the awareness level of farmers regarding four cropping systems. This study recommends further exploration that why farmers are still dependent on traditional sources and why fellow farmers are much preferred by the farmers.

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