The Pharma Innovation Journal 2022; 11(2): 1888-1891

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(2): 1888-1891

www.thepharmajournal.com
Received: 08-12-2021
Accepted: 06-01-2022

Vikash Singh Thakur
Assistant Professor, Rabindranath Tagore University, Raisen, Madhya Pradesh, India

Vinay Mishra
Technical Assistant, Agriculture Department, Faizabad, Govt. of Uttar Pradesh, India

Amit Tamrakar
Vocational Trainer, Govt. excellence Hr. Sc. School, Patera, Damoh, Madhya Pradesh, India

Kapil Kumar Chourasiya
Assistant Professor, Swami Vivekanand University, Sironj, Sagar, Madhya Pradesh, India

Mahesh Kumar
Assistant Professor, Rabindranath Tagore University, Raisen, Madhya Pradesh, India

Corresponding Author:
Vikash Singh Thakur
Assistant Professor, Rabindranath Tagore University, Raisen, Madhya Pradesh, India

Assessment of genetic diversity and yield performance in barley (*Hordeum vulgare* L.) under rainfed condition

Vikash Singh Thakur, Vinay Mishra, Amit Tamrakar, Kapil Kumar Chourasiya and Mahesh Kumar

Abstract
The experiment was carried out at Agriculture Farm, Rajoula, Department of Crop Sciences, Faculty of Agriculture, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidhayalaya, Chitrakoot, Satna (Madhya Pradesh). A field experiment was conducted to study assessment of genetic diversity and yield performance in barley (*Hordeum vulgare* L.) under rainfed condition, Ten barley genotype were taken for investigation *viz.*, Azad, IBOH-9025, IBOH-9026, IBCB-83, Jyoti, K-409, K-909, Jagrati, IB4T-920 and K-560. The experiment was laid in randomized block design with three replications. The most desirable genotypes for other characters coupled with superior grain yield were IBOH-9025 for high 100 grain weight and plant height, Jagrati for days to flowering, Azad for maximum ear length, IBOH-9025 for maximum ear bearing tillers plant^{-1}, Azad for number of tillers plant^{-1} and maximum number of seeds ear^{-1}. The superior lines identified for seed yield and other characters may be utilized as donor in hybridization programme for improving the characters for which they showed deficiency.

Keywords: Genetic diversity, yield performance, barley

Introduction
Barley (*Hordeum vulgare* L.), 2n=14, belonging to family gramineae and grown as a 4th mostly grown and important crop in the world after wheat, maize and rice (Madakemohekar *et al.*, 2018). It is often considered as an industrial crop because of its varied utility in food, feed and brewing industries. It has become an important crop due to its demand for manufacture of alcoholic beverages, such as beer, whisky and other non-alcoholic malted food products like baby food, cocoa malt drinks, Vinegar and in ayurvedic medicines (Misra *et al.*, 1982) [3]. It have very good medicinal value like, treating hyper Cholesteremia (Anderson *et al.*, 1990) [1] and reduce the serum cholesterol level in the blood because presence of bran and bran oil (Arun Kumar *et al.*, 2016).

For increasing the production of barley, it is essential to breed high yielding varieties combined with good amount and high quality of protein. To achieve this goal, detailed information about the genetic architecture of barley crop in respect of important economic and quality traits needs to be derived. In order to develop a high yielding and good quality varieties of barley suitable for different agro-climatic conditions and cropping systems, it becomes essential to obtain adequate genetic information about the genetic architecture of the existing cultivars/strains for quantitatively inherited traits such as yield and its components and quality attributes like lysine and protein content. Yield is a very complex character, which is controlled by polygenes depends upon its allied component and is a sum of its direct as well as indirect component.

Varietal development in barley has primarily been confined to exploitation of available genetic variability for establishment of homozygous lines possessing higher yield and stability. The release of such pure line varieties depends on the management of genetic variability for developing efficient plant types having genes for higher performance for yield and yield contributing traits. This requires quantitative characterization of the variability present in a crop by understanding the nature of gene actions involved in the inheritance of agronomically important characters.

The information on variability in exotic as well as indigenous material of barley is quite inadequate. Information on yield stability, high adaptation, cold, drought tolerance, and superior nutritional qualities of seed is vital for deciding on inclusion of particular introductions/parents in crop improvement program.

Thus there is urgent need of preliminary assessment of exotic as well as indigenous barley germplasm for breeding work which would presumably broaden the genetic variability through hybridization.

