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IDENTIFICATION OF THE ADOPTION LEVEL OF WATER SAVING INTERVENTIONS AND REASONS FOR NON ADOPTION IN FAISALABAD DISTRICT

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The irrigation water saving technologies mainly include watercourse improvement, improved farm layout, laser land levelling and bed planting of wheat. The techniques adopted in the Punjab have shown encouraging results. To see the adoption of latest technologies at small farms, district Faisalabad was selected as study area, which consists of five Tehsils; Faisalabad, Jaranwala, Sammandri, Chak Jhumra and Tandlianwala; out of these five three tehsils Jaranwala, Sammandri, Chak Jhumra were randomly selected. To see implications of the water saving irrigation interventions a tehsil-wise list of improved watercourse was collected from the office of the District Officer Water Management Faisalabad. A list of 25 watercourses from each tehsil was separately prepared duly authenticated by water management officer, where maximum water saving interventions were applied. Ten improved watercourses, where maximum (5 or 6 out of 10) water saving irrigation interventions were found applied, were selected by using random sampling from each tehsil, thus total 30 improved watercourses were taken where maximum water saving irrigation interventions were applied. From these 30 watercourses 9 small farmers (having landholding<12.5 acres) were selected randomly, 3 from Head, Middle and Tail respectively. Thus 270 small farmers were selected for the face to face interview. Quantitative data were collected in 2010 and analyzed at University of Agriculture, Faisalabad using the Statistical Package for the Social Sciences. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize different variables. Overall the results of the data show that adoption of the water saving irrigation interventions like water course improvement, improved farm layout, and laser land levelling were 100% whereas 99.6, 99.6, 96.7 and 91.1% respondents were of the view that they adopted scraper land levelling, turn replacement according to crop need, moisture saving by hoeing and maintenance of water courses, respectively. On the other hand the farmers who did not use water saving interventions reported the reasons for non-adoption as: shortage of time, small holdings, lack of subsidization, and lack of technical knowledge.
Keywords: Impact assessment, technology adoption, water technologies, irrigation, water losses.

INTRODUCTION

Pakistan's agriculture has been suffering, off and on, from severe shortage of irrigation water in recent years, against the normal surface water availability at canal heads of 91.8 million acre feet (MAF). Relatively speaking, Rabi season faces more shortage of water than Kharif. During the fiscal year 2013-14 the availability of water for Kharif season (for crops such as rice, sugarcane and cotton) was 65.5 MAF where as it was 32.5 MAF for Rabi season. Increase in water level in channels, above the deign level, of up to 30 cm is common in Pakistan (Govt of Pakistan, 2014). Primary causes of rise in water level are sedimentation and growth of vegetation in channels because of poor cleaning. Loss of water in old earthen channels increased exponentially as the water level rose in them due to growth of vegetation. The losses in Pakistani water channels were estimated as 12% (Akram *et al.,* 1981).

Cleaning vegetation from channels usually lowers the operating level of water to the designed value by decreasing the roughness coefficient of channel. Lining of irrigation channels has been widely practiced in the world for saving water and enhancing conveyance efficiency. Recent efforts have included development of low cost linings. Optimization models have been developed to decide which channels should be lined or earthen improved, based on the physical characteristics of the channels and durations of flow of water in the channels. The lining of channels is important but still beyond the financial capacity of many low income farmers (Kahlown and Kemper, 2004). Rasheed (2005) reported that lining of watercourses saved 33 to 40% water in gravel areas of Balochistan and NWFP but not in case of Sindh and Southern Punjab (below Panjnad) where soils are comparatively heavy. Zafar (2004) stated that using local resources and involving beneficiaries were essential for long-term impact of any project, particularly in the farming sector. He was of the view that particular attention should be

given to farmers who are at the tail of a watercourse. Such farmers are generally small, resource scarce and poor. Hussain (2004) also suggested to construct new watercourses on the small dams and improving the existing watercourses, thus formation of the water users associations seems imperative to manage and improve these channels. The construction and improvement of watercourse will create employment in the rural areas leading to reduction in poverty and increase in production and ultimately upgradation of living standards. Mustafa (2002) stated that in many parts of the world, the affluent landowners and government officials pin point heavy losses of water from water reservoirs, rivers, canals, watercourses and fields. So it was necessary to improve the irrigation system and reduce the losses of water especially from watercourses and fields. Munir (2000) reported that the 7 years inflow data of River Indus reveals that water productivity is far below due to inadequate and untimely availability of water causing stress at critical stages of the crop growth, water conveyance. Mukhtar (2000) suggested that more water can be stored for irrigation of crops by constructing dams, reservoirs, barrages and link canal and also water losses can be controlled by watercourse improvement and he emphasized the need on construction of bricked watercourses at farm level.

