

Performance of Two Cultivars of Wheat under Rod-kohi Areas in D.I. Khan

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Abstract: Under an old traditional method of irrigation system flood water is conserved in the specially prepared fields and later used for growing Rabi and Kharif crops. On farm research was conducted during 1996-97 and 1997-98 Rabi crop season to determine the better adoptability of Rawal-87 in the Hathala area of D.I. Khan. Within a 5 km² area, four plots were cultivated with two cultivars of wheat during 1996-97. The same wheat cultivars were planted in ten plots during 1997-98 in the Hathala target area. The plots cultivated with the improved variety had significant high quantity of water. Plant height of tillers of improved variety was smaller compared to local variety. Spike length of the improved variety was higher as compared to local variety. The comparison of Rawal-87 plots with local variety like Persabaq-85 was studied. Among these, the yield of Rawal-87 (improved variety) was higher as compared to local and Persabak-85 (graded varieties). While dry matter yield of local variety was higher as compared to improve variety due to greater plant height.

Key words: Soil moisture, water conservation, irrigation system, wheat, dry matter yield

Introduction

The Rod Kohi irrigation system which is practiced in D.I. Khan has a great potential for increasing the agricultural produce in the country. The Rod Kohi system is used for the irrigation done in the piedmont plains and beyond that in flat areas from the water channel emending from the mountains of Suleman Range and Waziristan Range. It comprises the accumulation of flood water received through heavy rains during monsoon (July and August). The floods of low intensity also originate in the months of March and April due to rains of low intensity. The flood water is diverted and stored in the fields varying in area (3-12 ha) by constructing 1-2 meter high earthen dikes (bunds) all around. The stored water percolates down the soil profile and is conserved till sowing time.

The climate of Rod Kohi area is and to semi and with precipitation occurring in the monsoon and spring season. Annual precipitation varies from 130 to 360 mm. June is warmest month with a mean maximum temperature of 41 °C (Ahmad, 1990). There is a great seasonal variation in the environment due to low humidity, continental location and scarcity of vegetation. January is the coldest month with a minimum temperature of 4 °C. Only in recent years some efforts have been

made related to agricultural production potential of Rod Kohi irrigated lands (Amin, 1990; Khan, 1990; Khan *et al.*, 1994). Introduction of improved crop varieties and the de-modification of tillage practices have been identified as potential to on-farm practices that could increase the agriculture productivity.

Materials and Methods

The experiments were conducted in the farmer's fields at Hathala, target area in the years 1996-97 and 1997-98. They were carried out at different locations with three treatments i.e. sowing of improved variety, graded farmer's variety and non-graded variety. The seeds were sown in 40 × 50 m² plots. The land was prepared in June with disc harrow before the advent of floods each year. Improved wheat varieties i.e. Rawal-87, local Persabak-85 (farmer's graded) and local (non graded) were grown.

The fields were ploughed again with a cultivator and some plots with bullocks in the last week of October or first week of November. Recommended dose of NPK (80-60-0) was applied to the field. Nitrogen was applied in two splits. Half with the sowing and the second half with the first irrigation. The seed rate was 100 kg ha⁻¹. Soil samples were collected and analyzed for their physico-chemical properties (Table 1). The samples were collected before sowing and after harvesting in triplicate per treatment with a king tube to determine the average water (moisture) content each year.

The average rainfall during Rabi season (1996-97 and 1997-98) is presented in Table 2. There was a flood in August during Rabi 1996-97 and a supplementary irrigation on February 24, 1997 was also applied. During 1997-98 the flood occurred in September, 1997. The data regarding the characteristics of soils, average rainfall, plant population, plant height, number of tillers, grain and straw yield, spikes per plant and moisture content of soil were recorded. The data obtained was subjected to statistical analysis according to Steel and Torrie (1980).

Results and Discussion

The results are based on two years (1996-97 and 1997-98) study.

Soil moisture

The soil moisture content of each plot were determined before sowing and after harvesting. The soil percent moisture content of different plots were almost uniform (NS) before sowing as well as after the harvest during 1996-1997. However, a notable decrease in the soil moisture content had been noted at the time of harvesting. During the second year the plots had significantly different soil moisture percentage. The plots with improved variety had significantly high quantity of water content than the graded and non-graded varieties. Data on the various plant characteristics were recorded following on the harvesting of the crops in the last week of April, 1997 and 1998. The data included the following plant population m², plant height at maturity, number of tillers plant⁻¹, spike length, grain yield kg ha⁻¹ and dry matter yield (Table 5 and 6).

