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Variability for yield and yield contributing traits in released varieties of barley (*Hordeum vulgare* L.)

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Abstract

Sixty four released varieties of barley collected from Directorate of Wheat Research, Karnal were grown under partially reclaimed saline- sodic soil, under irrigated conditions during Rabi 2010-11showing wide spectrum of variation for various characters. The characters studied were yield and yield contributing traits; namely plant height, days to maturity, fertile tillers plant^{-1}, length of main spike, grains per main spike, 1000-grains weight, grain yield plant^{-1}. The data on 7 characters was utilized for estimation of mean, range and least significant differences. The varieties RD 2552, HBL 276, RD 2592, PL 419, Kedar, PL751, JB 58, K 508 produced higher grain yield plant^{-1} and showed high to very high mean performance for several other yield component also.

Keywords: Barley, genetic variability, quantitative characters

Introduction

Barley (*Hordeum vulgare* L; 2n=14) a high energy, nutritionally and environmentally safe crop, has potential to produce satisfactory yield under problematic soils qualitatively and quantitatively. It is a hardy crop able to produce reliable harvest in area with poor rainfall and saline alkaline soils. Being very versatile, it is used in major staple food for millions of people in developing countries. It is a key animals feed in dry areas and principal ingredient in beer, many beverages and health tonics. Barley is better option for poor farmer to cope with the climate change, land degradation and desertification.

At national level barley is grown on about 6.46 lacks ha area with production of 11.96 lacks metric tons and productivity of 19.85 q ha^{-1} (Anonymous, 2009 - 10). In Uttar Pradesh, barley occupies an area of 1.71 lacks hectares with a total production of 3.76 lacks metric with productivity of 21.88 q ha^{-1} (Anonymous, 2009 - 10). Barley is main source of calories and improves micro nutrients, multi nutrition hormonal balance and treatment of many acute illnesses like blood pressure, osteoarthritis, gastric, ulcer, kidney stone and cancer. In addition barley is indispensible in virtually every Hindu ritual ceremony as sacred grain. Barley flourishes well under limited resources of irrigation and fertilizers. Barley has beta-glucan and anticholesterol substance, acetyl choline which energies our nervous system and recover memory losses. It is easily digestible due to low gluten, soluble dietary fibres, high lysine, thiamine, and riboflavin which provide inflammatory effect.

Genetic diversity and variability is fundamental for increase grain yield and nutritional quality. In order to launch sound breeding programme it is essential to have an idea of the nature and magnitude of variability heritability and expected genetic advance in respect of breeding materials at hand. Thus, there is urgent need of preliminary assessment of barley varieties for breeding work, which would presumably broaden the genetic variability through various breeding tools.

Materials and methods

The present investigation was conducted during *rabi* 2010-11 at Genetics and Plant Breeding Research Farm of Narendra Deva University of Agriculture & Technology, Narendra Nagar, Kumarganj, Faizabad. The experimental materials for the present investigation are comprised of 64 released varieties of barley collected from Directorate of Wheat Research, Karnal. Narendra Nagar is situated between $26^0 47'$ N latitude, $82^0 12'$ E longitude and at an altitude of 113 m above the mean sea level. The climate of district Faizabad is semi arid with hot summer and cold winter. Nearly 80 per cent of total rainfall is received during the monsoon (only up to September) with a few showers in the winter.

The 64 released varieties (table.1) were evaluated in a Simple Lattice Design with two replications. Each plot consists of three rows, each of three meter long with spacing of 23 centimeters. The plants within a row were spaced approximately 10 centimeters apart. The eight contiguous plots collectively constituted one tier. Thus there were eight tiers each of eight plots in a replication. The varieties were allocated randomly in each replication. The recommended cultural practices were adopted to grow a good crop. The experimental site was partially reclaimed saline- sodic soil (pH 8.6-8.9, EC = 4-4.2 dSm^{-1}, ESP = > 15).

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Results and discussion

Mean, range and critical differences for all traits studies are given in table 2. Detailed studies of particular character are interpreted here one by one.

The results of the analysis of variance for Simple Lattice Design in respect of 7 characters are presented in Table 3. The variation due to replication was highly significant for plant height, days to maturity, fertile tillers per plant, and length of main spike, grains per main spike, 1000-grain weight, and grain yield per plant. The variation due to treatment were found to be highly significant for plant height, days to maturity, length of main spike, grains per main spike, and significant for grain yield per plant, but non-significant for remaining two characters viz. fertile tillers per plant, 1000-grain weight.

