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Assessment of Technology Transfer Means, used in Watershed Rehabilitation Project for Technology Dissemination

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Abstract: Information about new technologies is important for improving agricultural production. Technology transfer through demonstration and dissemination, using different means, remained one of the regular activities in the agricultural research and development agencies in Pakistan. The current study employed survey methodology to appraise various means of technology transfer used to disseminate water saving technologies among the farmers under watershed rehabilitation and irrigation improvement project implemented by International Center for Agricultural Research in Dry Areas (ICARDA) for improving livelihood of rural farmers in Pakistan through demonstration and dissemination of technologies (2012-2016) by different agricultural research institutes in Pothwar region of the Punjab. A total of 74 farmers with respect to targeted technologies were selected through purposive random sampling. The results, based on descriptive analysis, revealed that, generally, farmers were getting information about agricultural technologies through multiple means. Electronic media substantiated a major source of dissemination followed by Agriculture Service Providers (ASPs) trainings and print material for drip/sprinkler technology. Demonstration sites proved to be the most efficient means for gypsum application for moisture conservation, followed by farmer field days.

Key words: Technology transfer, Dissemination, Watershed, Agriculture, Assessment.

INTRODUCTION

In order to make informed decisions, it is essential for the small farmers to acquaint themselves with appropriate information (Chisita, 2010). However, only stipulation of knowledge to farming community does not assure its logical usage. The reason behind this is the congregation of societal, financial and psychological aspects, which affect the speed of rural information usage (Akande, 1999). A review of different studies, conducted by Munyua (2006), Onu (1991), Atala (1992), Akande (1999) and Yayock and Misari (1990), indicates that variables, that affect pattern of agriculture information seeking behavior by farming community, are socio-economic, cultural, political, geographical and personal characteristics of farmers.

An overwhelming majority of farmers in Pakistan is underprivileged, illiterate, and lack most of rudimentary societal facilities; their insufficiency originates from their incapability to obtain an up-to-date and judicious agricultural information. Logically speaking information-poverty may result in resource deficiency and relegation (Zakar and Zakar, 2009). The success of technology transfer depends much upon the means selected for transferring the respective technology to the farmer. Moreover, wide adoption or diffusion of certain technology is the result obtained from the effective means, used for the dissemination of that technology. Various research studies have indicated that farmers' information revelation is an important aspect towards logical use in farming business (Munyua, 2006; Onu, 1991).

The major hurdle in obtaining agricultural information is due to unsuitable arrangement of agriculture information, contemptible information supplier, low courtesy of agriculturalists, and uncertain farming community growth (Yaseen *et al.*, 2016).

Rapid breakthrough in agricultural productivity stresses purposeful teaching of peasants about modern agricultural technologies. It can be accomplished through informal teaching by extension organizations. Agrarians constantly require evidences about the farming matters and, for this purpose, they tend to use different information means, e.g., extension agencies, television, newspapers, private sector, radio, NGOs and fellow farmers. Print media is considered as an important means to distribute agricultural information to the farming community through booklet, broachers, and pamphlets by different agencies (Rehman *et al.*, 2011).

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Muhammad *et al.* (2002) highlighted the importance of information flow through neighboring farmers to one another. They investigated efficacy of means of information transmission employed by Novartis Company. Neighbors/friends/relatives appeared to be the major sources, through which the respondents became aware of Novartis Company as reported by a vast majority (89.16%) of the respondents. The priority means were agricultural campaigns, literature, lectures meetings, exhibitions, demonstrations, result demonstrations and movies in rank order. Relatively less effective means were farm and home visits, discussion meetings, radio and TV. There is a big gap between average and potential yield of various agricultural crops. However, the technologies, being adopted by farmers according to recommendations, can increase the agricultural production up to considerable extent (Irfan *et al.,* 2006).

The watershed rehabilitation and irrigation improvement project was implemented by International Center for Agricultural Research in Dry Areas (ICARDA) for improving livelihood of rural farmers in Pakistan through demonstration and dissemination of technologies (2012-2016) in different regions of Pakistan. Means of technology transfer used in watershed project were farmer field days, Agriculture Service Providers (ASPs), trainings, demonstration sites, visits to research stations, print media and electronic media.

There are very few studies, which have contributed to the technology specific means of technology dissemination. However, this study is one such efforts which assesses the technology specific means of dissemination. Target audience obtained information by more than one means, although, several means of technology dissemination were employed but all the means did not work for every technology. There was a set of different means, which was suitable for different technologies, depending on the technology used and its nature, which is not found in the literature so far and was investigated during this study.

