

Response of barley (*Hordeum vulgare*) to nitrogen under moisture-scarce condition

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ABSTRACT

A field experiment was conducted during the winter (*rabi*) seasons of 1986-87 and 1987-88 on sandy-loam soil of Kanpur, to study the performance of barley (*Hordeum vulgare* L. sensu lato) with varying levels of N under moisture-scarce condition. 'Lakhan' barley showed higher growth, yield attributes and yield than 'Vijaya', 'K 169', 'K 125' and 'K 141'. Increase in the levels of nitrogen affected the plant-growth development, yield attributes and yield. N @ 60 kg/ha gave the maximum yield of barley.

A number of barley (*Hordeum vulgare* L. sensu lato) varieties have been developed recently and are now available in Uttar Pradesh. These varieties are suited to different agro-climatic conditions and available inputs like irrigation and fertilizer. In view of declining area and poor productivity of barley in Uttar Pradesh, choice of suitable variety and fertilizing it with suitable dose of nitrogen offer a good scope to enhance production potential of barley in Uttar Pradesh. Hence a study was carried out on these aspects.

MATERIALS AND METHODS

A field experiment was conducted at Kanpur during the winters 1986-87 and 1987-88. The experiment was laid out in split-plot design with 4 replications, having combinations of 5 varieties ('Vijaya', 'K 169', 'K 125', 'K 141' and 'Lakhan') in main plots and 4 levels of nitrogen (0, 20, 40 and 60 kg/ha) 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 crop was done on 26 October 1986 and 3 November 1987, deploying seed @ 100 kg/ha at 5-6 cm depth. One life-saving irrigation was also provided uniformly in both the years on 5 December 1986 and 21 November 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 with pH 7.8, organic carbon 0.28%, available N, P_2O_5 and K_2O @ 210, 16.2 and 113.5 kg/ha respectively. Field capacity, wilting point and bulk density of the surface layer was 18%, 5.8 and 1.44 g/cc respectively. At the time of sowing available soil moisture in 100 cm-soil profile was 22.82 and 22.80 cm during 1986-87 and 1987-88 respectively. Rainfall during the crop-growing season was 38.5 mm and 25.0 mm during 1986-87 and 1987-88 respectively.

Table 1. Effect of varieties and levels of N on growth and development of barley

Treatment	Plant height at maturity (cm)		Leaf-area index at jointing		Dry-matter pro- duction 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
<i>Variety</i>								
'Vijaya'	80.9	79.6	5.91	5.33	57.3	56.2	1,645	1,531
'K 169'	84.8	83.1	7.19	6.72	60.3	59.9	1,645	1,545
'K 125'	82.0	80.6	7.09	5.54	58.7	57.9	1,615	1,501
'K 141'	85.3	84.3	7.36	7.01	64.1	63.5	1,629	1,531
'Lakhan'	86.6	85.3	7.45	7.20	65.5	64.5	1,679	1,545
CD (P = 0.05)	1.31	1.43	0.078	0.069	0.80	0.43		
<i>N (kg/ha)</i>								
0	75.3	73.7	5.03	5.43	43.1	42.4	1,601	1,473
20	81.8	80.3	7.03	6.58	60.6	59.6	1,629	1,517
40	88.5	87.2	7.60	7.23	68.4	67.5	1,661	1,545
60	90.1	89.1	8.15	7.81	72.6	71.8	1,689	1,594
CD (P = 0.05)	1.19	1.05	0.089	0.084	0.53	0.40		

RESULTS AND DISCUSSION

Performance of varieties

'Lakhan' showed best performance among the varieties in terms of growth and yield attributes like, leaf-area index, dry-matter production, heat-unit accumulation, spikes/m², grains/ear, 1,000-grain weight, harvest index, which ultimately resulted in the maximum grain and straw yields over the other barley varieties (Tables 1, 2). Best performance of variety 'Lakhan' may be attributed to its better survival under moisture-scarce condition and its ability to withstand moisture-stress condition Ghadekar *et al.* (1985), Siddique *et al.* (1989) and Slafer and Andrade (1989) also reported similar findings in sorghum, wheat and wheat crops respectively.

Effect of N

Application of 60 kg N/ha increased significantly plant height, leaf-area index, dry-matter production, spikes/m², grains/ear, 1,000-grain weight and harvest index. These characters in turn resulted in the highest grain and straw yields over other levels of N (Tables 1, 2). Improved growth and yield attributes increased with increased dose of N, may be due to the fact that N being an important constituent of nucleotides, proteins, chlorophyll and enzymes, involves in various metabolic process which has a direct impact on the vegetative and reproductive phase of plants. At low level of N, plant might have not been able to meet N requirement; ultimately resulting in stunted growth. At higher level of N, crop absorbed sufficient amount of N, resulting in better

Table 2. Yield attributes and yield of barley as influenced by varieties and levels of 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
<i>Variety</i>												
'Vijaya'	206	195	3.33 (28.0)	3.29 (26.8)	42.3	41.4	16.4	15.4	38.7	37.3	29.5	38.8
'K 169'	225	208	3.51 (33.5)	3.48 (32.5)	43.6	32.8	18.9	18.0	43.9	42.5	29.8	29.5
'K 125'	210	197	3.37 (29.2)	3.33 (27.9)	42.7	42.1	18.0	17.0	42.3	40.7	29.6	29.2
'K 141'	230	214	3.55 (34.7)	3.52 (33.8)	43.8	32.0	20.0	19.5	46.5	44.5	29.8	28.7
'Lakhan'	234	216	3.67 (35.4)	3.55 (34.8)	43.8	43.1	22.0	20.7	50.2	48.6	30.1	29.9
CD (P = 0.05)	5.61	3.77	0.045	0.037	1.12	0.95	0.88	0.78	2.91	1.51	NS	0.69
<i>N (kg/ha)</i>												
0	176	163	3.23 (25.1)	3.19 (24.3)	41.0	40.2	11.3	10.6	29.0	27.4	28.0	27.8
20	202	184	3.45 (31.6)	3.43 (30.9)	43.2	42.3	18.1	17.2	44.1	42.5	29.1	28.7
40	236	224	3.56 (35.2)	3.53 (34.0)	44.2	43.4	22.5	21.6	51.7	49.5	30.3	30.2
60	270	253	3.63 (37.6)	3.59 (36.2)	44.5	44.0	24.4	23.2	52.5	51.5	31.7	31.0
CD (P = 0.05)	4.47	3.58	0.025	0.062	1.10	0.91	0.80	0.67	1.93	1.62	0.23	0.31

growth parameters which in turn gave higher grain and straw yields. The finding is in accordance with that of Jha *et al.* (1980).

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