Plant population m⁻²

The plant population m⁻² of improved variety was significantly higher as compared to local variety. The rate of germination of improved variety was better as compared to local variety. Non-graded variety has least germination rate in the present study, but it was nonsignificantly different from that of farmers graded variety. It was also observed that the number of plant was higher in the improved variety during crop year 1996-97. It was comparatively higher than the second cropping season (1997-98). It may be due to suitable and almost uniform (non-significant) moisture content of the soil at the time of sowing (Table 5). The favourable moisture content was also provided due to a rainfall at the time of sowing during 1996-97 (Table 2). During 1997-98 there was a lower rainfall than the previous year and therefore a significant difference was also observed in various plots. Which resulted in lower germination percentage resulting lower number of plant m⁻². The results are similar to those of Burnett and Hauser (1967).

Plant height

The plant height of improved variety was smaller as compared to local variety (graded and non-graded) but the plant population m⁻² was greater compared to local varieties (Table 3). Both the characters are desired by the farmers and are helpful to improve the net production. The short stature of the wheat plant helps in reducing the lodging during strong winds (Salem *et al.*, 1983).

Table 1: Physico-chemical characteristics of soils of plots sown with improved, graded and non-graded varieties

Characteristics	Improved variety	Farmer's Graded	Non-Graded
Textural class	Sandy Loam	Sandy Loam	Silt Loam
EC ppm	660.0	1000.0	1000.0
pH	8.40	8.40	8.50
Bulk Density	1.28	1.30	1.18
Organic Matter	1.31	1.154	1.035
N%	0.065	0.057	0.051
P (ppm)	8.00	6.0	9.00
Lime	2050.0	20.50	22.00
Cl ppm	1.40	1.28	1.64
HCO ₃ PPM	0.68	0.64	0.92
Ca + Mg ppm	2.10	3.00	2.30

Table 2: Average rainfall (mm) during the experiment in the area

Month	Rabi 1996-97	Rabi 1997-98
November	Nil	Nil
December	9	4
January	Nil	6
February	Nil	15
March	15	55
April	59	28
Average of whole	(101)	(108)

Table 3: Wheat crop data Rabi 1996-97

Treatments	Plant Height (cm)	Plant population m ⁻²	No. of Tillers plant ⁻¹	No. of spikes plant ⁻¹	Grain yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)
Improved variety	67.7B	52.00A	7.75A	7.00A	4355A	11040B
Farmer's Graded	77.8A	47.75AB	2.75B	2.50B	4024AB	13020A
Fanner's Non-graded	76.0AB	42.50B	2.50B	2.25B	3730B	12015AB

Table 4: Wheat crop data Rabi 1997-98

Treatments	Plant Height (cm)	Plant Population m ⁻²	No. Of Tillers plant ⁻¹	No. of Spikes plant ⁻¹	Grain yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)
Improved variety	62.00B	29.4A	4.4-A	3.9A	2541A	9473B
Farmer's Graded	72.13A	23.7B	2.3B	2.2B	2409A	12380A
Farmer's Non-graded	70.13A	21.8B	2.0B	1.9B	2138B	11933A

Figures sharing different letters are significantly different at P > 0.05

Table 5: Moisture Percentage Rabi 1996-97

Treatments	Before Sowing	After Harvesting
Improved Variety	14.55	9.48
Fanner's Graded	14.19	9.65
Fanner's Non-graded	14.28	8.80
Significance	NS	NS

Table 6: Moisture percentage Rabi 1997-98

Treatments	Before Sowing	After Harvesting
Improved Variety	14.92A	7.21A
Fanner's Graded	13.57AB	6.57AB
Farmer's Non-graded	12.82B	6.36B

Figures sharing different letters are significantly different at P > 0.05

Number of tillers plant⁻¹

Number of tillers of improved variety was higher as compared to local variety. In the year 1996-97, the improved variety plots had 4-8 tillers plant⁻¹. But local variety had 1-3 tillers plant⁻¹. Number of tillers in different varieties was significantly different. A decrease in the tillers had been observed in the second crop season (Table 3 and 4).

Spike length

The average length of spikes of improved variety was significantly higher (P<0.05) compared to local variety. During crop year 1996-97 the spikes were larger probably due to application of supplementary irrigation on February 24, 1997. The availability of the water to the plants ensured better growth of crop especially at the maturity stage. Better moisture percentage (Table 5) during the crop growth helped in the present case. The present results are in accordance with Salem *et al.* (1983).

