

Root development and moisture use in wheat (*Triticum aestivum*) and barley (*Hordeum vulgare*) as influenced by crop variety and nitrogen

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ABSTRACT

Root development of wheat (*Triticum aestivum* L. emend. Fiori & Paol.) and barley (*Hordeum vulgare* L. sensu lato) and its consequent effect on moisture use, yield and moisture-use efficiency under the influence of varieties and nitrogen levels was studied at Kanpur, during 1986-87 and 1987-88 under moisture-scarce conditions on light-textured alluvium soil. In wheat, except root depth, variety 'K 78' showed better root development, higher moisture extraction, yield and moisture-use efficiency than the other varieties. In barley, best development of roots in respect of depth, number of primary roots, moisture use, yield and moisture-use efficiency was observed in variety 'Lakhan'. Application of N @ 60 kg/ha resulted in the maximum root expansion, moisture use, moisture-use efficiency and yield of wheat and barley compared with that obtained with 0, 20 and 40 kg N/ha.

Barley (*Hordeum vulgare* L. sensu lato) and wheat (*Triticum aestivum* L. emend. Fiori & Paol.) are grown under semi-irrigated conditions, which may suffer due to deficiency of water at critical stage of growth and development. Adequate fertilization and choice of a good variety consistent with available moisture at the critical stage of crop growth offer a good scope to enhance the production potential of barley and wheat crops. Therefore the present experiment was conducted.

MATERIALS AND METHODS

Two separate field trials on wheat and barley were carried out during 1986-87 and 1987-88 at Kanpur. The treatment comprised 5 recommended varieties each of wheat ('K 65', 'K 72', 'K 78', 'K 8430' and

'C 306') and barley ('Vijaya', 'K 169', 'K 125', 'K 141' and 'Lakhan'). These were tested at 4 nitrogen levels (0, 20, 40 and 60 kg/ha). Split-plot design was adopted assigning varieties in main plots and levels of N in subplots with 4 replications. A common dose of 20 kg P₂O₅ and 20 kg K₂O/ha was applied basal. Sowing of crops was done on 27 October and 4 November during 1986-87 and 1987-88. One life-saving irrigation was also provided uniformly in both the years on 5 December 1986 and 21 November 1987. The soil of the experimental field was sandy loam in texture, with pH 7.8 and organic carbon 0.28%, and available N, P₂O₅ and K₂O 210, 16 and 138 kg/ha respectively. Field capacity, wilting point and bulk density of the surface layer (0-25 cm) were 18%, 5.8%

Table 1. Root development, moisture use and moisture-use efficiency of wheat as influenced by varieties and levels of N (mean data of 1986-87 and 1987-88)

Treatment	Root depth (cm)	Primary roots/plant	Root weight/plant (g) in 0-30 cm	Total moisture use (mm)	Grain yield (kg/ha)	Moisture-use efficiency (kg/ha-mm)
<i>Variety</i>						
'K 65'	23.1	9.9	1.33	174.3	1,300	7.46
'K 72'	25.3	11.4	1.53	175.4	1,530	8.72
'K 78'	25.5	11.8	1.58	176.1	1,600	9.08
'K 8430'	23.2	10.2	1.40	174.2	1,350	7.75
'C 306'	25.9	11.2	1.48	175.4	1,420	8.09
CD (P = 0.05)					108	
<i>N (kg/ha)</i>						
0	19.3	6.6	1.08	172.9	860	4.97
20	24.3	10.5	1.39	174.4	1,390	7.97
40	25.9	12.6	1.63	175.9	1,680	9.55
60	29.0	14.0	1.76	177.2	1,820	10.27
CD (P = 0.05)					68	

Table 2. Root development, moisture use and moisture-use efficiency of barley as influenced by varieties and levels of N (mean data of 1986-87 and 1987-88)

Treatment	Root depth (cm)	Primary roots/plant	Root weight/plant (g) in 0-30 cm	Total moisture use (mm)	Grain yield (kg/ha)	Moisture-use efficiency (kg/ha-mm)
<i>Variety</i>						
'Vijaya'	23.4	11.1	1.47	173.1	1,590	9.18
'K 169'	26.5	12.2	1.57	174.2	1,845	10.59
'K 125'	23.5	11.6	1.51	173.9	1,750	10.06
'K 141'	25.8	12.6	1.62	174.7	1,975	11.30
'Lakhan'	26.3	13.2	1.65	175.1	2,135	12.19
CD (P = 0.05)					83	
<i>N (kg/ha)</i>						
0	19.6	7.5	1.20	172.3	1,095	6.35
20	24.8	11.5	1.48	173.6	1,765	10.17
40	26.6	13.6	1.73	174.9	2,205	12.61
60	29.5	15.9	1.85	175.3	2,380	13.58
CD (P = 0.05)					73	

and 1.44 g/cc respectively.

RESULTS AND DISCUSSION

In wheat, variety 'K 78' gave the maximum number of primary roots followed 'K 72', whereas 'K 65' showed the poorest root development in respect of depth and number of primary roots (Table 1). Root depth was higher in 'C 306' than the others. In case of barley, variety 'Lakhan' showed a better root development in surface layer than the other barely varieties, which gave maximum number of primary roots followed by 'K 141'. The root depth was maximum in 'K 169' (Table 2). Barley crop showed slightly higher root development than wheat crop. A dose of 60 kg N/ha showed an excellent root-distribution pattern over the other doses of N applied in both the crops. Brown *et al.* (1987) also reported similar findings.

The moisture use was higher under 'K 78' wheat (Table 1) and barley 'Lakhan'

(Table 2), owing to better development of root-system in both varieties. Increasing levels of N up to 60 kg/ha increased the moisture use, leading to efficient utilization of water. The results confirm the findings of Prihar and Singh (1983).

Wheat variety 'K 78' and barley variety 'Lakhan' gave higher grain yields and moisture-use efficiency over the other varieties of wheat and barely (Tables 1, 2). Grain yield and moisture-use efficiency increased with increasing levels of N. These findings are in conformity with those of Prihar and Singh (1983).

REFERENCES

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