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Research Article

Water saving irrigation interventions at small farms of district Faisalabad: Implications for Food, and Agriculture

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Abstract

Wheat is a staple food crop of Pakistan and grown on about 8 million hectares every year in *Rabi* (winter) season fallowed by rice and cotton in rice-wheat and cotton-wheat systems, respectively. It is, imperative to enhance wheat yield by encouraging farmers, predominantly small farmers, to grow more wheat with efficient and judicious use of land and water resources to face ever increasing of Pakistan. A list of 25 watercourses was separately prepared duly authenticated by water management officer, where maximum water saving interventions was applied. Ten improved watercourses where maximum (5 or 6 out of 10 water saving irrigation interventions) was found applied. These were selected by using Randomizer.com pathway from each Tehsil, thus total 30 improved watercourses were taken. 9 small farmers (having landholding<12.5 acres) were selected randomly, 3 from Head, Middle and Tail respectively from each watercourse. Thus 270 small farmers (having landholding<12.5 acres) were selected regarding Head, Middle and Tail. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize different variables. Data shows that 41.9 % respondents adopted bed –furrow method out of them 22.2 % have adopted this method since the year 2001-2005 and 38.9% respondents have sow wheat by bed- furrow method on up to 4-6 acres of them and 18.9 % have sown wheat 4-6 acres without bed-furrow, 17.0 % were getting yield 36- 45 munds without bed-furrow where as only 28.9 % were getting yield 36 - 45 munds on bed-furrow. Overall the results of the data show that adoption of the water saving irrigation interventions increase the wheat yield which enhances the income of the respondents. Furthermore the adoption of water saving irrigation interventions also affected upon the food, agriculture and nutritional level of the respondents.

Keywords: Water saving, Interventions, Food, Agriculture,

Introduction

Wheat (*Triticum aestivum L.)* being the main staple food of country's population and largest grain crop of the country is at premium. As far as its contribution to the value added in agriculture and GDP is concerned it is 14.4% and 3.0%, respectively. It is grown in a diversity of agro-climatic conditions. The area in Pakistan where it is grown lies between 23^0 N to 37^0 N, 61^0 E to 76^0 E and almost 2500 m above sea level. Generally, the climate of wheat producing areas is largely arid and semi-arid to dry temperate. Area and production target of wheat for the year 2006-07 were set at 8459 thousand hectares and 22.5 million tons, respectively. It was cultivated on an area of 8494 thousand hectares; it shows that the production was increased 10% as compared to last year's. The production of the crop is estimated at 23.52 million tons which is 4.0% higher than the target Govt. of Pakistan, (2007). Wheat was cultivated on an area of 8494 thousand hectares, showing 1.0 percent increase over last year and 0.4 percent increase over the target.

Chaudhry and Qureshi (1991) recorded the highest water saving of 30% in furrow-bed method compared

with flat border method of irrigation. This study was, therefore, designed to compare three different furrow sizes keeping the same size of 60cm wide bed for wheat crop in order to find out the proper furrow size for wheat crop for maximum yield and WUE. The findings of this study are very helpful to researchers working in the field of water management and policy makers and especially to the farmers who are growing wheat crop in limited amount of water supply. Gupta (2002) made yield comparison for several diverse crops planted on beds and irrigated in furrows with conventional flat planting and flood irrigation in farmer fields in India. In all cases yields were higher and considerable irrigation water was saved with bed planting. Agriculture is the mainstay of Pakistan's economy. It is because of the fact that most of the population of the country is living in rural areas and the people living in rural areas are related directly or indirectly to agriculture as they get all the necessities of life through it. The yield level at the same time is below than the potential of our existing wheat varieties and needs of the population. So, officials suggested that growers should take steps to increase production of the commodity because food consumption is increasing all over the world day by day. The prevalent situation is very serious and have spread all over the world but the ray of hope is in better crop management especially by increasing by and outlook issued by the food and Agriculture Organization (FAO) that the global wheat utilization has reached 619 million tones in 2007-08 (FAO, 2008).

