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Yield and Yield Component Development in Dual-Purpose Barley

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Yield and yield component development in dual-purpose Barley

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Introduction

Barley (*Hordeum vulgare* L.) is a widely adapted small-grain annual cereal and is a key feed and fodder in India (Kharub *et al.*, 2013). Barley can provide nutrition to the animals through its green fodder at vegetative stage and grains after harvest from the regenerated plants. The vegetative portion of the crop is valuable as a source of pasture, cut green forage, and straw. Their relative importance is determined at different ontogenetic stages of plant. An area of barley breeding receiving increasing attention is the development of dual-purpose (green forage and grain) varieties for plains as well as hills. Up to certain yield level grain yield and vegetative yield are correlated, difficulty may arrive when attempts will be made to combine maximum grain yield with maximum forage yield. Objectives of this study was to compare yield and yield development component in barley cut 55-60 days after sowing (DAS) and harvested after regeneration at maturity.

Materials and Methods

The field experiment was conducted during *rabi* season of 2013, at IGFRI, Jhansi. The barley germplasm included in this study were RD-2552, RD-2715, JB-238, JB-240, Azad, NDB-1545, EC-631733, HUB-225 and K-1185. These nine germplasm were evaluated in a randomized block design with three replications under irrigated (twice) and normal fertility (60 kg N and 30 kg P /ha as basal + 25 kg N/ ha after one cut for green forage) conditions. Each plot consisted of eight rows 4.2 m long, 25 cm apart with 10-15 cm plant-to-plant spacing. Green matter yield, dry matter yield and number of leaves / square meter were taken from one cut at 55-60 DAS. From the regenerated crop, at harvest, number of spikes / square meter was recorded from the quadrates. From the rest net plots, ten plants were pulled at random and plant height, total number of spikes and kernels per plant were counted and grain yield per plant and kernel weight were recorded. On the net plot basis, biomass yield and grain yield were recorded.

Results and Discussion

The growth and development of crop plants consist of two distinct, though overlapping phases, viz. the vegetative and the reproductive. The green matter yield cut at 55-60 DAS was significantly higher in barley germplasm NDB-1545 (113.45 q/ha) than other germplasm except EC-631733 (26.78 q/ha); CD (5%) is 26.78 q/ha (Table 1). Dry matter yield was also higher in NDB-1545 (10.99 q/ha) and this was followed by JB-240 (9.29 q/ha). Leaves / square meter cut at 55-60 DAS was also higher in NDB-1545 (1180), followed by EC-631733 (1080). Biomass yield from the regenerated germplasm was higher in RD-2715 (140 q/ha), RD-2552 (130 q/ha) and JB-240 (125 q/ha) but lower in NDB-1545 (105 q/ha). Germplasm Azad was found to have high plant height (91.7 cm). Grain yield of barley can be partitioned into three components, *viz.,* number of spikes per unit area, number of kernels per spike, and kernel weight. Germplasm RD-2552 had higher grain yield (58 q/ha) than RD-2715 (54 q/ha), K-1185 (51 q/ha), JB-240 (50 q/ha) and NDB-1545 (44 q/ha). EC-631733 had lowest grain yield, though it had higher number of leaves / square meter at 55-60 DAS and higher spikes/ square meter after cut for green forage. Relative importance of the three components of grain yield in barley is determined at different ontogenetic stages of the plant. Rasmusson (1987) in barley had found negative correlations among spike number / square meter and spike length and penultimate leaf area. Both kernels/plant and kernels/spike were higher in K-1185 on 10-plant basis, but grain yield was higher in RD-2552 and RD-2715 on net plot basis. 100-kernel weight differed between 3.0 g to 4.82 g with mean of 4.122 g. Kernel number per unit area, which is determined before anthesis, is very closely related to yield of barley (Gallagher *et al.,* 1975; Willey and Holliday, 1971). Effect of compensation mechanism was found in the experiment. Among the evaluated germplasm RD-2552, K-1185, NDB-1545 and JB-240 showed higher harvest index (40-44%). As in barley, yield improvement especially in favorable environmental condition is linked to a reduction in plant height and increase in the harvest index, Rasmusson (1987) has speculated that further increments in grain yield are attainable only through an increase in total biomass production.

Table 1. Plant and yield performance of nine barley germplasm tested for dual-purpose (green forage and grain)

Data/varieties	**EC-631733**	**HUB-225**	**NDB-1545**	**JB-240**	**K-1185**	**JB-238**	**Azad**	**RD-2552**	**RD-2715**	**Mean**
Cut 55-60 DAS										
Leaves/m^2	1080	933	1180	852	813	722	685	925	773	884.8
GMY (q/ha)	87.7	78.9	113.4	95.3	90.1	63.7	80.1	72.5	73.7	83.93
DMY (q/ha)	7.9	8.4	11.0	9.3	7.9	5.7	7.6	8.0	7.3	8.12
After regeneration										
Plant height (cm)	71.4	84.5	74.9	76.6	77.3	81.4	91.7	77.1	77.8	79.19
Spikes/plant	15.0	15.3	12.2	13.2	12.5	10.2	10.2	13.6	11.8	12.67
Spikes/m^2	680	390	405	452	357	368	404	490	423	441
Kernels/plant	224	326	524	491	673	463	404	505	397	445.22
Kernels/spike	14.9	21.3	42.8	37.2	53.9	45.5	39.6	37.1	33.6	36.21
Weight/100 kernels (g)	4.15	4.82	3.0	4.25	4.15	3.95	4.37	4.11	4.30	4.12
Biomass yield (q/ha)	120	100	105	125	115	110	112	130	140	117.44
Grain yield (q/ha)	25	36	44	50	51	40	43	58	54	44.5
Harvest index	0.20	0.36	0.42	0.40	0.44	0.36	0.38	0.44	0.38	0.375

Conclusion

Among nine barley germplasm tested for dual-purpose performance, germplasm RD-2552, K-1185, NDB-1545 and JB-240 had high harvest index (40-44%). Germplasm NDB-1545 was found to have high green matter yield (113.45 q/ha) and high dry matter yield (11.0) at 55-60 DAS while germplasm RD-2715 (147.3 q/ha) and RD-2552 (138.0 q/ha) had high total biomass yield with high grain yield from the regenerated crop. These genotypes may be used for developing dual purpose barley through recombination breeding.

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