Material and Methods

The experiment was carried out at Agriculture Farm, Rajoula, and Biochemical analysis was conducted in Biochemistry Lab, Department of Crop Sciences, Faculty of Agriculture, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidhayalaya, Chitrakoot, Satna (Madhya Pradesh). The place of experiment in Chitrakoot is situated at $25^0$10' North latitude and $80^0$85' East longitude. The altitude is about 200m above mean sea level. The climate of Chitrakoot area is semi-arid and sub-tropical type with hot dry summers and cool dry winters. Annual average rainfall is around 950 mm. May and June are the hottest months, where maximum temperature reaches up to 45-50 ^{0}C. January is the coldest month of year, when average minimum temperature falls to 3-6 ^{0}C.

Experimental materials

The experimental material for the present investigation comprised of 10 varieties/ strains of barley (*Hordeum vulgare* L.). These genetically and geographically diverse genotypes of barley were obtained from germplasm maintained at C.S. Azad University of Agriculture & Technology, Kanpur. The name of each varieties/strains is given in Table 1.

Table 1: Names of varieties/ strains of barley

S.N.	Varieties/Strains
1	Azad
2	IBOH-9025
3	IBOH-9026
4	IBCB-83
5	Jyoti
6	K.409
7	K-909
8	Jagrati
9	IB4T-920
10	K-560

Experimental methods

The experiment was conducted to evaluate the 10 barley varieties/ strains under normal soil and rainfed condition. The experimental was laid out following Randomized Block Design with three replications on 30 November 2012. Each treatment was grown in single row of 3.0 m long, spaced 25 cm apart. Distance of plants within rows was maintained at about 10 cm by thinning. All the recommended agronomic practices were adopted for raising a good normal crop.

Experimental result

Genetic variability

The mean values for all the characters were calculated and are given in Table 2. The results on range and coefficient of variation are presented character wise in Table 2. In general, phenotypic coefficients of variation were higher than genotypic coefficient of variation for all the characters

Days to 50% flowering

A perusal of the Table 2 revealed that, days to 50% flowering ranged from 56.33 days (Jagrati) to 60.33 days (Azad) and the grand mean was 58.31 days. The phenotypic and genotypic coefficients of variation were 3.51 and 0.21, respectively for this character.

Plant height

A large amount of variability was found for plant height ranged from 64.37 cm (IB4T 920) to 85.23 cm (Jyoti) and the grand mean was 73.31 cm. Plant height exhibited higher values of phenotypic (9.48) and genotypic (8.93) coefficients of variation indicating that environment has played significant role in the expression of this character.

Number of tillers per plant

A large amount of variability was found for number of tillers per plant varied from 3.00 (IBCB 83) to 7.95 (Azad) and the grand mean was 5.83. Number of tillers per plant were showed phenotypic (25.97) and genotypic (24.78) coefficient of variation indicating that environment has played significant role in the expression of this character.

Ear bearing tillers per plant

A large amount of variability was found for ear bearing tillers per plant varied from 1.22 (IBCB 83) to 5.95 (IBOH 9025) and the grand mean was 3.78. Ear bearing tillers per plant were showed phenotypic (34.64) and genotypic (34.19) coefficient of variation indicating that environment has played significant role in the expression of this character.

Ear length (cm)

Ear length varied from 11.27cm (Jagrati) to 20.24cm (Azad) and the grand mean was 15.74. The phenotypic (17.25) and genotypic (17.20) coefficient of variation was higher for this character indicating that environment has played significant role in the expression of this character.

Number of seed per ear

Number of seed per ear ranged from 28.27 (IBOH 9026) to 53.27 (Azad) while the grand mean was 44.44. The phenotypic and genotypic coefficients of variation were 19.64 and 19.60, respectively for this character indicating that environment has played significant role in the expression.

100 Seed weight (g): A large amount of variability was found for 100 seed weight ranged from 4.04 gm (Azad) to 4.63 (IBOH 9025) and the grand mean was 4.25. The phenotypic and genotypic coefficients of variation were 5.18 and 3.26, respectively for this character indicating that environment has played significant role in the expression of this character.

