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Full Length Research Paper

An evaluation of genetic variability in seedling vigour in wheat *(Triticum aestivum L.)*

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This experiment was aimed to study whether genetic variability exists in the seedling vigour of 50 elite spring wheat lines and also to study its correlation with yield and yield components. Analysis of variance reveals significant difference for seedling vigour index as well as other yield and yield components. The phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) was observed highest in seed yield plot^{-1}, vigour index, 1000-seed weight and tillers m^{-2}. The highest heritability accompanied with genetic advance was observed in seed yield plot^{-1}, seed vigour index, 1000-seed weight and spike length which is due to additive gene action and direct selection for these traits would be rewarding. Seed vigour index had significant and positive correlation with seed yield and other yield components except for spike length at both phenotypic and genotypic level. This study revealed that seed vigour index is strongly under genetic control and has great scope to be included in wheat breeding program as a selection parameter to assess stress tolerant as well as vigorous genotypes.

Key words: Seed vigour, yield parameters, genetic variability, correlation, wheat.

INTRODUCTION

Wheat breeders are continuously seeking the improvement in wheat through various ways to ensure a near perfect stand crop, which in turn depends up on good quality seed with good germination followed by vigorous seedlings, which can help the crop to escape the hazards of water stress conditions etc. Optimum plant population is one of the most crucial factor for obtaining higher production and profitability for any crop which is generally influenced by vigorous status of seed (Kumar and Kharab, 2002).

Before a character is introduced in a breeding programme, study of its genetic variability and correlation is a pre-requisite. Variability in crop plants provides an opportunity for selecting desirable genotypes. Correlation on the other hand gives an idea about various associations existing between yield and other characters under study. This study was conducted with the objective to observe whether genetic variability exists in seed vigour index and its correlation with yield and yield components so that it may be included in a breeding program as selection parameter.

MATERIALS AND METHODS

The experiment was conducted in the Department of Genetics and Plant Breeding/ Seed Science and Technology, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad, for both laboratory and field experiment. The experimental material consisted of 50 elite spring wheat lines from CIMMYT, Mexico. Seed vigour index was calculated from procedure given by Abdul

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Table 1. Analysis of variance (two year data) and pooled PCV, GCV, heritability, genetic advance (as % mean) for 6 traits in wheat.

Characters	Mean sum of square (treatments) (2007-08)	Mean sum of square (treatments) (2007-08)	Genotypic coefficient of variation	Phenotypic coefficient of variation	Heritability (broad sence)	Genetic advance	Genetic advance as % mean
Seed vigour index	53.324**	53.324**	11.24	12.66	78.8	4.54	20.56
Tillers m^{-2}	43.22**	50.986**	10.61	12.46	**68.2**	5.18	18.59
Spike length (cm)	5.424**	3.528**	6.62	8.32	71.5	1.85	17.09
Seed $spike^{-1}$	104.21**	107.631**	8.95	11.09	65.2	7.21	14.90
1000-Seed weight (g)	52.24**	55.545**	10.66	12.05	71.9	7.63	19.41
	2.451**	3.721**	12.42	14.87	82.05	0.85	21.32

Baki and Anderson (1973). Other observations were recorded on five randomly selected plants from each line in each replication. The yield was calculated from plot basis of 6 m^2 size. The pooled data obtained from two years (2007 to 2008 and 2008 to 2009) was subjected to Analysis of variance by Fisher (1936), phenotypic and genotypic coefficient of variance (PCV and GCV) by Burton and Devane (1953), heritability (broadsense) by Burton and Devane (1953), genetic advance by Johnson et al. (1955) and correlation coefficient (phenotypic and genotypic) by Al- jibouri et al. (1958).

RESULTS AND DISCUSSION

The evaluation of germplasm for various yield components and other agronomic traits is not sufficient for identification of genotypes/lines especially when growing under varying environmental conditions. So it becomes necessary to evaluate lines/genotypes for those traits, which could be used to determine the good performance under stress conditions also. Analysis of variance revealed significant differences for Mean Sum of Squares (MSS) values for all the traits under study including seed vigour index (Table 1). Information about the genetic properties of the given population can be drawn from the relative magnitude of the components of variance. The variability and estimates of genetic parameters from pooled data of two years revealed that the phenotypic coefficient of variances (PCVs) were higher than that of corresponding genotypic coefficient of variances (GCVs) for all the traits indicating that traits interacted with environment (Table 1). The GCV was maximum for seed yield $plot^{-1}$ followed by seed vigour index and 1000-seed weight and was lowest in spike length. The maximum for seed yield $plot^{-1}$ followed by seed vigour index and tillers m^{-2} and lowest in case of spike length, Kumar and Luthra (1994) and Khan et al. (2002) reported similar results. Heritability specifies the proportion of the total variability that is due to genetic cause. Information on heritability provides the relative practicability of selection for a particular character. Highest heritability was observed in seed yield $plot^{-1}$ followed by seed vigour index and1000-seed weight while tillers m^{-2} and spike length showed medium ranges of heritability (Table 1). Johnson et al. (1955) suggested that heritability estimates supplemented with high genetic advance are more useful than heritability alone. In this present study, seed yield $plot^{-1}$, seed vigour index, 1000-seed weight and spike length showed high heritability accompanied with high genetic advance which is due to additive gene action and direction selection for such characters would be rewarding for crop improvement. These findings are in agreement with Raha and Ramgiri (1998). To bring a change in yield or other yield related traits to a desired level, proper understanding of association between yield, yield component traits or new traits which are being introduced in breeding programme is must. Table 2 illustrates that seed vigour index has significantly positive correlation with yield and yield components except spike length which has showed positively non-significant correlation with seed vigour index.

Conclusion

From the investigation it was observed that seed vigour index exhibited high genetic variability and heritability along with the yield and other yield components, indicating these traits are controlled by additive gene action. It has also showed significantly positive correlation with yield and yield attributes. Hence seed vigour index along with other yield attributes have great opportunity for selection in wheat breeding programme to

Table 2. Genotypic and phenotypic correlation coefficient among 6 traits in 50 elite spring wheat lines.

Characters		Seed vigour index	Tillers m^{-2}	Spike length (cm)	Seed $spike^{-1}$	1000-seed weight	Seed yield $plot^{-1}$
Seed vigour	rg	1.000	0.429**	0.302	0.485**	0.733**	0.814**
index	rp	1.000	0.384**	0.209	0.380**	0.560**	0.671**
Tillers m^{-2}	rg		1.000	-0.442**	0.279	0.172	0.412**
	rp		1.000	-0.352**	0.212	0.133	0.362**
Spike length	rg			1.000	0.524**	0.471**	0.525**
(cm)	rp			1.000	0.475**	0.302*	0.443**
Seed $spike^{-1}$	rg				1.000	0.421**	0.712**
	rp				1.000	0.384**	0.632**
1000-seed	rg					1.000	0.903**
weight	rp					1.000	0.812**

rg and rp-genotypic and phenotypic correlation coefficient; *-significant at 1%; **-significant at 5% level.

enhance yield.

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