Germinative Capacity, Vigour Index and Other Seed Traits in Barley and Their Utility in Future Crop Improvement

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Seed vigour is recognized as a component of seed quality distinct from germinability. The performance of established genotypes shows variations often associated with differences in seed vigour that may be physical, physiological or genetic in nature. Assessment studies led to the following findings: The wide range for different characters and comparison of means of germplasm using least significant differences indicated existence of very high degree of variability for all characters studied. The genotypes RD-2592, RD-2503, RD-2035, F_6 (S x S)-128, BH-492, K-560 25th IBON-10, F_6 (S x S)-102, 29 and K-603 showed high mean performance for grain yield coupled with other desirable seed traits. The genotypes 25th IBON-106, 25th IBON-48 and 7th HBSN-2 were found better for grain hardness, appealing seed shape and low husk content, respectively. Studies indicated that these superior genotypes may be utilized as donors in barley hybridization programme for improving most of the present day genotypes showing deficiency for yield and quality components.

Key Words: *Hordeum vulgare L.,* Germination capacity, Vigour index, Hybridization

Since ages, barely (*Hordeum vulgare* L.), a member of Poaceae family has held a prestigious place among cereals. It is grown worldwide for multifarious uses. Being hardy and versatile in nature, it possesses elasticity for superior grain yield under varying agro-climatic situations, with good nutritional qualities. Malt barley is used in brewing industry and medicine for preparation of beer and tonics. Recent studies have also shown that barley surpassed other cereals in the content of ß- glucon, total dietary and soluble fibre and easy digestibility. The cooling and soothing effect of flour/food product of barley is beneficial in treating hyper cholesterolemia (Anderson *et al.,* 1990). An estimated five per cent crop loss occurs each year because of low seed vigour (Woodstock, 1973). The present investigation was undertaken to assess and utilize the genetic variation for yield contributing seed traits in new accessions of exotic barley.

A total of 88 genetically and geographically diverse accessions, particularly stabilized F_6 generations, obtained from National Bureau of Plant Genetic Resources, New Delhi were evaluated during *rabi* 1998-99 in Augmented Block Design with three intermittent checks (standards) namely, Azad, Lakhan and Jyoti at research farm of Genetics and Plant Breeding, ND University of Agriculture and Technology, Kumarganj, Faizabad, Uttar Pradesh. Each accession and check was grown in single row of 1.5m length. The checks were distributed systematically in each block after 11 genotypes. Distance of plants within rows was maintained at about 10cm by thinning. Row to row distance was kept at 25cm apart. Recommended package of practices was followed to raise healthy crop. Five competitive plants were randomly selected to record observation for twelve metric traits. The analysis of augmented block design was done following Federer (1956). For scoring laboratory germination, counted seeds were germinated at 28 ± 2^0 C temperature and 97 per cent of relative humidity. Seeds showing emergence of plumule and radicle of 2 mm were counted as germinated. Vigour index was measured as seed germination (%) multiplied by seedling length (cm) after 5 days of germination.

Wide variability existed for all the traits amongst genotypes studied. High magnitude of variability in genotypes further provides the opportunity for selection to evolve a promising variety having desirable characters.

Mean squares for tillers/plant, spike length, weight of grains/spike, thousand grain weight, husk content, grain yield/plant were significant. However, variations due to blocks were found non-significant for germinative capacity, vigour index, plant height, harvest index, grain hardness and seed shape both in vegetative and reproductive phases. Thus result of germination capacity and vigour index indicated that intra-varietal differences were more pronounced. In general, long and bold seeds with higher vigour showed high germination (>85%). Bold seeded (>3mm = long axis/short axis) varieties with low to medium seedling vigour (93-144) showed more than 60% germination.

Germinative capacity ranged form 52.47 to 85.80 per cent. Eighteen genotypes were listed in top non-significant group. The highest and lowest value for vigour indices were observed in case of SBPM-EC 408442 (203.4%) and 25th IBON 59 (74.13%), respectively. Out of 88 genotypes, only 9 genotypes were of dwarf plant stature. Some of the dwarf and fertilizer responsive elite lines screened were 20th IBYT-2, 7th HBSN-2 and PL-604. The nine lines had better tillering capacity.

Six genotypes, present in the top non-significant group for higher seed yield per plant (g) were RD-2552 (6.76), RD-2503 (6.53), RD-2035 (6.46), F_6 (S x S)-128 (6.44), BH-492 (6.13) and K-560 (6.10). The highest yielding genotype RD-2552 showed high mean performance for most of the yield components. Similarly high mean performance was also found in RD-2035 whereas RD-2503 was found superior for number of tiller/plant, spike length, weight of grain/spike, harvest index, thousand grain weight and seed shape. The second highest yielder RD-2503 showed high mean performance for some other characters like number of tillers/ plant, spike length, weight of grain/ spike, thousand-grain weight, grain hardness and seed shape.

