

Performance of wheat (*Triticum aestivum*) cultivars under limited irrigation and fertility management

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ABSTRACT

A field experiment was conducted during the winter (*rabi*) seasons of 1986–87 and 1987–88 to study the performance of wheat (*Triticum aestivum* L. emend. Fiori & Paol.) under limited irrigation and fertility management at Kanpur. Three irrigations at crown-root-initiation + late tillering + flowering stages gave higher yield, net return and net return/rupee spent than 1 and 2 irrigations applied at crown-root-initiation and crown-root-initiation + boot stages respectively. The water use was more but the water-use efficiency was less with the 3 irrigations. Fertility level of 60 kg N + 30 kg P_2O_5 + 30 kg K_2O /ha and the variety 'K 8027' gave and maximum yield, net return (Rs/ha), net return/rupee spent, consumptive use of water and water-use efficiency.

In India, majority of the farmers do not apply optimum irrigation and fertilizers because of their inability to utilize inputs to the tune of recommended level. Most of the farmers use half of the recommended dose of nitrogen in wheat (*Triticum aestivum* L. emend. Fiori & Paol.) crop (Tandon, 1980), hence suitable variety which could be suited to lower application of fertilizers needs to be stressed. Number of irrigation also influences yield wheat (Kumar *et al.*, 1983; Patel *et al.*, 1983). Fertility and irrigation levels affect consumptive use and water-use efficiency (Reddy and Bhardwaj, 1982). Therefore, it was felt necessary to find out suitable wheat cultivars which could make efficient utilization of limited irrigation and nutrients under the agro-climatic condition of Kanpur.

MATERIALS AND METHODS

The experiment was conducted during the

winter seasons of 1986–87 and 1987–88 at Kanpur. The treatments consisted of combination of 3 irrigation schedules, viz. 1 irrigation at crown-root-initiation stage, 2 irrigations — 1 at crown-root-initiation stage and other at boot stage, and 3 irrigations, 1 each at crown-root-initiation, late tillering and flowering stages; and 3 fertility levels, viz. 20, 10 and 10; 40, 20 and 20; and 60, 30 and 30 kg/ha of N, P_2O_5 and K_2O , respectively in the main plots. Three cultivars, viz. 'K 8027', 'K 7827' and 'HUW 206' were in the subplots. The experiment was laid out in split-plot design with 3 replications. Half N with full dose of P_2O_5 and K_2O as per treatment was applied at sowing and remaining N was top-dressed after the first irrigation. Irrigations were given as per treatment at 6 cm depth of irrigation water. The soil was sandy loam with 0.05% total N, 18 kg available P_2O_5 and 180 kg available K_2O /ha, having pH 7.2. The

Table 1. Effect of irrigation, fertilizer and cultivar on yield, consumptive use, water-use efficiency and economics of wheat

Treatment	Grain yield (q/ha)		Straw yield (q/ha)		Consumptive use of water (mm)		Water-use efficiency (kg/ha/mm)		Net return (Rs/ha)		Net return/rupee spent	
	1986-87	1987-88	1986-87	1987-88	1986-87	1987-88	1986-87	1987-88	1986-87	1987-88	1986-87	1987-88
<i>Irrigation schedule</i>												
CRI	24.4	20.8	37.4	31.2	135.2	147.0	17.3	14.1	3,816	2,716	1.77	1.54
CRI + B	30.0	28.1	45.1	42.1	196.4	209.3	15.3	13.4	5,826	5,114	2.10	1.97
CRI + LT + F	34.6	33.2	48.4	49.8	254.6	268.2	13.6	12.4	6,912	6,604	2.22	2.16
CD (P = 0.05)	2.9	3.2	2.8	3.2								
<i>N + P₂O₅ + K₂O (kg/ha)</i>												
20 + 10 + 10	21.0	21.3	33.8	31.7	175.0	197.3	12.0	10.8	2,810	2,768	1.55	1.54
40 + 20 + 20	30.6	28.4	46.1	42.6	198.4	208.0	15.4	13.6	6,021	5,195	2.13	1.98
60 + 30 + 30	36.3	32.5	51.0	48.7	212.8	219.1	17.1	14.8	7,695	6,493	2.39	2.17
CD (P = 0.05)	3.7	2.2	4.1	3.7								
<i>Cultivar</i>												
'K 8027'	31.0	29.6	44.7	44.4	203.8	215.3	15.2	13.7	6,049	5,639	2.14	2.06
'K 7827'	29.8	28.5	44.4	42.7	200.0	209.5	14.9	13.6	5,695	5,229	2.07	1.98
'HUM 206'	27.0	24.1	41.6	36.0	182.4	199.7	14.8	21.1	4,743	3,595	1.82	1.68
CD (P = 0.05)	1.6	2.9	1.7	2.1								

CRI, Crown-root initiation; B, boot; LT, late tillering; F, flowering

field capacity, permanent wilting point and bulk density were 18.6–19.3%, 5.8–6.0% and 1.44–1.46 g/cc respectively. The crop was sown on 30 November and 2 December and harvested on 10 April and 9 April in respective seasons. During the crop seasons 25 and 38 mm rains were received in the first and second years respectively.

RESULTS AND DISCUSSION

Effect of irrigation

Irrigation significantly affected grain and straw yields in both the years (Table 1). The highest yield was obtained with 3 irrigations. Consumptive use of water was more but water-use efficiency was less with increase in number of irrigation. The findings confirm the results of Malik *et al.* (1987) and Kumar *et al.* (1987).

Effect of fertilizer

Application of fertilizers significantly affected the production of grain and straw yields during both the years (Table 1). The highest yield was obtained with application of 60 kg N + 30 kg P₂O₅ + 30 kg K₂O/ha. Increasing level of fertility increased both consumptive use of water and water-use efficiency, indicating that increase in grain yield was more in proportion to increase in water use. Hooda *et al.* (1988) opined similar view.

Effect of cultivar

Among the cultivars, 'K 8027' being at par with 'K 7827' gave significantly higher yield than 'HUM 206' during both the years (Table 1). 'K 8027' showed the highest consumptive use of water and water-use efficiency, showing potentiality of the cultivar to give more yield in proportion to consumed water than other cultivars.

Economics

Three irrigations at crown-root-initiation, late tillering, flowering stages provided the highest net return and net return/rupee spent, whereas the lowest net return and net return/rupee spent were with 1 irrigation applied crown-root-initiation stage (Table 2). Fertilizer 60 kg N + 30 kg P₂O₅ + 30 kg K₂O/ha gave maximum net return and net return/rupee spent, whereas 20 kg N + 10 kg P₂O₅ + 10 kg K₂O/ha showed the lowest. 'K 8027' wheat adjudged to be the best and gave highest net return and net return/rupee spent over other cultivars.

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