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Farmer Field Demonstrations on Water Conservation Technologies in Hoshiarpur District of Punjab

M. J. Singh
Department of Soils, Punjab Agricultural University, Ludhiana, Punjab

Abstract : Demonstration trials were conducted at farmers' fields on various water conservation technologies developed by Punjab Agricultural University. The results indicate that scheduling of irrigation to wheat as recommended by university leads to 16% saving of water. In case of paddy the saving of irrigation water was 58% as compared to farmers practice. Tensiometer, a device for irrigation management, leads to about 24% saving of irrigation water as compared to fixed irrigation schedule. Improved irrigation methods like bed planting saved significant amount of water as compared to flat method of irrigation. Laser levelling of land saved 10-20% of irrigation water in different crops in addition to other benefits. Mulching with paddy straw resulted in saving of 25% irrigation water and also improved yield of green chillies by 9%. Transplanting of sunflower as compared to direct sowing saved about 24% irrigation water although the grain yields remained the same.

Keywords: Irrigation; laser levelling; mulching; tensiometer.

INTRODUCTION

The state of Punjab, comprising 1.5% area of the country, has been contributing 40-50% rice and 60-65% wheat to the central pool for the last three decades. The change in cropping pattern in Punjab has increased irrigation water requirement tremendously and the irrigated area has increased from 71 to 95% in the state. Also the number of tubewells has increased from 1.92 to 11.68 lakhs in the last 35 years, resulting in over-exploitation of ground water and rapid decline in water tables (Kaushal et al 2008). In order to maintain long term productivity it has become necessary to make judicious use of available irrigation and rainwater. Extensive research by the scientists of the Punjab Agricultural University has led to the development of technologies for efficient irrigation without sacrificing the crop yields. There is need for transfer of technology for better utilization of limited available water resources.

STUDY AREA AND SAMPLING SITES

Present study is based on various on-farm demonstrations conducted in the Hoshiarpur district of Punjab on water conservation during the last four years. The research findings of the university were demonstrated to the farmers by on-farm demonstrations so that other farmers can join the save water campaign. Ensuring the adoption of these technologies by farmers in the state can certainly help sustain the soil and water resources.

RESULTS

Irrigation scheduling

Irrigation has played a key role in increasing and sustaining agricultural production in Punjab. Various irrigation schedules have been developed by the scientists of Punjab Agricultural University to ensure more economical use of irrigation water without any loss of yield. Irrigating the crops based on these irrigation schedules saves substantial amount of irrigation water compared to the conventional method of irrigation.

Wheat crop should be sown after a heavy pre-sowing irrigation except when it follows rice.

Table 1: Irrigation water applied and grain yield of wheat crop in relation to scheduling of irrigation

S. No.	Farmer	Village	Recommended schedule		Farmers practice	
			Irrigation water applied (cm)	Grain yield (kg/A)	Irrigation water applied (cm)	Grain yield (kg/A)
			Year 2005-2006			
1	Satnam Singh	Mehatpur	30	1640	37.5	1655
2	Ravinder Singh	Mehatpur	30	1705	37.5	1695
3	Jasbir Singh	Jatpur	30	1920	37.5	1915
4	Teja Singh	Jatpur	30	1640	30	1665
5	Vijay Kumar	Mal Majara	30	1590	30	1565
			Year 2006-2007			
6	Paramjit Singh	Kondla	15	1680	22.5	1655
7	Jaswinder Singh	Jatpur	15	1740	15	1755
8	Satnam Singh	Mehatpur	15	1710	22.5	1695
			Year 2008-2009			
9	Joginder Singh	Dansiwal	30	1480	37.5	1500
10	Om Singh	Satiana	30	1980	37.5	2030
11	Paramjit Singh	Harta	30	1490	30	1520
12	Parminder Singh	Rajpur Bahia	30	1480	37.5	1510
	Mean		26.25	1671	31.25	1680

