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Short Communication

Variability studies for spike and grain characters in wheat under timely and late sown conditions

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Abstract

Twenty four and nineteen lines developed for timely and late sown conditions respectively, were evaluated in RBD with 4 replications and two dates of sowing i.e. 2nd week of November (timely sowing) and 1st week of December (late sowing). Moderate GCV was recorded for spike length, grains spike^{-1}, grain yield plant^{-1}, spikelet's spike^{-1} and grain yield meter^{-1} (linear) under timely sown conditions, while higher GCV was recorded by grain yield plant^{-1} and grain yield meter^{-1} (linear) under late sown condition. This may be due to different parentage background of the genotypes. The estimates of heritability for all the traits revealed that except for grains spike^{-1} heritability estimates increased with the delay in sowing time. Economically important traits like grain weight spike^{-1}, 1000 grain weight exhibited high estimates for expected genetic advance accompanied with high heritability estimate can be improved by hybridization followed by selection. The study conclude that, correlated response obtained in grain yield as a result of selection for different spike and grain characters viz. harvest index, grains spike^{-1}, grain yield plant^{-1} exerted maximum response to grain yield followed by grain weight spike^{-1}, peduncle length and spikelet's spike^{-1}. Therefore selection for grain yield can be done through peduncle length, spikelet's spike^{-1}, grains spike^{-1}, grain weight spike^{-1}, grain yield plant^{-1} and harvest index.

Keywords: Coefficients of variation, heritability, genetic advance, correlation

Wheat is the second most important food crop in India after rice in terms of both area and production, with 12 per cent contribution in world wheat pool. Wheat is best adopted to cool growing conditions, while studies conducted under controlled environments have revealed that long hours of exposure to moderately high temperature as well as short exposure to very high temperature reduces wheat yield. Such situations arise when the crop is exposed to high temperature before anthesis, reduction in grain number occurs via reduction in spike per square meter and grains per spike, while reduction in grain weight results from reduction in grain filling duration and rate. The objectives of this study were to determine the variability for spike and grain characters and to evaluate degree of association between spike and grain characters with grain yield grown under timely and late sown conditions.

Experimental details: Field experiments were conducted at Wheat Research Unit, Dr. PDKV, Akola during Rabi 2009-10 season. The experimental material comprised of 24 lines developed for timely sown conditions and 19 lines developed for late sown conditions, which represents range of phenotypic variation in spike and grain characters, yield potential and tolerance to terminal heat stress etc. This material was evaluated in randomized block design with four replications and two dates of sowing i.e. timely sowing in 2nd week of November and late sowing in 1st week of December. Twelve rows of 6m row length were planted at a distance of 23 cm between the rows in timely and 18 cm in late sowing. All recommended package of practices were followed to raise the healthy crop. Observations were recorded on nine different spike and grain characteristics and analysis was done as per the standard procedure.

Variability: Moderate GCV values were recorded for four characters *viz.* spike length, grains spike^{-1}, grain yield plant^{-1}, spikelet's spike^{-1} and grain yield meter^{-1} under timely sown conditions. While higher GCV values exhibited by characters viz. grain yield plant^{-1} and grain yield meter^{-1} under late sown condition. This may be due to different parentage background of the genotypes. For some characters phenotypic and genotypic coefficients of variation were almost similar and indicative for presence of very low environmental effects. The results indicate that the above traits offer a better opportunity for improvement through selection. Ahmed *et al.* (2007) reported high values of GCV for spike length, grains spike^{-1}, grain yield spike^{-1} and plot^{-1}. While Burton, 1951 suggested that higher GCV together with higher values of heritability estimates would give the best results.

Heritability: The heritability estimates were minimum for grain weight spike^{-1} (47%) and maximum for grain yield plant^{-1} under timely sowing. Similarly, estimates were minimum for grain yield meter^{-1} (34%) and maximum for harvest index and/or peduncle length under late sowing. The results reported by Ahmed *et al.* (2007) for peduncle length, spike length; Monpara, (2011) for grain yield plant^{-1}; Wani *et al.* (2011) for harvest index are in support of the present findings. The comparison of heritability for all the

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traits was done under timely and late sowing indicated that except for grains spike^{-1} heritability estimates increased with delay in sowing time. This may be due to influence of environment on genotypes under temperature stress environment.

Heritability estimates provide information about genetic gain if accompanied with estimates of genetic advance. The expected genetic advance as per cent over character mean was minimum (6.09) for grain weight spike^{-1} and maximum for spike length (29.63) under timely sowing, while minimum for grains spike^{-1} (8.74) and maximum for 1000 grain weight (25.35) under late sowing. Higher estimates of genetic advance as per cent over mean were also recorded for grain yield plant^{-1} under timely and 1000 grain weight under late sowing, which is indicative of the fact that these traits are likely to show promise of improvement through selection. The importance of these traits in wheat has also been stressed by Soni *et al.* (2011); Wani *et al.* (2011); Singh *et al.* (2012). Therefore it can be said that economically important traits like grain weight spike^{-1}, 1000 grain weight which exhibited high estimates for expected genetic advance accompanied with high heritability estimate can be improved by hybridization followed by selection. Panse, (1957) reported that high heritability accompanied with high expected genetic advance is indicative of additive gene action which can be fixed by simple selection.

