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Performance of wheat (*Triticum aestivum*) varieties with different levels of nitrogen in moisture-scarce condition

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ABSTRACT

A field experiment was carried out during the winter (*rabi*) seasons of 1986–87 and 1987–88 at Kanpur, to find out best variety of wheat (*Triticum aestivum* L. emend. Fiori & Paol.) and optimum level of nitrogen for realizing maximum yield potential under moisture-scarce condition on light-textured alluvial soil. 'K 78' wheat gave the best performance amongst all varieties tested. Application of 60 kg N/ha resulted in the maximum yield which was significantly higher than that obtained with 0, 20 and 40 kg N/ha. The various growth and yield parameters were improved with increasing dose of nitrogen.

Yield is governed by many production factors including variety, level of fertilization and availability of moisture. Adequate fertilization and selection of a good variety in consistency with availability of moisture at the critical stage of the crop growth are vital for optimum production under the condition resource constraints. Therefore, a study was carried out to investigate the performance of wheat (*Triticum aestivum* L. emend. Fiori & Paol.) under different levels of nitrogen and moisture-scarce condition.

MATERIALS AND METHODS

The field experiment was conducted at the Soil Conservation and Water Management Farm of the university at Kanpur, for 2 consecutive winter (*rabi*) seasons of 1986–87 and 1987–88. The treatments consisted of 5 varieties of wheat ('K 65', 'K 78', 'K 72', 'K 8430' and 'C 306') and 4 levels of nitrogen (0, 20, 40 and 60 kg/ha). The experiment was laid out in split-plot design with 4 replications, having varieties in main plots and levels of N in subplots. A basal dose of 20 kg/ha each of K_2O and P_2O_5 was applied uniformly in all the treatments. Sowing of the crop was done on 27 October and 4 November during 1986–87 and 1987–88 respectively, using seed @ 100 kg/ha at 5–6 cm depth. One life-saving irrigation was provided uniformly on 5 December in 1986 and on 21 November in 1987, considering the critical stage of moisture in the soil adversely affecting the growth of crop.

The soil of the experimental field was sandy loam in texture with pH 7.8, organic carbon 0.28%, available N, P_2O_5 and K_2O 210, 16.2 and 137.5 kg/ha respectively. Field capacity, wilting point and bulk density of 0–25 cm soil depth were 18%, 5.8% and 1.44 g/cc respectively. The available soil moisture in 100 cm/soil profile at the time of sowing was 22.82 and 22.80 cm during

1986–87 and 1987–88 respectively. Rainfall received during the crop season was 38.5 mm and 25.0 mm during 1986–87 and 1987–88 respectively.

RESULTS AND DISCUSSION

Performance of variety

Wheat var. 'K 78' showed the best performance in terms of growth and yield attributes like leaf-area index, dry-matter production, heat unit accumulation, spikes/m^2, grains/ear, harvest index, which ultimately resulted in the maximum grain and straw yields compared with the other varieties (Tables 1, 2). Better survival and quick growth of a variety are considered pre-requisites for better performance under moisture-scarce conditions. 'K 78' appears to posses such characteristics and built-in mechanism too, by which it is better able to with stand drier conditions than the other varieties. These findings are in accordance with those of Mor and Agrawal (1980), Agrawal *et al.* (1986) and Bush and Evans (1988). The plant height and 1,000-grain weight, however, were higher in 'K 65' than in the other varieties because of genetic character of variety.

Effect of N

Increasing levels of N up to 60 kg/ha influenced the plant height, leaf-area index, dry-matter production, and spikes/m^2, grains/ear and harvest index and ultimately the grain and straw yields. The differences for these characters were found statistically significant. However, 1,000-grain weight was not affected significantly by the different doses of N. Nitrogen being an important constituent of proteins, chlorophyll and enzymes involves in various metabolic processes and directly influences the vegetative and reproductive growth of crop plants. At lower level of N application,

Table 1. Effect of variety and N on growth and development of wheat

Treatment	Plant height at maturity (cm)		Leaf-area index at jointing stage		Dry matter at maturity (q/ha)		Total heat unit accumulation (day °C)	
	1986–87	1987–88	1986–87	1987–88	1986–87	1987–88	1986–87	1987–88
Variety								
'K 65'	87.7	86.1	4.35	4.22	43.2	42.5	1,842	1,689
'K 72'	79.3	77.7	4.69	4.59	44.7	44.3	1,917	1,777
'K 78'	78.5	77.2	4.74	4.52	45.4	44.6	1,938	1,799
'K 8430'	79.8	78.8	4.41	4.28	43.5	42.6	1,842	1,728
'C 306'	87.7	85.9	4.56	4.43	44.1	43.3	1,896	1,709
CD (P = 0.05)	2.49	2.12	0.07	0.17	0.34	0.62		
N (kg/ha)								
0	74.3	72.7	3.70	3.62	36.4	35.6	1,752	1,631
20	80.9	79.6	4.41	4.29	42.3	41.9	1,842	1,690
40	85.2	84.3	4.86	4.73	47.1	46.3	1,958	1,777
60	90.0	88.0	5.23	5.08	51.2	50.1	1,999	1,838
CD (P = 0.05)	2.12	2.29	0.06	0.09	0.36	0.44		

Table 2. Yield attributes and yield of wheat as influenced by variety and N

Treatment	Spikes/ m^2		Grains/ ear		1,000-grain weight (g)		Grain yield (q/ha)		Straw yield (q/ha)		Harvest index	
	1986–87	1987–88	1986–87	1987–88	1986–87	1987–88	1986–87	1987–88	1986–87	1987–88	1986–87	1987–88
Variety												
'K 65'	174	168	3.48 (32.6)	3.42 (30.4)	41.4	40.7	13.6	12.4	23.7	21.9	36.3	35.9
'K 72'	194	189	3.58 (36.0)	3.54 (34.5)	39.8	39.6	15.9	14.7	26.5	24.2	37.3	37.6
'K 78'	200	195	3.62 (37.2)	3.58 (36.0)	39.7	39.5	16.7	15.3	27.6	24.6	37.5	38.1
'K 8430'	179	174	3.50 (33.3)	3.45 (31.4)	39.1	39.1	14.1	12.9	24.1	22.9	36.6	36.0
'C 306'	192	187	3.55 (34.7)	3.50 (33.0)	39.0	38.8	15.0	13.4	25.2	23.7	37.1	36.1
CD (P = 0.05)	11.05	5.93	0.05	0.05	NS	NS	1.47	0.73	0.89	1.40	NS	0.18
N (kg/ha)												
0	143	137	3.30 (27.1)	3.22 (25.0)	38.8	38.1	8.9	8.3	15.6	14.9	36.3	35.8
20	179	175	3.54 (34.5)	3.49 (32.7)	39.5	39.3	14.6	13.2	25.2	23.0	36.6	36.5
40	206	201	3.65 (38.3)	3.61 (37.0)	39.9	40.1	17.6	16.0	29.6	27.0	37.2	37.2
60	233	219	3.70 (40.5)	3.67 (39.1)	41.1	40.5	18.9	17.5	31.1	29.0	37.7	37.6
CD (P = 0.05)	10.90	4.67	0.06	0.05	NS	NS	0.41	0.95	0.62	1.65	0.78	0.21

Figures in parentheses are the original values or transformed back values

the N requirement of plant might have not fulfilled. These findings are in accordance with those of Bedenko (1986).

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