First irrigation should be relatively light and given after three weeks to October sown crop and after four weeks to the crop sown later. The subsequent irrigations are also determined by the date of sowing. If the wheat is sown up to 21st November, the second irrigation is given 5-6 weeks after 1st, 3rd irrigation after 5-6 weeks of 2nd and 4th irrigation 4 weeks after 3rd irrigation. For crop sown between 22nd November and 20th December, the second irrigation is recommended 5-6 weeks after 1st, 3rd irrigation after 3-4 weeks of 2nd and 4th irrigation after 2 weeks of 2nd irrigation. For crop sown after 21st December, 2nd irrigation is to be applied after 4 weeks of 1st irrigation, 3rd irrigation after 3 weeks of the 2nd and 4th irrigation after 2 weeks of 3rd irrigation. These irrigation dates are to be adjusted as per rainfall. For the crop sown after December 5, continue irrigation up to April 2010.

Twelve on-farm demonstrations were conducted on farmers' fields to demonstrate the effect of recommended irrigation schedule as compared to the farmers' practice of irrigation. Results indicate that there is water saving up to 33% in wheat with average of 16% saving by following recommended irrigation schedule (Table 1).

About 2/3rd of irrigation water in Punjab is used for rice cultivation. It is common notion among the farmers that ponding water in rice fields helps in getting higher crop yields. Based on the research experiments it has been observed that the standing water may be maintained only for the first 15 days after transplanting. Thereafter, the irrigation water may be applied 2 days after the complete disappearance of ponded water from the fields. Demonstrations were conducted on the farmers' fields for showing this effect. Results indicate that this practice alone can save up to 58% irrigation water in rice (Table 2).

Tensiometer based irrigation in rice

Irrigation interval of 2 days is recommended for paddy after continuous flooding for 15 days. But this irrigation interval of 2 days may get

Table 2: Irrigation water applied and grain yield of paddy crop in relation to scheduling of irrigation

S. No.	Farmer	Village	Recommended schedule		Farmers practice	
			Irrigation water applied (cm)	Grain yield (kg/A)	Irrigation water applied (cm)	Grain yield (kg/A)
			Year 2009			
1	Jasvir Singh	Jatpur	45	2640	67.5	2590
2	Iqbal Singh	Dhadiala	45	2470	75	2420
	Mean		45	2555	71.25	2505

reduced or prolonged depending upon the type of soil and atmospheric conditions. Keeping in mind the scientists have developed a simple, farmer-friendly and cheap instrument called "Tensiometer" which when inserted into the soil indicates the soil water status. This tensiometer displays a three-colour strip on the outer tube of the tensiometer. In case the water level inside the inner tube remains within the green strip, there is no need to irrigate the rice fields. The irrigation to rice is recommended when the water level in the inner tube just crosses the green strip and enters the yellow strip. The research experiments have shown that the irrigation to rice crop on the basis of tensiometer results in reduction in the amount of irrigation water to the extent of 20-25 per cent from that in 2-day irrigation interval. Farmers' field demonstrations were conducted and it was observed that the saving of water using tensiometer varied from 0 to 50% depending on the rainfall distribution and other factors with average saving being about 24% (Table 3).

This instrument is the invention of Punjab Agricultural University and is available at a nominal cost.

Improved irrigation methods

To overcome the problem of aeration due to excessive irrigation or heavy rains in less permeable fine textured soils and to improve the efficiency of applied water, it has been recommended to grow crops like wheat, sunflower, chillies, potato and chickpea etc. on raised beds.

Table 3: Irrigation water applied and grain yield of paddy crop by applying irrigation using tensiometer

S. No.	Farmer	Village	Irrigation using tensiometer		Farmers practice	
			Irrigation water applied (cm)	Grain yield (kg/A)	Irrigation water applied (cm)	Grain yield (kg/A)
			Year 2006			
1	Iqbal Singh	Dhadiala	45	2640	75	2590
2	Gurinderjit Singh	Bassi Jalal	45	2472	90	2420
			Year 2008			
3	Gurdeep Singh	Mehtiana	45	2710	60	2680
4	Tarsem Singh	Mehtiana	60	2580	82.5	2490
			Year 2009			
5	Gurdeep Singh	Mehtiana	90	2710	97.5	2740
6	Harjit Singh	Mukhliana	97.5	2820	97.5	2800
	Mean		63.75	2655	83.75	2620

Demonstrations were conducted at farmers fields for showing the effect of raised beds on potato yield and water saving. The results indicate that bed planting not only saves irrigation water but also improves the tuber yield of potato (Table 4).

