

Working with Water in Cotton; Developing Water Scouting Strategies at Farm Level

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Abstract Irrigation has been described as one of the most subsidized activity in the irrigated agriculture in Pakistan. The farmer's thinking about the canal water is as, a free commodity. The farmers observed the scheduled irrigation on weekly basis in cotton without knowing the cost and its impact on cotton crop. This study was conducted to empower the farming communities in developing and adoption of water scouting strategies at farm level in cotton ecosystem which resulted in enhanced water use efficiency and the number of irrigations was cut down up to 33.4% without affecting the seed cotton yield.

Keywords Cotton, Farming Community, Water Scouting

1. Introduction

The significance of protecting the water resources around the globe cannot be overstated. In environmental terms, water is the life blood of the planet. Without a steady supply of freshwater, all life, including human would cease to exist. In 1994, the General Assembly of the United Nations forced the international community in resolution 49/103 to put food and agricultural development high on the development agenda and to mobilize resources at national, bilateral and multinational levels in support of sustainable agriculture and food security in developing countries. The General Assembly recognizes that availability of freshwater resources is the prerequisite for economic growth and sustainable development in developing countries. [1].

FAO's recent report on World agriculture: towards 2015/30 highlighted that global food production will need to increase by 60% to overcome nutrition gaps, deal with the population growth and accommodate changes in diets over the next three decades. Water withdrawals for agriculture are likely to increase by some 14% in that period, representing an annual growth rate of 0.6%, down from 1.9% in the period 1963-1999. Much of the increase will take place on irrigated land, forecast to expand globally from some 2 million sq. km to 2.42 million sq. km. In developing countries, water use

efficiency in irrigation is expected to grow from an average 38% to 42% [2].

Pakistan, a water-surplus country in the past, is now a water-deficit country. The per capita water availability in Pakistan is about 1,038 cubic meters and below 1,000 cubic meters is a state of chronic water stress. Table 1 gives the comparison of per-capita water availability in some selected countries of the world including Pakistan [3].

Table 1. Per Capita Water Availability in Selected Countries (cubic meter).

Country	1955	1990	2025
China	4,597	2,427	1,818
Mexico	11,396	4,226	2,597
Philippines	13,507	5,173	3,072
Iraq	18,441	6,029	2,356
USA	14,934	9,913	7,695
Pakistan	2,490	1,672	837

Source: Population Action International, 1997

Pakistan's situation indicates that the country is nearing conditions of chronic water stress. The extended drought during the recent years reduced the freshwater supplies of the country, which has highlighted the importance of adopting water conservation measures for extremely judicious use of the finite quantity of water.

Cotton is the high delta crop after rice and sugarcane and it takes the biggest share of freshwater in the cotton growing areas [4].

This study was conducted to develop innovative water management tools at farm level and empower the farming communities in efficient use of water resources in cotton ecosystem.

2. Objectives

1. To develop water scouting strategies at farm level.
2. To identify and adopt the sustainable water management practices with long term benefits for

water resources.

- To empower the farming community in the rationale use of water in cotton.

3. Methodology

One Training of Facilitator (ToF) comprising of 31 participants based at Vehari and 12 Farmer Field Schools (FFS) each having 20-25 farmers, were established in the Vehari, Burewala and Mailsi tehsils of district Vehari. Twenty-eight ToF participants were Field Assistants of the district agriculture extension department, two were from the Caritas Pakistan (NGO) and one was the MSc Agriculture student. The ToF participants were divided in to six working groups (each group comprising five ToF participants). The groups were named as;

- Khushal group
- Moawan group
- Zardad group
- Zarkhaiz group
- Neghaban group
- Dehqan group

Two cotton plots were selected at Govt. Seed Farm Vehari, one farmer practice (FP) and the other Integrated Water Management (IWM) plot.