Efforts have been made in Pakistan to introduce water saving irrigation practices among farmers especially in the small farmers. The efforts for these include construction of cemented water channels, improving earthen parts of watercourses, replacing flood irrigation with bed–furrow, drip and sprinkler irrigation techniques, laser land leveling and improved farm layout methods etc. Such efforts were started in 1970's. A Water Management Research Centre was established in University of Agricultural Faisalabad. Farmers of Faisalabad district had honored to receive pioneer messages concerning improvement in irrigation techniques at their farms. During the last two decades water saving projects were run by Water Management Research Centre, University of Agriculture, Faisalabad including On-Farm Research & Development Component of Rehabilitating Lower Chenab Canal System project funded by Japan International Co-operation Agency (JICA). Optimizing Canal and Ground Water Management to Assist Water User Associations in Maximizing Crop Production and Managing Salinization to convey water saving interventions in Faisalabad district. The activities of projects included introducing water saving interventions; lazer land leveling and Bed–Furrow method. In depth analysis of the available reviewed literature indicates that there were no efforts done to find out the long-term impact of water saving interventions. Therefore, the researchers felt it the need of the time to plan and conduct the present study.

METERIAL AND METHODS

The district Faisalabad has maximum small holding in the Punjab province. It is an important district of the mixed cropping zone where a variety of crops are grown. Faisalabad is famous city where University of Agriculture is situated, in which 41 departments (Govt. of Punjab, 2010) are working under different faculties. Agricultural research work and field activities especially irrigation water saving interventions; watercourse improvement, improved farm layout, laser land levelling and bed furrow for wheat are in progress. To see the adoption of latest technologies at small farms, district Faisalabad was selected as study area, which consists of five tehsils; Faisalabad, Jaranwala, Sammandri, Chak Jhumra and Tandlianwala. Three Tehsils i.e. Chak Jhumra, Jaranwala and Sammandri out of five tehsils were selected randomly using simple random sampling technique. To see implications of the water saving irrigation interventions a tehsil wise list of improved watercourse was collected from the office of the District Officer Water Management, Faisalabad. Then with the coordination of Deputy District Officer Water Management, researcher himself worked out the total applied water saving irrigation interventions on each improved watercourse. A list of 25 watercourses was separately prepared duly authenticated by Water Management Officer, where maximum water saving interventions were applied. Thus ranking was made and ten improved watercourses where maximum (5 or 6 out of 10) water saving irrigation interventions were applied, selected by using Randomizer.com pathway in each Tehsil, thus total 30 improved watercourses were taken where maximum water saving irrigation interventions were applied. From these 30 watercourses 9 small farmers (having landholding <12.5 acres) were selected randomly, 3 from Head, Middle and Tail, respectively. Thus from 30 watercourses, agriculture graduates collected the data from the randomly selected 270 respondents. The data were collected for the doctoral study of the corresponding author in the year 2010 with the help of validated interview schedule.

RESULTS AND DISCUSSION

The data in Table 1 show that all respondents adopted the water saving irrigation interventions like water course improvement, improved farm layout, laser land levelling whereas above 90% respondents were of the view that they had also adopted scraper land levelling, turn replacement according to crop need, moisture saving by hoeing, maintenance of water courses. Farmers demonstrated patterns of positive, negative and mixed attitudes towards the adoption of different practices. Changing the behaviour of farmers is one of the most important and difficult job of an extension worker, all social change is dependent to some degree on attitude change (Muhammad, 2005).

Table 1. Distribution of the respondents according to the extent of their adoption level of water saving irrigation interventions.

Water saving interventions	Adoption				Extent of adoption level									
	Yes		No		1		2		3		4		5	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	N.	%
Water course improvement.	270	100.0	-	-	1	0.4	-	-	13	4.8	248	91.9	8	3.0
Maintenance of watercourses	248	91.01	22	8.1	-	-	4	1.5	44	16.3	188	69.6	12	4.4
Improved farm layout	270	100.0	-	-	-	-	1	0.4	147	54.4	115	42.6	7	2.6
Laser land leveling	270	100.0	-	-	-	-	4	1.5	138	51.1	125	46.3	3	1.1
Scraper land leveling	269	99.6	1	0.4	5	1.9	6	2.2	88	32.6	164	60.7	6	2.2
Bed and furrow irrigation	124	45.9	146	54.1	-	-	4	1.5	29	10.7	87	32.2	4	1.5
Moisture saving by hoeing	261	96.7	009	3.3	-	-	8	3.0	91	33.7	161	59.6	1	0.4
Turn replacement according to crop need	269	99.6	001	0.4	-	-	1	0.4	83	30.7	179	66.3	6	2.2

1= To some extent, 2= To below an average extent, 3=To an average extent, 4= To above an average extent, and 5= To high extent

Furthermore regarding extent of adoption of water saving techniques 91.9 and 69.6% respondents adopted the watercourse improvement and maintenance of watercourse, respectively, to above average extent whereas 54.4 and 51.5% respondents adopted the improved farm layout and laser land levelling to an average extent, respectively. An overwhelming majority i.e. 91.9% respondents were of the view that their watercourses were improved to above average extent, whereas 69.9, 66.3, 60.7 and 59.6% were also of the view that they also adopted the water saving interventions like maintenance of water courses, turn replacement according to crop need, scraper land levelling and moisture saving by hoeing to above average extent. Similarly a fair majority i.e. 54.4 and 51.5% of the respondents were of view that they adopted water saving interventions like improved farm layout, laser land levelling to an average extent. The data regarding extent of adoption of water saving interventions also showed that a fair majority (54.4%) respondents did not adopt the bed–furrow irrigation intervention.