Table 1. List of barley varieties used for study

1.Clipper	9.Dolma	17.K-141	25.Manjula	33.PL-426	41.DL-88	49.DWR-28	57.DWRUB-52
2.Jyoti	10.BG-101	18.Lakhan	26.BH-169	34.BCU-73	42.RD-2552	50.RD-2624	58.RD-2668
3.Amber	11.Azad	19.Jagrity	27.Karan-16	35.RD-2503	43.HBL-276	51.BHS-352	59.PL-751
4.RS-6	12.PL-56	20.BH-75	28.Gitanjali	36.RD-2508	44.NB-1	52.RD-2592	60.RD-2715
5.Ratna	13.RD-31	21.BHS-46	29.RD-2035	37.K-409	45.NB-2	53.NDB-1173	61.BH-902
6.RDB-1	14.Bilara-2	22.PL-172	30.HBL-316	38.K-508	46.K-603	54.JB-58	62.BHS-380
7.Vijay	15.Kedar	23.VLB-1	31.Alfa-93	39.K-551	47.BH-393	55.VLB-56	63.DWR-73
8.Himani	16.Sonu	24.RD-2052	32.PL-419	40.K-560	48.NB-3	56.RD-2660	64.UPB-1008

Table 2. Variability and least significant differences for seven characters in barley

Character	Range	Mean value	Range of parameters		
			LSD_1 (5%)	LSD_2 (5%)	LSD_3 (5%)
Plant height	52.46-89.44	66.181	3.034	3.100	3.086
Days to maturity	110.98-119.05	115.27	1.742	1.730	1.732
No. of fertile tillers/ plant	3.47-5.506	4.375	1.952	1.947	1.948
Length of main spike	5.39-8.893	7.8945	1.085	1.104	1.100
Grains main/ spike	29.341-39.182	33.648	4.329	4.422	4.401
1000-grain weight	34.51-41.67	37.938	4.315	4.354	4.345
Grain yield per Plant	5.636-8.523	6.9759	1.606	1.606	1.609

LSD_1 = Least significant difference between adjusted in the same block, LSD_2 = Least significant difference between adjusted in the different block, LSD_3 = Least significant difference adjusted average.

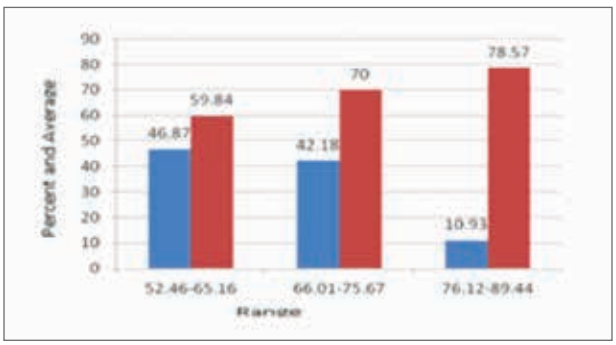
Table 3. Variance of simple lattice design for seven characters

Character	Source of variation		
	Replication	Treatments	Error
Degree of freedom (d. f.)	1	63	63
Plant height (cm)	214.78**	113.01**	2.46
Days to maturity	76.57**	6.09**	0.74
No. of fertile tillers per plant	13.78**	0.52	0.93
Length of main spike (cm)	15.46**	0.80**	0.30
No. of grains per main spike	250.32**	10.75**	5.00
1000-grain weight (g)	298.62**	6.02	4.70
Grain yield per plant (g)	21.73**	0.99*	0.64

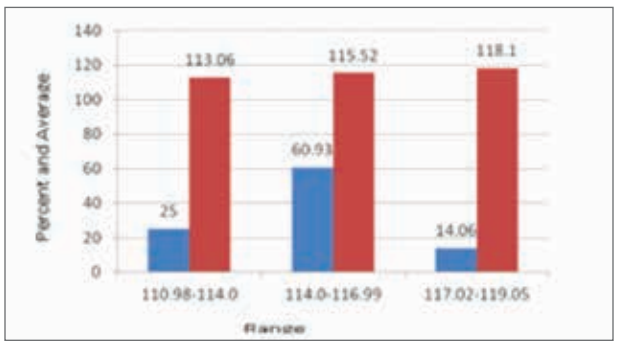
*Significant at 5 % probability level, **Significant at 1 per cent probability level.