All the inputs regarding irrigation, fertilizer, agronomic practices and pest management decisions in the IWM plot were maintained by the ToF participants. The irrigation requirements of the IWM plot was observed on the basis of when to irrigate? keeping in view the water scouting strategies (developed by the farmers and trainer during the brainstorming session) as follows;

- The cotton leaves showing water stress at 9-10 a.m.
- Less soil moisture near the cotton plant below 5-6 inches.
- Flower appearance at the top portion of the cotton plant.
- Inter-nodal distance of the cotton plant decreases.
- Reddish / pinkish streak on the main stem reaches 5-6 inches below the top during early growing season.
- The upper tender shoot of cotton plant does not break up easily.

The threshold of these water scouting strategies was observed as; when three of the above stages reached, the cotton field should be irrigated (Groups decision).

At each FFS site two cotton plots (FP and IWM) were selected. The IWM plot was maintained (in irrigation, fertilizer, agronomic practices and pest management) by the FFS participating farmers while the FP plot was maintained by the concerned farmer through conventional crop management techniques.

4. Farmer and Experimentation

Farmer and science is the experiential learning by the farming communities. Farmer is a scientist who does experiments regularly since he is in farming, at his own farm on various aspects of agricultural activities. When a question was asked to the farmers; do they know any impact of water on cotton crop? the answer was yes. If there is less irrigation, the crop dried up and ultimately less yield, and if apply water regularly then there is more yield. They were asked how we could save water in cotton. The answer was if we cultivate on bed and furrow and irrigate at proper time. Then they were asked how they knew the water saving in bed and furrow and proper time of irrigation. The answer was less time for irrigation in bed and furrow as compared to flat/line sowing, having the same source of irrigation (canal / tube-well) in both cases. And about the proper time of irrigation (when to irrigate), they don't have any answer. Now to setup the easy understandable water trial, the farmers were facilitated in;

- When to irrigate by following the water scouting strategies.
- Just to keep the watch in their hands at the time of irrigation to IWM plot and find out the time of water application from the same source of irrigation either the plot was planted on bed and furrow or in flat/line sowing.

5. Results

In the IWM plots, managed by the participating FFS farmers at all the sites, the irrigation application decisions were made by following the water scouting strategies while the irrigation application decisions in the FP plots were made by the concerned farmers (non FFS participating farmer). The detail of irrigation applications and seed cotton yield in the IWM and FP plots at all the FFS sites in Vehari are presented in Fig. 1 and Fig. 2 respectively.

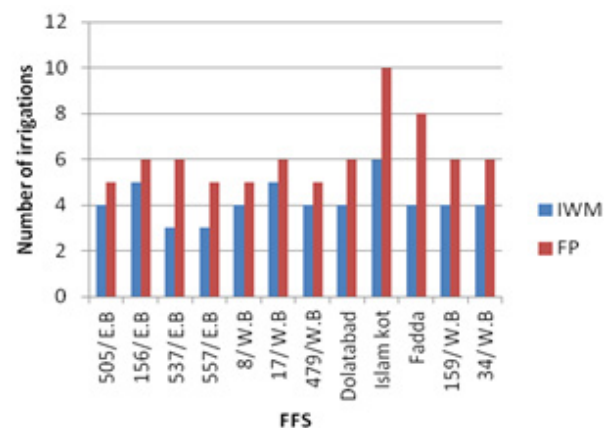


Figure 1. Number of irrigations in FFS plots at Vehari

The results showed that the number of irrigations in all the FP plots were high as compared to the IWM plots where the water scouting strategies were adopted. In the FFS, Islam Kot and 479 /E.B, where both the IWM and FP plots were planted on bed and furrow, the number of irrigation

applications were six and four in the IWM plots respectively while in the FP plots it were ten and five respectively. In the FFS Fadda the IWM plot was planted on bed and furrow while the FP plot was line/flat sown. The number of irrigations in the IWM plot was four while eight in the FP plot.

In the FFS Islam Kot where both IWM and FP plots were planted by bed and furrow method, the yield in both the plots was almost same even by applying more irrigations and pesticides in the FP plot. In the FFS site at Fadda where the IWM plot was planted on bed and furrow while the FP plot was line/flat sown the yield was high (80kg more) in the FP plot than the IWM plot. The number of irrigations was more in the FP plot than the IWM plot. In Dolat abad both the IWM and FP plots were line/flat sown, the cotton yield was high (70kg more) in the IWM plot than the FP, even by applying more number of irrigations.