This paper is targeted to highlight the farmers' usage of agricultural information sources. Following are specific objectives of the study:

- To explore the information sources, used by the target community in project area.
- To assess different means of technology transfer by technology disseminated under watershed project.
- To provide empirical evidence for improving technology dissemination mechanisms for agriculture sector in Pakistan.

MATERIALS AND METHODS

In Pothwar region, a number of institutes, including Pakistan Agricultural Research Council (PARC), Barani Agricultural Research Institute (BARI), Soil and Water Conservation Research Institute (SAWCRI), and South Asian Conservation Agriculture Network (SACAN), were involved in demonstrating and disseminating different water saving technologies. Therefore, this region was selected as study population. The target areas within Pothwar region included Chakwal, Kallar Kahar, Fateh Jang, Attock and Murree. Villages were pre-selected by the project team, keeping in view the project activities. The water saving techniques included drip/sprinkler irrigation system, roof top rain water harvesting technology, gypsum application for moisture conservation, green manuring, raised bed and micro-catchments.

Purposive random sampling technique was adopted in the project demonstration areas for host farmers, and farmers participating in project activities. 74 farmers were selected as a sample, out of which 47% were from Chakwal, 23% from Fateh Jang, 22% from Kalar Kahar and 8% from Murree District.

A well-structured and pretested questionnaire was implemented to record the perception of the respondents regarding the means of technology transfer used for technology dissemination. Moreover, farmers' perception for the most desirable and efficient means was also recorded. The socio-economic features of the response farmers were also made a part of the questionnaire. Quality of data was ensured through data editing and checking during survey on daily basis while cross checking and consistency checks were made before data analysis using SPSS. Descriptive analysis was performed for variables of interest.

RESULTS AND DISCUSSION

Watershed rehabilitation project has demonstrated the water saving technologies at farmers' fields. Target community was made aware through different means, including farmer field days, onsite demonstrations, print media (brochures), electronic media (radio talks, TV programs, videos and CDs), research station visits, host demonstration sites, ASPs trainings, etc. Purpose of this awareness was to disseminate the knowledge of technologies among the farmer, so that farming community may adopt these technologies at their farm. The present study investigated different means to identify the most effective mean for technology transfer and for further uptake of technologies.

Socio economic characteristics of the study area: Socio economic indicators (i.e., age, education, farming experience, size of land holdings, etc.) play an important role in farming system. These features play an important role in determining the information seeking behaviors and patterns of individuals (Hassan, 2008). The information regarding socio-demographic features of the sample farmers are displayed in Table 1. Average age of farmers was 38.5 years with an average farming experience 17.5 years. A significant number of respondents reported that they have been

practicing agriculture inherently. Average education of the respondents was 7 grades.

Information about land holdings is presented in Table 2. Operational land holdings were divided into three classes, i.e., small (1-12.5), medium (12.5-25) and large (25 and above). Total number of farmers in small, medium and large category were 39, 14, and 21, respectively.

Table 1: Socio-economic characteristics.

Indicator	Mean (Years)
Age	38.5
Farming experience	17.5
Education	7

Table 2: Operational land holdings.

Acres	No. of farmers
Small (1-12.5)	39
Medium (12.5-25)	14
Large (25 and above)	21

Irrigation plays an important role in farm productivity. Proportion of irrigated land in Pothwar is less, as most of the farmers have rain fed land. In project area, 31% respondents were applying irrigation, while the rest 69% were practicing rain fed farming system. Those who were using irrigation, out of them, 65% were using bore while 18% were using dam, 13% were using dug-well and 4% used streams. Table 3 depicts the irrigation sources of farmers.

Table 3: Irrigation sources and percentage of irrigated farms.

Indicator	Response (%)
Irrigated farms	31
Water sources	---
Bore	65
Dug well	13
Dams	18
Streams	4

Comparative inspiration of the farmers' information use, individual and societal features of farmers was examined. Household and farm assets holdings were investigated to scrutinize the resources of the respondents in target community. Table 4 shows the asset base of the population of target area. Out of the total sample, 93% own television while 85% hold refrigerator. Motor cycle and cycle was possessed by 60 and 63%, respectively. Tractor, radio and car were held by 46, 30 and 24%, respectively.

Table 4: Household and farm assets.

Assets	Percent farmers
Television	93
Refrigerator	85
Motor cycle	60
Cycle	63
Tractor	46
Radio	30
Car	24

Accessibility and use of information source: The fundamental principle of any information use is associated with the convenience of its approachability. It may be the case that information seeker may access it physically but may not be able to translate its use logically due to poor understanding. In another case, the seeker may have the capacity to understand but financial resources may hinder access to information sources. Households in the study area were found to have an access to multiple information sources. In the target areas, overall around 3% sample household have access to radio, 11% having access to newspapers, 7% have access to internet, while the major source of information in three districts happen to be TV with cable facility having accessed by 83% of household, followed by mobile as a second source of communication, i.e., 62% household have access to it (Table 5).