Seed yield per plant (g): Seed yield per plant ranged from 3.47 g (IBCB 83) to 12.73 g (IBOH 9025) while the grand mean was 8.29 gm. Seed yield per plant exhibited moderate values of phenotypic (35.66) and genotypic (35.56) coefficient of variation. The similar results were reported by Arbi *et al*. (1992) for grain yield per plant, grains per spike, spikelets per spike, tillers per plant; Sharma and Maloo (1994) for grain yield per number of grain per plant and effective tillers per plant; Sharrna *et al.* (1986) [6] for grains per spike; Sharma *et al*. (2002) [5] for grain yield per plant, grains per spike, spikelets per spike and tillers per plant; Shahinnia *et al*. (2005) for kernel number per spike and yield; Mishra *et al*. (2007) [2] for number of productive tillers per plant and number of grains per ear; Singh *et al*. (2008) [8] for grain yield per plant.

Table 2: Mean, range, genotypic, phenotypic variance and coefficient of variation for 8 quantitative characters in barley.

S.N.	Characters	Grand mean X±SE	Range		Phenotypic variance	Genotypic variance	GCV	PCV	CV%
			Min.	Max.					
1	Days to flowering	58.31±1.20	56.33	60.33	4.29	0.01	0.21	3.55	3.56
2	Plant height (cm)	73.31±1.34	64.37	85.23	47.94	42.56	8.93	9.48	3.18
3	Number of tillers per plant	5.83±0.27	3.00	7.95	2.35	2.14	24.78	25.97	7.78
4	Ear bearing tillers per plant	3.78±0.12	1.22	5.95	1.75	1.70	34.19	34.64	5.59
5	Ear length (cm)	15.74±0.12	11.27	20.24	7.37	7.33	17.20	17.25	1.28
6	Number of seeds per ear	44.44±0.14	28.27	53.27	78.75	78.69	19.64	19.64	0.52
7	100-seed weight	4.25±0.10	4.04	4.63	0.05	0.02	3.26	5.18	4.03
8	Seed yield per plant (g)	8.29±0.13	3.47	12.73	8.83	8.77	35.56	35.66	2.77

Heritability and Genetic advance

Heritability in broad sense was computed for all the characters and has been presented in Table 3.High heritability estimates were found for ear length, number of seeds per ear, plant height, number of tillers per plant and ear bearing tillers per plant in decreasing order. Moderate heritability was found for 100-seed weight, seed yield per plant and days to flowering in decreasing order.

The expected genetic advance in per cent of mean ranged from 2.92 per cent for days to flowering to 66.23 per cent for seed yield per plant (Table 3). High estimates of expected genetic advance were found for seed yield per plant, ear bearing tillers per plant, number of tillers per plant, number of seeds per ear, ear length and plant height in decreasing order, and low estimates of expected genetic advance were found for 100-seed weight and days to flowering in increasing order.

Table 3: Heritability (%) in broad sense, genetic advance and genetic advance in per cent of mean for 10 characters in barley

S. No.	Characters	Heritability (%)	Genetic advance	Genetic advance in per cent of mean
1	Days to flowering	61.41	1.69	2.92
2	Plant height (cm)	93.81	17.27	25.28
3	Number of tillers per plant	91.20	2.96	43.29
4	Ear bearing tillers per plant	90.00	1.75	43.71
5	Ear length (cm)	98.69	5.36	32.52
6	Number of seeds per ear	98.59	19.78	43.28
7	100-seed weight	72.78	0.30	7.26
8	Seed yield per plant (g)	71.90	5.45	66.23

Correlation coefficients

The estimates of correlation coefficients at genotypic and phenotypic levels for all the eight characters of barley genotypes are presented in Table 4. In general, genotypic correlations were higher than phenotypic ones in magnitude for all the characters. The character which showed negative association at genotypic level also showed negative association at phenotypic level.

The seed yield per plant showed positive and highly significant correlation with ear bearing tillers per plant (0.535) and (0.503) and number of seeds per ear (0.691) and (0.679) at both genotypic and phenotypic levels, respectively.

100-seed weight showed non-significant but positive correlation with number of tillers per plant (0.318) and (0.271), with days to flowering (0.197) and (0.117), ear bearing tillers (0.256) and (0.196) at both genotypic and phenotypic level, respectively.

Number of seeds per ear showed significant and negative correlation with plant height (-0.374) and (-0.358) at both genotypic and phenotypic level, respectively, whereas non-significant and positive correlation with ear bearing tillers per plant (0.142) and (0.134) at both genotypic and phenotypic level, respectively.

Ear length showed significant and negative correlation with plant height (-0.405) and (-0.389) at both genotypic and phenotypic level, respectively, whereas non-significant and positive correlation with number of tillers per plant (0.188) and (0.183) and days to flowering (0.169) and (0.128) at both genotypic and phenotypic level, respectively.