Table 4. Trait specific desirable barley varieties identified

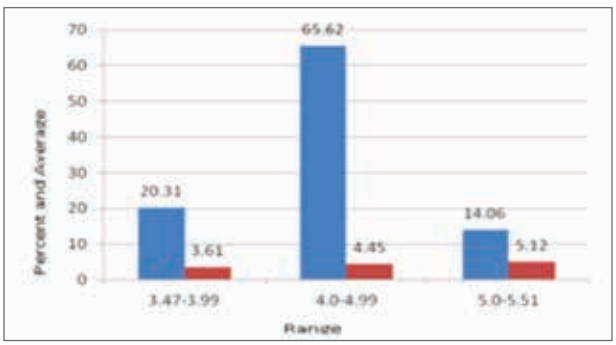
Character	Variety
Plant height (cm)	Alfa-93(66.10), Gitanjali(66.04), Manjula(66.01), RD-2503(65.16), JB-58(64.88), DWRUB-52(64.59), K-508(64.42), DL-88(64.17)
Days to maturity	BG-101(110.98), Bilara-2(111.97), BH-169(112.03), Vijay(112.48), K-508(112.99), Dolma(113.00), BH-75(113.01), PL-419(113.04)
No. of fertile tillers per plant	HBL-276(5.51), Lakhan(5.50), RD-2508(5.03), K-508(5.02), DL-88(5.02), PL-172(5.00), BHS-380(5.00), Sonu(5.00)
Length of main spike (cm)	Jagrity(8.89), BHS-46(8.87), DL-88(8.84), UPB-1008(8.81), Alfa-93(8.78), RD-2552(8.78), K-141(8.77), RD-2624(8.74)
No. of grains per main spike	RD-2552(39.18), Jagrity(38.25), Alfa-93(38.07), RD-2624(38.05), UPB-1008(37.91), K-141(37.21), K-551(36.98), RD-2035(36.93)
1000-grain weight (g)	Jagrity(41.67), RD-31(41.16), K-508(40.95), Sonu(40.46), Gitanjali(40.44), HBL-276(40.37), BCU-73(40.30), DWR-73(40.16)
Grain yield per plant (g)	RD-2552(8.52), HBL-276(8.35), RD-2592(8.17), PL-419(8.15), Kedar(8.11), PL-751(8.10), JB-58(8.06), K-508(7.96)



