Evaluation of Elite Breeding Lines of Wheat for Yield, Yield Components and Important Quality Parameters

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One hundred nineteen lines/cultivars of wheat (*Triticum aestivum* and *T. durum*) were planted in augmented design with 3 checks (PBW 343, UP 2338, WH 542). Data were recorded on 13 characters. The nature and magnitude of variability and character associations were studied. The high value of PCV was observed for grain yield whereas moderate values of PCV were obtained for grains/ear, harvest index, ear length, sedimentation value, biological yield, 1000- grain weight and plant height. Low values of PCV were observed for rest of the characters. Character association analysis revealed highly significant and positive correlation of grain yield with biological yield/plot and harvest index. Other characters which showed positive and significant correlation with yield were grains/ear, hectoliter weight and 1000-grain weight. Days to heading showed highly significant and negative correlation with grain yield. Protein content showed significant and negative correlation with harvest index. Potential donors for different characters have been identified in the present investigation.

Kew Words: Wheat, *T. aestivum*, *T. durum*, Yield components, Quality parameters

At present most of our wheat varieties are good to very good for chapati making properties. However, these varieties need further improvement if we wish to enter the international grain trade. Released Indian wheat varieties have 12 per cent protein, >78 kg/hl test weight, >550 c.c. loaf volume and 49 c.c. sedimentation value that is suited for bread purposes (Nagarajan, 2002). The endosperm of the wheat grain usually contains 7-15 per cent protein and about half of this is gluten. Different end products of wheat, as bread or biscuits cookies, noodles, semolina etc. require special grain quality for their manufacture. Wheat flour with strong gluten strength and good balance of physical dough properties are for bread making while for biscuits, cakes, pastries, soft wheat with weak gluten strength is required.

Improvement of crop depends upon the magnitude of genetic variability in economic characters, therefore, the evaluation and utilization of genetic variability in desired direction becomes extremely important in any yield improvement programme. The extent of genetic variability in a specific breeding population depends on the genotypes included in it and its selection history. In this regard, it is necessary to survey the valuable useful variability and to study the nature of association among the various plant characters. As grain yield and quality are complex characters, such studies may be useful in identifying the yield components warranting due attention during selection process. Keeping this in view, the present study was carried out to estimate the relative genetic variability for different characters, to assess the nature and magnitude of association among yield and yield contributing characters and quality parameters,

Materials and Methods

The experimental material for the present study comprised 122 genotypes of bread (*T. aestivum*) and (*T. durum*) wheat including three checks. The planting of experiment was done in augmented block design under irrigated timely sown condition. There were 7 blocks with 119 genotypes and three checks (PBW 343, UP 2338 and WH 542) in each block. The plot size consisted of 2 rows, 3 m long and 23 cm apart. Data were recorded on plot basis for days to heading, days to maturity, biological yield, grain yield, harvest index, grains/ear and 1000-grain weight. For rest of the characters data were recorded on randomly selected five plants. Protein content and sedimentation value were recorded in laboratory through special techniques. The mean values of test genotypes and checks with respect to various characters were computed and were used in analysis of variance for augmented design, PCV and character association. The analysis of variance for augmented design was done as per Federer (1961) and Federer and Raghavarao (1975).

Results and Discussion

The analysis of variance indicated significant differences among the check varieties for days to heading, plant height, ear length, grains/ear and 1000-grain weight. The check varieties did not differ for rest of the characters.