Ahmad *et al*. (1995) conducted experiment using seed rates of 40, 60, 80,100 and 120 kg/ha and reported that seed rates significantly affected most of the characters. Numbers of spike, harvest index and 1000-grains weight was decreased with the increase in seed rate. The highest grain yield was obtained at seed rate of 120 kg/ha. Tehseen (1996) found that most of the respondents were either not aware or not interested in come of the very important recommendations like improved varieties, seed treatment, motivator use of phosphorus and potash, weedicide control measures of insect pest/diseases etc. As a result of this, such respondents were getting significantly low yield as compared to those who had adopted the recommendations fully. He also suggested that the extension wing of Agriculture Department should focus on educating the farmers regarding wheat cultivation. Ahmad (1997) revealed that majority of the respondents (76%) used chemicals methods to control weeds. He also found that age and education of the respondents had significant association with per acre average of wheat crop. He further revealed that farmers contact with change agents had significant effect on the high yielding varieties. Akhtar (1997) revealed that simple majority of the respondents (53%) fell in the age group of 36-50 years. Majority of the respondents i.e. (82%) used improved varieties of wheat. Majority of the respondent (90.7%) got information about improved varieties of wheat crop from fallow farmers. He also found that age and education had non-significant effect on the adoption of high yield varieties and per acre average yield of wheat crop. Size of land holding had a significant effect on the per acre average yield of wheat crop. The evidence is accumulating that increase in yields of rice, wheat and other crops have started slowing down in the high potential agricultural areas of Pakistan. The factors that installed the Green Revolution are; mining of soil nutrients, declining organic matter, increasing salinity, fluctuating water tables, and buildup of weed infestation and pest population. Another important element in stagnation of productivity could be traditional way of cultivation leading to heavy tillage. Also population of Pakistan is increasing at an annual rate of over two percent projected population in 2012/13 is 195.1 millions and wheat requirements are 24661 tons Kahloon and Majeed (2004). These conflicting realities i.e. declining rate of production and increasing population growth are of course very serious concerns. Moreover, inputs use compared to other countries with similar conditions. Similarly, the input use efficiency for wheat is almost double in India than Pakistan.

It is, therefore, warrens adopting such technologies that offer effective and efficient utilization of natural resources for crop production. Luckily, productivity enhancement technologies exist that do not pose any threat to natural resources. The present study was therefore was conducted to estimate the increase in wheat yield as a result of the adoption of water saving interventions under the prevailing conditions of Faisalabad, Pakistan.

Materials and Methods

As district Faisalabad has maximum small holding of 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 are working under different faculties (Government of Pakistan, 2010). 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 impact of the water saving irrigation technologies a tehsil wise list of improved watercourse was collected from the office of the District Officer Water Management Faisalabad the study was conducted in last 2010. Then with the coordination of Deputy District officer water Management, researcher himself worked out the total applied water saving irrigation interventions on each improved water course. A list of 25 watercourses was separately prepared duly authenticated by water management officer, where maximum water saving interventions was applied. Thus ranking was made and ten improved watercourses where maximum (5 or 6 out of 10 water saving irrigation interventions) was found applied, were selected by using Randomizer.com pathway from each tehsil, thus total 30 improved watercourses were taken where maximum water saving irrigation interventions was applied. From these 30 watercourses 9 small farmers (having landholding<12.5 acres) were selected randomly, 3 from Head, Middle and Tail respectively. From these 30 watercourses, 270 respondents were selected randomly and uniformly from head, middle and tail. Thus 270 small farmers (having landholding<12.5 acres) were selected regarding Head, Middle and Tail. Researcher himself with the help of well-educated agri. graduates collected the data from the randomly selected respondents. The data was collected with the help of validated interview schedule.