The correlation coefficient of ear bearing tillers per plant showed highly significant and positive correlation with number of tillers per plant (0.516) at genotypic and (0.466) at phenotypic. Similar results were reported earlier by Pal *et al.* (2010) [4] for spikelets per spike level. Singh *et al.* (2008) [8] for plant height and grain yield per plant; Mishra *et al.* (2007) [2] for number of grains per ear; Singh *et al.* (2006) [7] for plant height, ear length, number of grains per ear and grain yield per plant; Sharma *et al.* (2002) [5] for grain yield per plant, grains per spike, spikelets per spike and tillers per plant; Moderate heritability coupled with low genetic advance was observed for 100-seed weight and days to flowering.

Table 4: Genotypic and phenotypic correlation coefficients between 8 characters in Barley.

S. No.	Characters		Days to flowering	Plant height (cm)	Number of tillers	Ear bearing tillers	Ear length (cm)	Number of seed per ear	100-seed weight (g)	Seed yield per plant (g)
1.	Days to flowering	G	1.00	0.180	0.176	0.061	0.169	-0.177	0.197	-0.208
		P	1.00	0.116	0.101	0.075	0.128	-0.156	0.117	-0.155
2.	Plant height (cm)	G		1.00	-0.198	-0.197	-0.405*	-0.374*	0.043	-0.108
		P		1.00	-0.185	-0.195	-0.389*	-0.358*	0.028	-0.102
3.	Number of tillers per plant	G			1.00	0.516**	0.188	-0.224	0.318	0.143
		P			1.00	0.466**	0.183	-0.210	0.271	0.129
4.	Ear bearing tillers per plant	G				1.00	-0.096	0.142	0.256	0.535**
		P				1.00	-0.086	0.134	0.196	0.503**
5.	Ear length (cm)	G					1.00	-0.077	-0.047	-0.258
		P					1.00	-0.074	-0.036	-0.253
6.	Number of seeds per ear	G						1.00	-0.257	0.691**
		P						1.00	-0.217	0.679**
7.	100-seed weight	G							1.00	0.209
		P							1.00	0.168
8.	Seed yield per plant (g)	G								1.00
		P								1.00

*,** Significant at probability level 1% and 5% respectively.

Conclusion

The genotypes IBOH-9025 produced highest grain yield per plant followed by K 560 (11.10g). The most desirable genotypes for other characters coupled with superior grain yield were IBOH-9025 for high hundred grain weight and plant height, Jagrati for days to flowering, Azad for maximum ear length, IBOH-9025 for maximum ear bearing tillers per plant, Azad for number of tillers per plant and maximum number of seeds per ear.

Phenotypic coefficients of variability (PCV) were higher than genotypic coefficients of variability (GCV) for all the characters. Maximum phenotypic and genotypic coefficients of variation were observed for seed yield per plant followed by ear bearing tillers per plant, number of tillers per plant and 100-seed weight, whereas, moderate for ear length and plant height.

In general, genotypic correlations were higher than phenotypic ones in magnitude for all the characters.

References

1. Anderson JW, Deakine DA, Floore TL, Smith BM, White SE. Dietary fibre and coronary heart disease, Critical Reviews in food Science and Nutrition. 1990;29:95-147.
2. Mishra CN, Singh SK, Singh PC, Bhardwaj DN, Singh HL. Genetic variability in barley. Int. J Pl. Sci. 2007;3(2):220-221.
3. Misra BN, Verma BS, Singh KN. Effect of varying levels of N, P and K application on grain and straw yield and nutrient uptake pattern in six row barley. Indian Journal of Agricultural Research. 1982;16:139-144.
4. Pal, Sukram, Singh, Tejveer, Ramesh B. Estimation of correlation parameters and path coefficient in barley. Crop Improvement. 2010;37(1):52-56.
5. Sharma, Yogendra, Sharma SN, Joshi P. Genetic variability, character association and path analysis of yield and its component characters in six rowed barley. Indian J Plant Genet. Resour. 2002;15(3):258-261.
6. Sharrna AN. Genetical study for earliness, yield and its contributory characters in barley cross. Enyptian J Genet. Cyto. 1986;11:83-95.
7. Singh HL, Singh SK, Singh P, Singh BC. Correlation coefficient and path coefficient analysis in barley. Int. J Pl. Sci. 2006;1(2):256-258.
8. Singh SK, Sirohi A, Kerkhi SA, Singh D, Kumar V, Singh A, *et al*. Genetic variability and correlation coefficient of grain yield in barley. Environment and Ecology. 2008;26(4C):2379-2381.