The third highest yielder, RD-2035 appeared in top non-significant group for vigour index, number of tillers/ plant, spike length, weight of grain/spike, harvest index, thousand grain weight, grain hardness, seed shape and husk content. The genotype F_6 (S x S)-128 showed very high mean performance for vigour index, grains/ spike, harvest index and seed shape as it was present in non-significant group. BH-492 appeared in top non-significant group for germinative capacity, number of tillers/ plant, spike length, harvest index, seed shape. K-560, which ranked sixth for seed yield, had virtue of being in top non-significant group for germinative capacity, number of tillers/ plants, spike length, weight of grains/ spike, harvest index and seed shape.

The most desirable and high performing genotypes were 7th HBSN-85 (for germinative capacity, seed shape and number of tillers/plant) SBPMEC 408442 (for vigour index, plant height number of tillers/ plant, spike length thousand grain weight and seed shape), F_6 (S x S) 87 (for plant height and seed shape), 7th HBSN 35 (for number of tiller/ plant, grain hardness seed shape). Likewise F_6 (S x S) 104 showed best response for plant germinative capacity, weight of grains/ spike and husk content and K-604 exhibited high performance for harvest index, seed shape and husk content, followed by F_6 (S x W)-20 for 1000 grain weight, 25 IBON-106 for 1000 grain weight and grain hardness, 25th IBON-48 for seed shape F_6 (S x S)-31 for grain hardness and husk content (Table 1).

Mahalakshmi *et al.* (1994) suggested that two rowed species are cross compatible and fully inter-fertile with cultivated barley. Improvement in the progenies was found to be due to improved harvest index and water use efficiency. It was further suggested that wide crosses of barley on locally adopted genotypes may be more effective in dry environment than wide crosses on exotic germplasm. In confirmity of above results Kabirian (1998) proposed that harvest index was not significantly influenced by plant density alone. However, the barley plant had a higher harvest index. Weltzien and Fishebeck (1990) especially observed that plant height and time to flowering were of intermediate variation, while under stress environment, highly significant genetic variation

Table 1. The most desirable genotypes identified for 12 characters studied.

Sl.No.	Characters	Genotypes
1	Germinative capacity	7HBSN-85, 25IBON-35, F_6SXS-30'SBPMEC408424, F_6 SXS-102, 25IBON-27, 7HBSN-79'25IBON-10
2	Vigour index	SBPMEC408442'EC408424'25IBON-106'25IBON-3,7HBSN-85, 25IBON-109, 25IBON-48.
3	Plant height	F_6 SXS-87, SBPMEC-408424, 25INON-97, F_6 SXS-86, F_6SXS-128, EC404163, 25IBON-44, 5HBSN-65.
4	No of tillers per plant	7HBSN-35, 7HBSN-85, 7HBSN-38, 7HBSN-65, 7HBSN-79, 7HBSN-8,EC408424,25IBON-3, 20IBYT-19.
5	Spike length	F_6SXS-128, EC-408442, F_6SXS-90,25IBON-48, EC-408424, 25IBON-29, 7HBSN-16, F_6SXS-86,EC-404163, 25IBON-12.
6	Weight of grains	F_6SXS-104, F_6SXS-6, F_6SXS-102, F_6SXS-3, RD-2503, F_6SXS-107, F_6SXS-4, EBN-67, F_6SXS-90, 20IBYT-2
7	Grain yield per plant	RD-2592, RD-2503, RD-2035, F_6SXS-128, BH-492, K-560, 25IBON-10, F_6SXS-102, 25IBON-29, K-603.
8	Harvest index	K-604, K-603BH-492, 25IBON-29, RD2503, K-560, 25IBON-10, 25IBON-52, RD-2559, F_6SXS-102
9	Thousand grain weight	F_6SXW-20, 25IBON-52, F_6SXS-31, EC-408442, F_6SXW21,25IBON-71,RD-2035, F_6SXS-86, F_6SXS-4.
10	Grain hardness	25IBPN-106, 25IBON-35, 25IBON-23, F_6SXS-123, PL-512,7HBSN-35, F_6SXS-86, RD-2508, F_6SXS-31, F_6SXS-102.
11	Seed shape	25IBON-48, EC-404163, 25IBON-44, 25IBON-59, 25IBON-29, 25IBON-23, F_6SXS-85,EBN-35, 25IBON-717HBSN-85.
12	Husk content	F_6SXS-31, F_6SXS-84, 25IBON-106,7HBSN-11, F_6SXS-104, EC-404162, 25IBON-23, F_6SXS-6, 25IBON-12, 5HBSN-65.

among genotypes and races was found responsible for grain yield. Similarly in the present study, days to 50 per cent flowering, followed by seed shape, breadth of seed and plant height had comparatively low variability indicating that for these traits additional variations need to be induced.

Vigour is recognized as an important factor distinct from germinability and likewise genotypes having similar germinability may exhibit different degree of vigour. Genetic differences evident among cultivars in respect of seed vigour as measured by different parameters suggested that it should be possible to incorporate this trait into high yielding genotypes, through appropriate breeding methodology. This would help to minimize the yield loss due to seed deterioration.

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