Grain yield

The grain yield m⁻² was taken randomly. Therefore, grain yield in each treatment was determined. The grain yield of improved variety was higher compared to local variety due to

increase in numbers of tillers as well as large size of spike. It was probably due to better germination and application of supplementary irrigation in the year 1996-97. Better germination and favourable environmental conditions helped the net growth of the plant resulting a significant increase in the grain yield. Average grain yield from 64330 ha in the Rod-Kohi area in D.I. Khan district was 1706 (Allauddin, 1989). In the present study average yield from 4 plots in an area of 5 km² was 4355 kg ha⁻¹ from improved variety (Rawal 87). Even the non-graded variety gave a higher grain yield (3730 kg ha⁻¹) than that of average yield in the area.

Dry matter yield

The agro-ecological conditions in Baluchistan and D.I. Khan are almost same. The straw yield in the Rod-Kohi area is considered very important because wheat straw is extensively used as an animal feed. Sheep, goats and camels graze in the rangeland while cattle, horses and buffaloes depend (60-100 % on the agricultural produce (Khan and Akbar, 1989). A maximum wheat stalk yield (5560 kg ha⁻¹) had been reported by Khan (1990) for Pirsabak-85 variety. We had observed a maximum of 13020 kg ha⁻¹ wheat straw from the same variety (Pirsabak-85). The farmers non-graded variety had also given significantly higher straw yield (12015 kg ha⁻¹). The straw yield of local variety was higher as compared to improved variety due large size of plant. The improved variety was short stature compared to farmers graded and non-significant varieties. Therefore later produced significant higher straw yield.

During Rabi 1997-98 the data recorded had shown a significant decrease in the almost all the growth parameters. Thus it is concluded that the possible reason was the availability of flood water irrigation during the first year. However, during the second year there was no extra water available and the crop may have born a water stress shock which resulted in a significant low yield due to less plant population, tillering and smaller length of the spikes. Under Rod-Kobi system of water conservation, for the irrigation, there will be surety of water availability during the growth of the crop. Therefore, proper irrigation at suitable time and growth stage can improve the production significantly. The selection of better variety may significantly add to the net crop production.

References

- Ahmad, M., 1990. Keynote address. In Rod-Kohi Agriculture. Problems and prospects symposium. Pak. Agril. Res. Council, Islamabad, Pakistan, pp: 3-10.
- Allauddin, K., 1989. Reproduction of cereal crops in Rod-Kohi agriculture in D.I. Khan. In: Rod-Kohi Agriculture Problems and Prospects Symposium. Pak. Agril. Res. Council, Islamabad, Pakistan, pp: 79-84.
- Amin, R., 1990. Improving water management and conservation practice for increased agriculture production in the Arid Zone of D.I. Khan. In Rod-Kohi Agriculture. Problems and prospects symposium. Pak. Agril. Res. Council, Islamabad, Pakistan, pp: 60-64.
- Burnett, E. and V.L. Hauser, 1967. Deep Tillage and Soil-Plant-Water Relationships. In: Proc. Tillage for Greater Crop Production. Am. Soc. Agric. Eng. St. Joseph, Mich., pp: 47-52.

- Khan, H.U., M. Azam, I.U. Awan and M.A. Khan, 1994. Pre-flooding tillage influence on wheat and chickpea production in a semi-arid climate of Pakistan. BOSTID-PARC, Res. Program, BOSTID, National Research Council, Washington D.C., USA.
- Khan, B.R. and G. Akbar, 1989. Sailaba (Rod-Kohi) Agriculture in Balochistan. In: RodKohi Agriculture Problems and Prospects Symposium. Pak. Agril. Res. Council, Islamabad, Pakistan, pp: 85-94.
- Khan, M., 1990. BARD Experiences in Rod-Kohi Agriculture. In: Rod-Kohi Agriculture Problems and Prospects Symposium. Pak. Agril. Res. Council, Islamabad, Pakistan, pp: 98-114.
- Salem, A.H., G.A. Morshed, M.M. El-Ashry and A.A. Ageez, 1983. Studies on gene effect of some quantitative characters (plant height, spike length, spike weight, number of spikes plant⁻¹) in wheat crosses. *Annals of Agric. Sci.*, Moshtohar, Egypt, 19: 1-12.
- Steel, R.G.D. and J.H. Torrie, 1980. *Principles and Procedures of Statistics*. Mc Graw-Hill, New York, USA, pp: 107-109.