Those who have access to radio, out of them 10.4% households are using it, while mobile and internet is followed by 37 and 35% respondents, respectively, by those having access to these facilities. Newspaper is followed by 53% respondents, while TV is being used by a maximum number of respondents, i.e. 91%. Overall results depict that the use of information for agricultural purposes is being influenced by some geographic, ethnic, demographic, personal, and dogmatic factors, i.e., the use of radio in all the three districts seems to be obsolete for obtaining agriculture information and on an average 0.5% household use of radio for obtaining agriculture information. The use of newspaper for obtaining agriculture information is reported by 7% household, while mobile and internet are not used significantly, i.e., 4 and 5%, respectively. However, the use of TV and cable is a major source of agriculture information in all three districts, i.e. 34%.

Table 5: Access and use of information sources.

Information sources	Access to information sources	Use of information sources	Use of information sources for agricultural purposes
	Response (percent)		
TV	83	91	34
Mobile	62	37	4
Newspaper	11	53	7
Internet	7	35	5
Radio	3	10.4	0.5

Yaseen *et al.* (2016) reported somewhat different results, i.e., transfer of information, related to farming, using electronic media was not much significant. Nevertheless the print media (i.e., magazines, newspapers, books/booklets and pamphlets), is an important mean for the farming community to obtain up-to-date information related to agriculture. The use of mobile for obtaining agricultural information is not common, due to inappropriate knowledge about exploitation of mobile phones.

As far as accessibility of the sources is concerned, the majority of the respondents have access to TV and cable facilities. Farmers in all the villages watch television except at places where there is no electricity. However, an increasing number of respondents tend to use TV for agricultural information and most of them use TV for weather forecast for crops. Use of radio was not very common among farming community. Youth of the area reported the use of radio only for entertainment purpose. Radio has lost its strength in villages and not even the farmers bother to keep it. Therefore, the access of radio is denied by choice. The use of newspaper was low and farmers preferred TV for news. Only few households have newspapers, while the same newspapers are used to circulate throughout the village. Although, overall internet has proliferated access of information but the present study shows that internet access has a missing link with factors, like, literacy, innovative capacity, awareness and interest. Therefore, it is accessed by a limited number of households in a village and situation is overall the same. Though, mobile is an efficient technology, as long as, the sources of information are concerned. However, its use as a mean for technology transfer in agriculture, in general, and watershed rehabilitation project specifically, has not come up as a vibrant mean of technology transfer. The major reason is that farming is mainly the profession of middle aged or old people. Youngsters are not taking it as an opportunity of livelihood generation and do not show much interest in farming but they are very much efficient in the use of mobile. However, the older generation, though having interest in farming yet they are backward in mobile use. Therefore, mobile use in the study was found to be used minimum (least) for technology transfer. However, Khan *et al.* (2014) reported mobile phone as a prominent medium for passing information related to poultry and livestock.

Dissemination of watershed technologies through different means of technology transfer: Dissemination status through watershed activities was investigated from respondents about individual means (Table 6).

Farmers' field days: Farmers' field day is a participatory mean of technology transfer, where farmers are invited by the research stations involved in dissemination of watershed technologies. One to one discussion of fellow farmers with each other facilitates them to share their faming knowledge and experience on equal level at farmer field days. It also facilitates them to use a platform of sharing thoughts within farmers' groups. Around 19.2% respondents obtained information about drip/sprinkler irrigation system through farmer field days. However, for roof top, gypsum, micro-catchments and raised bed 16.2, 39.2, 11.2 and 14.2% respondents, respectively, got information through farmers' field days. Farmer field day as a mean of technology transfer was considered the best for gypsum application for moisture conservation. Other studies, e.g., Heiniger *et al.* (2002) and Louhaichi *et al.* (2015), considered it a powerful tool of dissemination of agricultural information.

Agriculture Service Providers (ASPs) training: ASPs were considered an integral part of dissemination of watershed technologies and considered partners in the process of technology transfer. Local ASPs were taken into this process for first time under watershed project for effective transfer of water conservation technologies. Considering the importance of capacity building for effective technology transfer, trainings were made a part of the project to build capacity of ASPs through developing skills of designing, installation, and operation of water conservation technologies (Zaman *et al.*, 2016). Through ASPs' trainings, 79% respondents gain information about drip/sprinkler. A limited number of respondents reported to seek information about roof top, micro catchments, and gypsum application through ASPs, i.e., 7% for each technology, since ASPs resulted as the best means for dissemination for drip/sprinkler technology.