The mean squares due to blocks were non-significant for all the characters, except for days to heading. The estimation of variability is of utmost importance in a crop for the identification of genotypes which can be used to generate further variability so that the selection of desirable genotypes can be made in the segregating generations. Grain yield/ plot had highest value of PCV (21.05%), followed by grains/ ear (17.75%), harvest index (17.67%), ear-length (16.87%), sedimentation value (16.56%) and biological yield (16.33%). Higher variation for grain yield was also reported by Getachew *et al.* (1993), Dhonde *et al.* (2000) and Walia and Garg (1996). Dhonde *et al.* (2000) and Getachew *et al.* (1993) also observed large variation for grains/ear. Moderate values of PCV were noted for 1000-grain weight (13.23%), plant height (12.64%) spikelets/ear (10.90%), days to heading (10.57%) and protein content (9.4%). Korkut *et al.* (2001) reported 11.25 per cent value of PCV for plant height and 11.13 per cent for 1000-grain weight. Large variation for plant height was also reported by Dhonde *et al.* (2000). Low value of PCV were observed for other characters. Jagshoran (1995) also observed low values of PCV for days to heading and maturity. The high variability may be exploited to select superior donors for important yield and quality traits which can be used in hybridization programme to generate large variability. For the characters which have low variability such as days to maturity and hectoliter weight, additional genotypes may be evaluated or additional variability may be generated through hybridization or mutation. The genotypes significantly superior to the best check for various characters are given in Table 1. Selection of genotypes for short duration in heading and maturity may be useful to develop variety for late sown conditions because such varieties can do better in intercropping and mixed cropping. For 1000-grain weight 95399 P-1B, CM 504 P-20B and 95402 P-10B are significantly superior (> 53 g seed weight) to the best check (PBW 343). For protein content 95399 P-1B and 96078 P-37B showed significant superiority (> 11.8% protein content) over the best check (WH 542), and satisfying the threshold value of protein needed for bread quality. The genotypes carrying the protein content < 10 per cent may be used for making the biscuits, cakes and pastries. Nine genotypes were superior to best check for sedimentation value. Of these, 4 genotypes viz., ESWYT-50, IBWSNP-169, 95223P-4B and 94223 P-3B exhibited sedimentation value of > 49 c.c. Higher sedimentation value is desirable for bread-making potential of genotype (Rao, 2001). Only one genotype was significantly superior to the best check for grain yield (IBWSN P-73), harvest index (CM 504 P-20B) and grains/ear (96078 P-59B). None of the genotypes was superior to the best check for hectoliter weight and biological yield.

The study of correlations would help in selection of traits associated with highest expression of yield and secondly, it would help in improvement of one character without sacrificing the other character. The correlation coefficients among various characters are given in Table 2. Grain yield/plot showed highly significant and positive correlation with biological yield/ plot (0.549) and harvest index (0.671) and significant and positive with grains/ ear (0.189), hectoliter weight (0.211), and 1000-grain weight (0.204). Getachew *et al.* (1993) carried out correlation studies on 70 durum wheat genotypes and reported strong positive association of grain yield with all characters, except days to heading and harvest index, where as in present study protein content (-0.209), days to maturity (-0.212) and days to heading (-0.266) exhibited significantly negative correlation with grain yield. Jaglan *et al.* (1997) while studying correlation in tall vs. dwarf populations of bread wheat reported that yield showed highly significantly positive correlations with plant height, number of tillers and 1000-grain weight which is in accordance with the present investigation. Grain yield and hectoliter weight was found significantly and positively correlated, as high hectoliter weight expressed sound and mature grain.

There was positive and significant association between grain yield and 1000-grain weight and days to maturity and days to heading which is in agreement with the findings of Moghaddam *et al.* (1997). Prasad and Pandey (2000) studied character association in *Triticum durum* and reported low correlation between 1000-grain weight and yield. This indicated the limited role of 1000-grain weight in enhancing yield in case of durum wheat and the two traits were behaving independently.

The negative and highly significant correlation between grain yield and days to heading is also supported by Jaradat (1990) and Getachew *et al.* (1993). The negative correlation may prove to be boon in present day context of high intensity cropping system where short duration genotypes are necessary and urgently required to fit in crop rotation. Biological yield had positive and significant correlation with plant height, which is in conformity with the findings of Getachew

Table 1: List of genotypes significantly superior to the best check for various characters