Land leveling through laser technique is a proven technology that is highly useful in conservation of irrigation water as 20-25% of irrigation water is lost because of poor farm designing and unevenness of the fields. The laser leveling saves 25-30 % of irrigation water, improves crop yields, increase effective farm area and reduce farm operations time. Results of the demonstrations conducted at farmers fields show that laser leveling of land saved 10-20% irrigation water in different crops (Table 5).

Small plot size also saves irrigation water and for efficient use of irrigation water in wheat, farmers are advised to make 8 plots per acre in heavy textured soils and 16 plots in light textured soils. Furrow irrigation system in wide spaced crops like maize, cotton etc. may save 25-40% irrigation water as compared to flat method of irrigation. Drip method of irrigation require very low amount of water and is being used successfully in orchard plantations.

Cultural practices

Paddy straw residues are usually burnt in the field causing atmospheric pollution. Application of this straw as mulch during early growth period of various crops like maize, sugarcane, chillies, autumn potato, moong etc. could save 7-34 cm of water and improves crop yields also. Demonstration was conducted on the farmers field and the results indicate that mulching leads to yield increase by about 9% and irrigation water saving by 25% (Table 6).

Table 4: Tuber yield of potato (t/ha) under different methods of planting

S. No.	Farmer	Village	Bed planting	Ridge & furrow planting
			Year 2007	
1	Kabul Singh	Satiana	12.5	12.6
2	Om Singh	Satiana	12.8	12.2
3	Ranjit Singh	Dhehpur	18.1	16.8
4	Ramji Singh	Pandori	23.2	21.1
	Mean		16.65	15.67

Table 5: Effect of laser levelling of land on water saving

S. No.	Name	Village	Rabi crop	Water saving	Kharif crop	Water saving
			Year 2009		Year 2009-2010	
1	Jaswant Singh	Mukhliana	Wheat	15%	Paddy	20%
2	Jaswinder Singh	Mukhliana	Wheat	10%	Paddy	15%
3	Harjit Singh	Mukhliana	Berseem	15%	Paddy	20%
4	Manpreet Singh	Mukhliana	Wheat	15%	Paddy	22%
5	Deeppal Singh	Mukhliana	Wheat	18%	Paddy	20%
6	Iqbal Singh	Phuglana	Potato	15%	Paddy	15%
7	Om Singh	Satiana	Potato	18%	Maize	15%
		Mean		15%		18%

Transplanting method of planting crops saves water in some crops as compared to direct sowing. For example in sunflower to realize higher yield and to save irrigation water, its sowing should be done by the end of January. But when sowing is likely to be delayed to second fortnight of February, the crop should be raised by transplanting the nursery. It saves irrigation water. Demonstration trials were conducted on farmers fields and the results indicate that transplanting of sunflower saved about 24% irrigation water although the grain yields remained the same (Table7).

Tillage and inter-culture also improves water availability in crops by suppressing weed flora and improving soil environment. Optimum time of sowing is also helpful in efficient utilization of irrigation water. Crop diversification also helps in proper utilization of water resources.

If the technologies, which have been demonstrated in the farmers' fields, are properly extended to other areas may lead to higher water use efficiencies and higher productivity.
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Table 6: Effect of mulching on water saving in chillies

S. No.	Farmer	Village	Mulch + 9 irrigations		No mulch + 12 irrigations	
			Year 2006			
			Green chillies yield (kg/acre)	Water use (cm)	Green chillies yield (kg/acre)	Water use (cm)
1	Dilbag Singh	Bheelowal	6910	67.5	6350	90

Table 7: Grain yield and water saving in sunflower by raising crop through transplanting

S. No.	Farmer	Village	Transplanting		Direct sowing	
			Grain yield (kg/acre)	Water use (cm)	Grain yield (kg/acre)	Water use (cm)
			Year 2005-2006			
1	Jasvir Singh	Jatpur	733	45	680	60
2	Rupinderjit Singh	Mehatpur	1040	52.5	1093	67.5
	Mean		886.5	48.75	886.5	63.75