Results and Discussion

The objective of this study was to estimate the increase in wheat yield as a result of the adoption of water saving interventions. An attempt has been made to discuss, analyze and interpret relevant data in order to draw pertinent conclusions and formulate appropriate suggestions in the light of the study results. These suggestions may prove helpful in developing strategy to enhance wheat production in Pakistan

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Table 1: Distribution of the respondents according to wheat sowing in this area before water course improvement

Wheat sowing in this area before water course improvement	**No.**	**Percentage**
Yes	270	100.0
No	-	-
Total	270	100.0
Area of sown wheat (acres)		
Up to 3	39	14.4
4-6	209	77.4
7 and above	22	8.2
Total	270	100.0
Production of wheat (munds)		
Up to 35	71	26.3
36-40	78	28.9
Above 40	121	44.8
Total	270	100.0

Table 4.20 shows that 77.4 % respondents were sowing wheat on 4-6 acres before water course improvement and 44.8 % were getting yield above 40 munds of wheat, before watercourse improvement.

Table 2: Distribution of the respondents according to wheat sowing in this area after water course improvement

Wheat sowing in this area after water course improvement	**No.**	**Percentage**
Yes	270	100.0
No	-	-
Total	270	100.0
Area of sown wheat (acres)		
Up to 3	24	8.9
4-6	228	84.4
7 and above	18	6.7
Total	270	100.0
Production of wheat (munds)		
Up to 35	18	6.7
36-40	125	46.3
Above 40	127	47.0
Total	270	100.0

Comparison between wheat productions (in munds)

	Minimum	**Maximum**	**Mean**	**Std. Deviation**
Production of wheat before watercourse improvement	25	46	39.86	3.95
Production of wheat after watercourse improvement	26	46	40.60	3.50

Table 2 shows that 84.4% respondents were sowing wheat on 4-6 acres after water course improvement and 46.3 % were getting yield 36-40 munds of wheat. The results are almost similar with the findings of Khan (1997) and Akhtar (1997). In this regard comparison of before and after watercourse improvement shows that there is increase in wheat sowing area and wheat yield after watercourse improvement. The results are almost supported by Ali (1983) and Ahmad (1997) with 20 % increase in cropping intensity and 15 % increase in wheat yield.

Table 3: Distribution of the respondents according to improved farm layout

Do you have an improved Farm layout	**No.**	**Percentage**
Yes	270	100.0
No	-	-
Total	270	100.0
Year of improved far layout		
Up to 1980	154	57.0
1981-1990	56	20.8
2006-2010	60	22.2
Total	270	100.0
And how much area did you improved of farm layout? (acres)	**No.**	**Percentage**
1-3	68	25.2

4-6	193	71.5
7 and above	9	3.3
Total	270	100.0
Did you sow wheat in this area before improved Farm layout?		
Yes	270	100.0
No		
On how many acres did you sown wheat (acres)		
Up to 3	33	12.2
4-6	214	79.3
7 and above	23	8.5
Total	270	100.0

Table 3 shows that entire respondents were of the view that they have Improved their farm layout and 57.0 % were of the view that have Improved their farm layout in the year up to 1980, where as 71.5 % respondents were of the opinion that they have improved their farm layout for 4-6 acres. Furthermore Table shows that 79.3 % respondents were sowing wheat on 4-6 acres before improved farm layout.

Table 4: Distribution of the respondents according to wheat sowing in this area after improved farm layout

Did you sow wheat in this area after improved farm layout?	**No.**	**Percentage**
Yes	270	100.0
No	-	-
Total	270	100.0
And how much area (acres)		
Up to 3	30	11.1
4-6	152	56.3
7-12.5	88	32.6
Total	270	100.0

Yield(munds)	**Before**		**After**	
	No.	%	No.	%
Up to 35	72	26.7	59	21.9
36-40	85	31.5	57	21.1
Above 40	113	41.9	154	57.0
Total	270	100.0	270	100.0
	Mean = 39.07, S. D. 5.35		**Mean = 40.70, S. D. = 4.10**	

Table 4 shows that 56.3 % and 32.6 % were of the opinion that they have sown wheat in improved farm layout in 4-6 and 7-12.5 acres after improved farm layout respectively. Table shows that the 31.5% and 21.1 % respondents were getting yield 36-40 munds of wheat, whereas 41.9 % and 57.0 % respondents were getting yield above 40 munds before and after improved farm layout respectively. The results are almost in concomitant with the findings of PIDA (2004) and Rasheed (2005.)