Sl. No.	Characters	Genotypes	Best check	Value
1.	Days to heading (early)	95245P-7B	UP 2338	70.48
		95245P-10B		70.48
		95154P-2B		70.14
2.	Days to maturity (early)	95154P-2B	WH542	128.19
		HRWSN-6		128.52
		SAWSN-118		126.52
		95215P-4B		127.52
		95421P-11B		127.86
3.	Plant height (cm) (short)	CM 512 P-13B	WH 542	77.26
		CM 512 P-17B		77.46
		96078 P-16B		74.86
		96078 P-20B		77.66
		96078 P-37B		72.86
		SHAG-8		75.12
4.	Ear length (cm)	CM 463 P-1B	UP 2338	13.90
		95413P-4B		14.96
		95413P-7B		13.56
		95413P-17B		14.16
		95423P-4B		14.16
		95423P-5B		13.36
5.	Number of spikelets/ear	CM 463P-1B	WH 542	21.57
		96011P-2B	22.57	
		96011P-3B	22.57	
		96011P-8B	24.57	
		94546P-10B	22.57	
		IBWSN P-169	21.57	
6.	Number of grains/ear	96078 P-59B	WH 542	83.19
7.	Hectolitre weight (kg/hl)	PBW 343 (check)		
8.	1000-grain weight	95399 P-1B		54.59
		CM 504 P-20B		55.97
		95402 P-10B		53.84
			PBW 343 (check)	
9.	Biological yield/ plot (kg)	PBW 343 (check)		–
10.	Grain yield/plot (kg)	IBWSN P-73		1.80
		PBW 343 (check)		
11.	Harvest index (%)	CM 504 .P-20B		49.82
		PBW 343 (check)		
12.	Sedimentation value (cc)	94668 P-3B		47.71
		94546 P-10B		46.71
		ESWYT-50		55.71
		IBWSNP -169		55.71
		SAWSN-35		46.38
		95223 P-4B		49.38
		95223 P-3B		51.05
		SAWSN-165		47.05
		SAWSN-178		48.05
			PBW-343 (check)	
13.	Protein content (%)	95399 P-1B		11.82
		96078 P-37B		13.42
			(WH 542 check)	

Table 2. Correlation coefficients for different characters

Sl. Characters	Days to maturity	Plant height (cm)	Ear length (cm)	No. of spikelets/ ear	No. of grains/ ear	Hecto-litre weight (kg/hl)	1000-grain weight (g)	Biological yield/plot (kg)	Harvest index (H.I.) %	Sediment-ation value (cc)	Protein content (%)	Grain yield/ plot (kg)
1. Days to heading	0.708**	0.164	-0.000	0.543**	0.259**	-0.249**	-0.414**	0.324**	-0.589**	0.066	0.132	-0.266**
2. Days to maturity		0.030	0.063	0.425**	0.194*	-0.300**	-0.461**	0.256**	-0.450**	0.127	0.108	-0.212*
3. Plant height (cm)			0.241**	0.194*	0.096	0.322**	0.033	0.314**	-0.180*	0.291**	-0.139	0.066
4. Ear length (cm)				0.446**	0.335**	-0.210*	-0.150	0.149	-0.018	0.178*	0.062	0.084
5. No. of spikelets/ear					0.368**	-0.220*	-0.391**	0.203*	-0.344**	0.240**	-0.019	-0.179*
6. No. of grains/ear						-0.185*	-0.236**	0.331**	-0.066	0.119	0.004	0.189*
7. Hectolitre weight (kg/hl)							0.485**	-0.011	0.257**	-0.006	-0.170	0.211*
8. 1000-grain weight (g)								-0.097	0.323**	-0.121	-0.047	0.204*
9. Biological yield/plot (kg)									-0.220*	0.160	-0.053	0.549**
10. Harvest index (%)										-0.092	-0.223*	0.671**
11. Sedimentation value (cc)											0.028	0.026
12. Protein content (%)												-0.209*

** Significant at 1% level of probability
* Significant at 5% level of probability

et al. (1993). Harvest index and days to heading exhibited negative correlation, which is in agreement to the findings of Moghaddam *et al.* (1997). Harvest index had significant negative correlation with plant height. Similar results were obtained by Getachew *et al.* (1993). Thousand-grain weight exhibited significant and negative association with number of spikelets/ear. Number of spikelets/ear showed positive correlation with days to heading. Number of spikelets/ear was positively and significantly associated with ear length and plant height suggesting that more ear length will lead to higher number of spikelets/ear. Similar results were obtained by Khan *et al.* (1993). Sheikh and Singh (2001) observed strong positive correlation of harvest index with grain yield and significant negative association of harvest index with biological yield.

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