Table 1. Various genetic parameters for nine metric traits in wheat

Character	Timely sown						Late sown					
	Range	Mean	GCV	PCV	h^2	EGA	Range	Mean	GCV	PCV	h^2	EGA
Peduncle length	25.78-35.54	30.76 ±0.55	7.67	8.46	82	14.31	24.06-38.49	31.59 ±0.57	11.97	12.50	91	23.63
Spike length	5.19-8.43	6.68 ±0.13	14.89	15.42	53	29.63	5.57-7.75	6.95 ±0.016	8.83	10.07	76	15.94
Spikelet spike^{-1}	12.29-18.40	15.52 ±0.48	10.12	11.93	72	17.71	13.43-17.90	16.04 ±0.26	8.32	8.96	86	15.94
Grains spike^{-1}	33.00-50.00	40.83 ±1.55	11.04	13.41	67	18.73	35.75-45.25	40.60 ±1.36	6.23	9.15	46	8.74
Grain wt spike^{-1}	1.62-2.17	1.95 ±0.06	6.13	8.91	47	6.09	1.45-2.10	1.92 ±0.06	8.01	10.53	57	12.54
1000 grain weight	32.12-42.60	38.43 ±0.51	7.89	8.33	89	15.41	27.52-46.17	36.70 ±0.86	13.09	13.92	88	25.35
Harvest index	31.59-40.06	37.39 ±0.32	5.51	5.77	83	10.85	31.26-39.00	34.88 ±0.36	8.10	8.46	91	15.99
Grain yield plant^{-1}	3.15-4.80	3.78 ±0.10	12.21	13.40	91	22.92	2.87-5.25	3.83 ±0.42	14.02	23.64	35	17.12
Grain yield meter^{-1}	97.69-133.24	110.61 ±5.68	10.70	11.76	90	19.69	39.50-72.00	52.52 ±4.86	13.29	22.80	34	15.96

Table 2. Correlations in timely sown (above diagonal) and late sown (below diagonal) wheat

Character	Peduncle length	Spike length	Spikelet spike^{-1}	Grains spike^{-1}	Grain wt. spike^{-1}	1000 grain wt.	Harvest index	Grain yield plant^{-1}	Grain yield m^{-1}
Peduncle length	-	-0.450**	-0.586**	-0.158	-0.504**	0.304**	0.100	0.301**	-0.134
Spike length	-0.210	-	0.731**	0.423**	0.264**	0.032	-0.324**	-0.121	-0.203*
Spikelet/ spike	0.001	0.075	-	0.366**	0.489**	0.088	-0.369**	-0.240*	-0.087
Grains/ spike	0.105	0.337**	0.649**	-	0.439**	0.346**	-0.115	-0.031	0.032
Grain weight/ spike	0.166	-0.301**	-0.224	-0.319		0.113	-0.599**	-0.460**	-0.465
1000 grain weight	0.467**	-0.294**	-0.169	0.088	-0.144	-	-0.299**	-0.026	-0.662**
Harvest index	0.065	-0.192	-0.280*	0.164	0.504**	-0.444**	-	0.260*	0.823**
Grain yield/ plant	-0.038	0.231	-0.163	0.391**	-0.494	-0.204	0.221	-	0.421
Grain yield/ meter	0.316**	-0.096	0.231*	0.531**	0.326**	-0.218	0.645**	0.490**	-

Correlation analysis: The estimates of genotypic correlation coefficient between spike and grain characters with grain yield are presented (Table 2). Grain yield showed significant positive correlation with harvest index (0.823) and grain yield plant^{-1} (0.421) under timely sowing and it was significant positive with harvest index (0.645), grains spike^{-1} (0.531), grain yield plant^{-1} (0.490), grain weight spike^{-1} (0.326), peduncle length (0.316) and spikelet's spike^{-1} (0.231) under late sowing. These characters can be effectively used as selection criteria for grain yield under high temperature regime (Monpara, 2011; Wani *et al.,* 2011; Singh *et al.,* 2012).

Under timely sowing, spike length possessed significant positive correlation with spikelet's spike^{-1}, grains spike^{-1} and grain weight spike^{-1}. Spikelet's spike^{-1} and grains spike^{-1} possessed significant positive correlation with grain weight spike^{-1} and 1000 grain weight. Similarly under late sowing conditions peduncle length possessed significant positive correlation with 1000 grain weight, spike length possessed significant positive correlation with grains spike^{-1}, spikelet's spike^{-1} possessed significant positive correlation with grain number spike^{-1}, grains spike^{-1} with grain yield plant^{-1} and grain weight spike^{-1} with harvest index.

From the study it was concluded that correlated response obtained in a grain yield as a result of selection for different spike and grain characters *viz;* harvest index, grains spike^{-1}, grain yield plant^{-1} exerted maximum response to grain yield followed by grain weight spike^{-1}, peduncle length and spikelet's spike^{-1}. Therefore, selection for grain yield can be done through peduncle length, spikelet's spike^{-1}, grains spike^{-1}, grain weight spike^{-1}, grain yield plant^{-1} and harvest index.

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