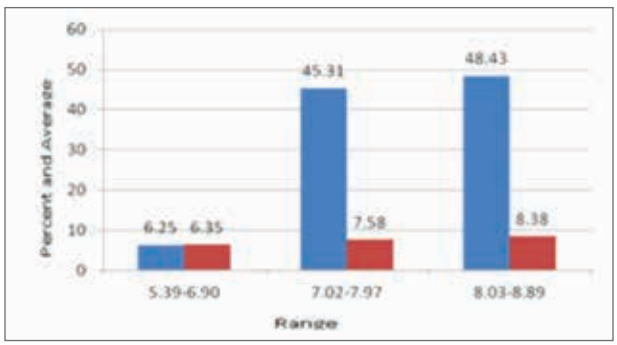
Plant height



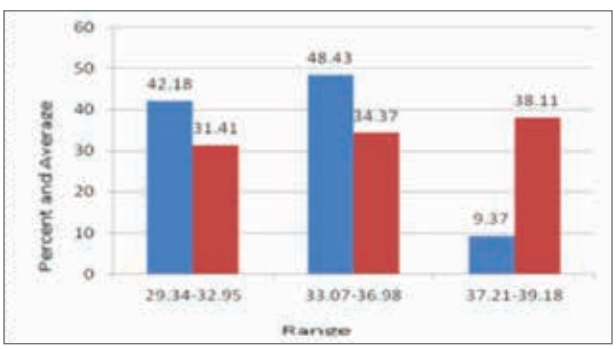
Days to maturity



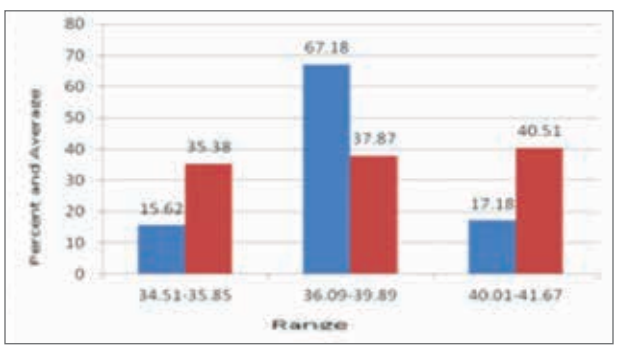
No. of fertile tiller per plant



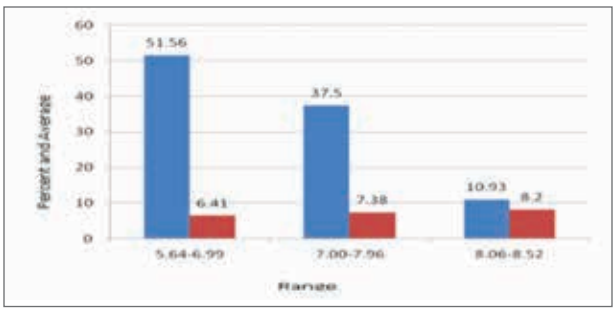
Length of main spike



No. of grains per main spike



1000-grain weight



Grain yield per plant

Plant height: It is clear that dwarf varieties of barley are more fertile, vigorous and fertilizer responsive. Thus may be higher yielder. The varieties under study presented high degree of variability in plant height from 52.46 to 89.44 centimeters. The class 52.46-65.16 centimeters formed 46.87 per cent population and class 66.01-75.67 centimeters comprised 42.18 per cent population, while the class 76.12-89.44 centimeters plant height formed lowest population of 10.93 per cent which could be viewed more suitable for high fodder yield.

Days to maturity: The varieties under study presented broader variability in days to maturity 25.0, 60.93 and 14.06 per cent entries fall under early, medium and late maturity group having 110.98-114.0, 114.0-116.99 and 117.02-119.05 days. This suggests that early maturing varieties represent broader ecological adaptation with non-shattering traits.

Number of fertile tiller per plant: It is obvious that economic yield is dependent on number of fertile tiller per plant. The class 3.47-3.99 emerged with lowest tiller per plant having 20.31 per cent population and class 5.00-5.51 comprised highest tiller per plant having 14.06 per cent population, while class 4.00-4.99 showed moderate tiller per plant having 65.62 per cent population. This view that the plant having maximum number of fertile tillers per plant may contribute directly towards grain yield.

Length of main spike (cm): In this study, length of main spike class 5.39-6.90 comprised 6.25 per cent population; class 7.02-7.97 comprised 45.31 per cent population and remaining class 8.03-8.89 comprised 48.43 per cent population. Length of main spike directly contributes to yield. Plant having highest length of main spike may be high yielder.

No. of grains per main spike: Number of grains per main spike was highly correlated with grain yield per plant it means grain yield can be increased with increasing the number of grains per main spike. Grains per main spike class 29.34-32.95 having 42.18 per cent populations, class 33.07-36.98 having 48.43 per cent population and class 37.21-39.18 comprised 9.37 per cent population.

1000-grain weight (g): Like other characters, 1000-grains weight has direct contribution in increasing grain yield per plant. 1000-grain weight is almost stable character. The class 34.51-35.85 comprised 15.62 per cent population, class 36.09-39.89 comprised 67.18 per cent population and class 40.01-41.67 comprised 17.18 per cent population.

Grain yield per plant (g): Grain yield is the resultant of multiple interactions of various factors or dependent other various yield contributing traits. The class 5.64-6.99 comprised 51.56 per cent population, class 7.00-7.96 comprised 37.5 per cent population and class 8.06-8.52 comprised 10.93 per cent population.

To accomplish success in barley improvement programme it is necessary to collect information on genetic variability as it provide the basis for an efficient selection of varieties for hybridization. The varieties mentioned above collected from Directorate of Wheat Research, Karnal exhibiting very high mean performance for desirable characters, may be utilized as donors for improving those characters in a component breeding approach which had medium or low grain yield.

Many workers have realized the importance of genetic variability in the selection of parents for hybridization (Korkut *et al.*, 2001; Asif *et al.*, 2004; Paul *et al.*, 2006; Lisowska M (2006). Sidharthan and Malik, 2007; Singh and Sharma, 2007; Chaitali and Bini, 2007; Mishra *et al.*, 2007; Saktipada *et al.*, 2008; Singh *et al.*, 2008; Pal *et al.*, 2009;). In nut shell, utilising elite germplasm lines in breeding programme it is important to ascertain whether the lines is possessing on the desirable genes to next generation or not. Hence, utilization of these better germplasm lines in barley improvement programme will help in breaking the yield plateau.

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