Table 5: Distribution of the respondents according to make laser land levelling

Did you sow wheat in this area before Laser land levelling?	**No.**	**Percentage**
Yes	270	100.0
No		
On how many acres did you sow wheat?		
Up to 3	80	29.6
4-6	187	69.3
7 and above	3	1.1
Total	270	100.0
Yield before Laser land levelling		
Up to 35	35	13.0
36-45	124	45.9
Above 45	111	41.1
Total	270	100.0

Mean yield before laser land level = 39.89, S. D. =3.55

Table 5 show that entire respondents were of the view that they adopted Laser land levelling and 84.4% respondent were have laser land levelling from the year 2000-2005 and 68.1 % respondents have laser land levelling on 4-6 acres and 45.9 % respondents getting yield 36-45 munds before laser land levelling. These results are in line with the findings of Sharif (1990) and Khan (1997).

Table 6 Distribution of the respondents according to after laser land leveling

Did you sow wheat in this area after Laser land levelling	**No.**	**Percentage**
Yes	270	100.0
No	-	-
On how many acres did you sow wheat		
Up to 3	77	28.5
4-6	182	67.4
7 and above	11	4.1
Total	270	100.0
Yield after Laser land levelling		
Up to 35	29	10.7
36-45	86	31.9
Above 45	155	57.4
Total	270	100.0

Mean yield after laser land levelling = 40.93 Std. Dev. = 7.70

Table 6 show that 67.4% respondents were of the opinion that they have laser land levelling on 4-6 acres whereas 31.9% respondents were getting yield 36-45 munds and 57.4% respondents were getting yield above 45 munds, which shows that there is increase wheat sowing area as well as yield after laser land levelling specially in above 45 munds category. These results are in accordance with the findings of Mahmood and Ahmad (2005).

Table 7: Distribution of the respondents according to grow wheat in bed –furrow Method

Did you sow wheat in this area without bed –furrow Method?	**No.**	**Percentage**
Yes	113	41.9
No	157	58.1
On how many acres did you sow wheat? (acres)		
Up to 3	24	8.9
4-6	51	18.9
7 and above	38	14.1
NA	157	58.1
Total	270	100.0
What was the yield without bed –furrow Method		
Up to 35	67	24.8
36-45	46	17.0
Above 45	113	41.9
NA	157	58.1
Total	270	100.0
	Mean = 34.55, S. D. = 2.91	
What was the average yield mund/acre in bed –furrow Method?		
Up to 35	19	7.0
36-45	78	28.9
Above 45	16	5.9
NA	157	58.1
Total	270	100.0
	Mean = 38.22, S. D. = 2.83	

In Table 7 the respondents were distributed according to grow wheat in bed-furrow method. Table shows that 41.9 % respondents adopted bed –furrow method out of them 22.2 % have adopted this method since the year 2001-2005 and 38.9% respondents have sow wheat by bed- furrow method on up to 4-6 acres of them and 18.9 % have sown wheat 4-6 acres with out bed-furrow, 41.9 % were getting yield above 45 munds without bed-furrow where as only 5.9 % were getting yield above 45 munds on bed-furrow. Mean and S.D of wheat yield before and after bed furrow were 34.55, 2.91 and 38.22, 2.83, respectively which shows more than before bed – furrow. Khurshid and Chuahdry (1990) and Jamshad (1998) concluded that in this method of water was more saved as compare to flood irrigation.

Conclusion

Majority of respondents adopted water saving irrigation interventions like watercourse improvement, improved farm layout, laser land levelling and bed-furrow method data show that water saving irrigation interventions enhance crop area and wheat yield which shows positive increase in farm production so useful implications for food, agriculture.

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