The benefit / cost ratio is presented in Table 2 and it was

observed that in all the IWM plots, the benefit/cost ratios were higher than the FP plots even by applying more number of irrigations and other farm inputs.

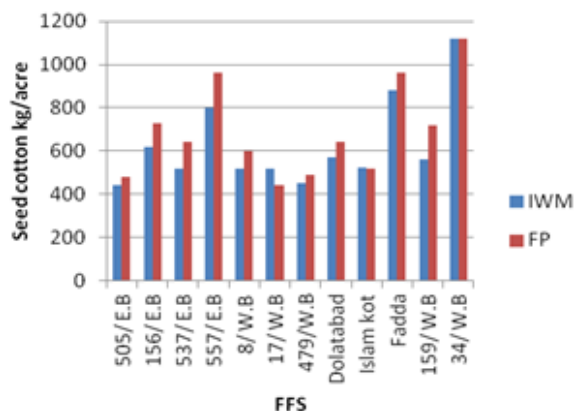


Figure 2 . Seed cotton yield in FFS plots at Vehari

Table 2. Cost (on acre basis) of different farm inputs, net income and benefit cost ratio of the IWM and FP plots in FFS at Vehari based on the number of irrigations.

FFS	Plot	Irrigation cost*	Spray Cost **	Agronomic practices & fertilizer cost	Total cultivation cost	Income***	Net income	Benefit/cost ratio
505 /E.B	IWM	1600	300	1800	3700	14080	10380	3.80
	FP	2400	1500	1800	5700	15360	9660	2.69
156 /E.B	IWM	2000	1200	1800	5000	19840	14840	3.96
	FP	2400	2400	2100	6900	23360	16460	3.38
537 /E.B	IWM	1200	900	1700	3800	16640	12840	4.37
	FP	2400	1800	1800	6000	20480	14480	3.41
557 /E.B	IWM	1200	900	2400	4500	25600	21100	5.68
	FP	2000	2400	3200	7600	30720	23120	4.04
8 /W.B	IWM	1600	-	1800	3400	16640	13240	4.89
	FP	2000	900	2600	5500	19200	13700	3.49
17 /W.B	IWM	2000	900	2400	5300	16640	11340	3.13
	FP	2400	1500	2400	6300	14080	7780	2.23
479 /E.B	IWM	1600	900	2000	4500	14432	9932	3.20
	FP	2000	1500	2000	5500	15680	10180	2.85
Dolatabad	IWM	1600	900	2500	5000	18240	13240	3.64
	FP	2400	1200	2500	6100	20480	14380	3.35
Islam Kot	IWM	2400	600	1600	4600	16800	12200	3.65
	FP	4000	1200	2000	7200	16640	9440	2.31
Fadda	IWM	1600	900	3000	5500	28160	22660	5.12
	FP	3200	2400	3400	9000	30720	21720	3.41
159 /W.B	IWM	1600	600	2800	5000	17920	12920	3.58
	FP	2400	1800	2800	7000	23040	16040	3.29
34 /W.B	IWM	1600	900	3500	6000	35840	29840	5.97
	FP	2400	2100	3500	8000	35840	27840	4.48

*Per irrigation cost: Rs 400 / acre, **Per spray cost Rs: 300/acre, ***Seed cotton value: Rs 32/ Kg

6. Conclusion

The benefit / cost ratio was higher in all the IWM plots (managed by the FFS farmers) at all FFS sites as compared to Farmer Practice plots even by applying more number of irrigations and pesticides. The significant achievements were;

- About 250-300 farmers and thirty-one technical staff (Field Assistants and NGOs people) were empowered in water conservation strategies in cotton particularly at Vehari during the cropping season.
- The number of irrigations was cut down to 33.4% respectively in IWM plots in the overall twelve FFS sites in Vehari.

The capacity building of the farming community in water scouting strategies and the adoption of innovative water management tools in cotton ecosystem can enhance the water use efficiency and conserve the water resources for the future.

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