Table 6: Dissemination of watershed technologies through different means of technology transfer.

	Farmer field days	ASP training	Demonstration site	Visit to research station	Print media	Electronic media
			Response (percent)			
Drip/Sprinkler	19.2	79	19	40	54	90
Gypsum	39.2	7	63	34	26	10
Roof top rain water harvesting	16.2	7		20	16	
Micro-catchments	11.2	7	6			
Raised bed	14.2		12	3		
Green Manuring				3	4	

Visit to demonstration site and sharing with host farmer: This study reveals that demonstration site developed by the research station is an effective tool of dissemination. Fellow farmers not only observe but also seek information, appreciate it and tend to adopt it. Through visits to demonstration site, 19% respondents reported to seek information for drip/sprinkler technology. For gypsum application for moisture conservation 63% respondents reported to seek information from demonstration sites. Gypsum technology was new to farmers and most of them visited farmer demo site, discussed its use and then adopted as they were reluctant at initial level, regarding its working. Modest response was reported for obtaining information through this mean for micro-catchments and raised bed (6 and 12%, respectively). Therefore, demonstration sites proved most efficient means for gypsum application for moisture conservation. Khatam *et al.* (2013) reported farm visits and demonstration as an important mean of disseminating agricultural technologies among farming community in KPK. However, Yaseen *et al.* (2016) presented contradictory results, i.e., demonstrations, were usually ignored by the farming community and they did not show their interest in visiting the demonstration sites or follow any group discussion and lectures.

Visit to research station: Visit to research station is also used for obtaining information regarding technologies. Around 34% respondents reported to get information about gypsum by making visit to research station. Drip/sprinkler irrigation system was reported to be disseminated to 40% of respondents through visit to research station, while, roof top rainwater harvesting technology was reported by 20% respondents. However, for green manuring and raised bed, each of 3% respondents reported to obtain information from research station.

Print media (brochures): For roof top rainwater harvesting, 16% of respondents reported to use this mean and for drip/sprinkler irrigation system 54% respondents consulted print material. 26% followed the printed material for gypsum application, followed by 4% for green manuring. An overall use of printed material for information seeking for agricultural technologies was relatively low except drip/sprinkler. These results are in line with the study conducted by Naveed *et al.* (2012). Some other studies considered print media as an efficient tool for dissemination of information for agricultural technologies (Yaseen *et al.,* 2016; Khan *et al.,* 2013; and Farooq *et al.* 2007).

Electronic media (CDs, TV program, radio talks, and websites): Electronic media substantiated a major source of dissemination for drip/sprinkler technology for 90% respondents. However, only 10% of the respondents consulted electronic media for gypsum. These results are in line with other studies e.g., Aldosari *et al.,* 2017; Abbas *et al.* 2003; Khan *et al.* 2010; and Khan *et al.* 2013. Electronic media proved effective for high efficiency irrigation system because of its versatile use across the country. Secondly, the government is doing advertisements about drip mostly through electronic media to address wide range of farmer community.

CONCLUSION

Agriculture information system plays a significant role in efficiency and acceptance of modern technologies. The current study appraised different means of technology transfer used to disseminate water conservation technologies. Watershed rehabilitation project used different means for all the technologies to disseminate information to targeted audience. Target audience obtained information by more than one mean. Several means of technology dissemination were employed but all the means do not work for every technology. There was a set of different means, which were suitable for different technologies, depending on the technology use and its nature. Electronic media substantiated a major source of dissemination for drip/sprinkler technology for 90% respondents, followed by ASPs 79% and print material 54% of respondents. Demonstration sites proved most efficient means for gypsum application for moisture conservation, i.e. 63%, followed by farmer field day, i.e. 39.2%. Keeping in view the results of this study, it is recommended that appropriate means should be used for different technologies according to the local environment. It is the need of the hour to implement effective and easy ways for transferring agricultural information to the farming community to improve the overall production of the agriculture sector. Moreover, the adoption of modern technologies related to water saving must be encouraged at large scale. This study further reveals that there is an emerging requirement for the efficient dissemination of agricultural knowledge to the farming community in order to acquaint them with modern agricultural practices and to make a shift from traditional practices which may ultimately affect the agricultural production. While designing the dissemination plan, special care should be taken to execute technology specific mean. The right mean of technology transfer should be used for right participants. Every mean is not suitable for every technology. Moreover, the cost effectiveness of the mean selected for dissemination should be rational and must be considered.

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