Table 2 shows that when the respondents were asked that why the common people do not adopt water saving interventions, the 100% respondents were of the view that common people do not adopt water saving interventions due to shortage of time, small holdings, lack of subsidization, etc. The respondents were of the view that the reason for not using water saving irrigation interventions were due to shortage of time, small holdings, lack of subsidization, lack of technical knowledge, non-availability of machine and not suitable/affordable, whereas only 3.3% respondents were of the view that people do not adopt water saving interventions due to lack of information. The data also showed that 99.6, 99.6, 94.1 and 99.6% respondents were also of the view that the people do not adopt water saving interventions due to soil tenancy, lack of funds, and non-availability of technician and non-cooperation of agriculture department, respectively. In a study by Khan, Ali, and Ahmad (1986) it was reported that lack of awareness, interest, finances, and

Table 2. Distribution of the respondents according to the reasons why common people do not using the water saving irrigation interventions

Reasons	Yes		No	
	No.	%	No.	%
Lack of information	9	3.3	261	96.7
Lack of interest	35	13.0	235	87.0
Shortage of time	270	100.0	-	-
Lack of subsidization	270	100.0	-	-
Small holdings	270	100.0	-	-
Non availability of machine	270	100.0	-	-
Not suitable/affordable	270	100.0	-	-
Lack of funds	269	99.6	1	0.4
Lack of technical knowledge	270	100.0	-	-
Soil tenancy	269	99.6	1	0.4
Non-availability of technician	254	94.1	16	5.9
Non-cooperation of Agriculture Department	269	99.6	1	0.4

Table 3. Weighted score, mean, standard deviation, and rank order of adoption level of water saving irrigation interventions.

Water saving techniques	Weighted score	Mean	Std. deviation	Rank order
Water course improvement	1072	3.97	0.33	1
Turn replacement according to crop need	997	3.71	0.51	2
Scraper land leveling	967	3.59	0.67	3
Maintenance of water courses	952	3.84	0.52	4
Moisture saving by hoeing	938	3.59	0.56	5
Improved farm layout	938	3.47	0.56	6
Laser land leveling	937	3.47	0.55	7
Bed and furrow irrigation	463	3.73	0.57	8

inputs were the main reasons for the non-adoption of innovations. It was reported in 2001 in Pakistan that the irony is that most of the farmers were even not aware of the existence of sources of information (Davidson, Ahmad, and Ali, 2001). The results are supported by Chaudhry (1970).

Pakistan is a progressing country and modern water saving interventions like, drip and trickle irrigation, rain–gun irrigation are introduced in the country and no doubt that the agriculture farming community is aware about these two water saving interventions (99.6 and 97.4%, respectively) but their adoption level is very low (Chaudhry, 1970).

Table 3 shows that adoption level of water saving irrigation interventions like watercourse improvement, was ranked at top among other water saving irrigation interventions with weighted score values (1072), mean values (3.97) and standard deviation values (0.33), regarding watercourse improvement indicates that water saving irrigation intervention nearly above an average extent. Similarly the water saving irrigation interventions like, turn replacement according to crop need, scraper land levelling and maintenance of water courses were ranked as 2nd, 3rd and 4th with weighted score values 997, 967 and 952 and mean values 3.71, 3.59 and 3.84 with standard deviation values 0.51, 0.67 and 0.52, respectively. The data also showed that water saving irrigation interventions like bed and furrow irrigation and improved farm layout were ranked at bottom among others with weighted score values 463 and 938, mean value 3.73 and 3.47 and standard deviation 0.56 and 0.57, respectively. Finally it was observed that adoption of water saving irrigation interventions like watercourse improvement, showed significant contribution in water saving and farmers realize the importance of watercourse improvement after adopting it.

Construction of new reservoirs is the ultimate solution of water saving and thus water availability in Pakistan as suggested by Mukhtar (2000) regarding storage of water and energy crisis. It was observed during the course of study that farmers were conscious about water shortage and were in opinion that government should give due priority for construction of reservoirs to provide water during rabi season. Improvement of watercourses and fixing control structure in plain areas of Pakistan reduce the conveyance losses of water which will increase water flow and make it easy in water irrigation (Kahlown and Kemper, 2004). It is, therefore, suggested to improve the infrastructure and water pricing which will help to make water available at tail of the watercourses. The maintenance of watercourses is essential for smooth running of water. There should be special arrangements of funds either by government or public resources.

***Conclusion*:** An overwhelming majority i.e. 90% respondents were of the view that their watercourse was improved to above an average extent, where as 70% farmers adopted the water saving interventions like maintenance of water courses, turn replacement according to crop need, scraper land levelling, moisture saving by hoeing to above an average extent. And on the other hand reason for not using water saving irrigation interventions by common farmers was shortage of time, small holdings, lack of subsidization, lack of technical knowledge.

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