Heritability and Genetic Advances of different Wheat (*Triticum aestivum* L.) Cultivars

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Abstract—*A field experiment conducted during rabi season. Fifteen genotypes (varieties) of wheat were grown at Kanpur , Daleepnagar and Uttaripura centres in Randomized Block Design with three replications to test the Heritability and genetic advances of different wheat (Triticum aestivum L.) cultivars. High heritability was observed on pooled basis for days to 75 per cent heading while moderate heritability was associated with plant height, peduncle length, number of grains per spike and grain yield per plant. Days to maturity revealed the high heritability and maximum genetic gain. The thousand grain weight also exhibited high heritability and maximum genetic gain. It means these traits might be rewarding for high grain yield.*

Keywords*: Wheat (Triticum aestivum L.), Heritability; and Genetic advances*

1. INTRODUCTION

Wheat is the dominant grain of world commerce. It constitutes the major food for millions and millions of people on this planet; occupying the foremost position among the cereal crops of the world. Among the cereals, wheat accords a place of pride because of vast acreage covered in its cultivation, its nutritional value and its association with some of the earliest and most important civilization of the world. India is the second largest wheat producer of the world after China and it accounts for nearly fifteen per cent of the world wheat production i.e. 580.00 million metric tonnes with productivity of 28.0 q/ha and total area of 282.00 million hectares during 2007-08. In India, about 80 per cent of wheat area is confined to only seven states viz., Punjab, Haryana, Uttar Pradesh, Rajasthan, Gujarat, Bihar and Madhya Pradesh which account 75 per cent of the total wheat production in the country.

Among the leading states, Uttar Pradesh is the biggest wheat producing state, contributing more than 36.0 per cent in area and production in the country. Although, the wheat production level has gone down in the world according to growth rate of wheat production (2.20 %) which is still below the population growth rate (2.30 %) in the earth. It means the need for accelerating the productivity rate is essential. Similar is the situation in India as well as in Uttar Pradesh. However, there are still many opportunities before the scientists for further increase in yield potential through genetic manipulation.

Therefore, for attaining higher yield level, the breeder is required to simplify this complex situation through handling of yield components. For this rational approach, it is essential to gather information on the genetics of yield contributing attributes along with nature and magnitude of association between yield components to resolve and quantify their mode of contribution to grain yield. With the change in yield potential, there is need to improve the quality of wheat grains.

Wheat alone contributes about eight million metric tonnes of protein to the world's total supply of 40 million metric tonnes (Raina *et al.*, 1982).

Therefore, the present investigation entitled, "Stability analyses of yield contributing characters and yield of wheat", was planned for the stability analyses of wheat.

2. MATERIALS AND METHODS

The basic materials for the present investigation compared of 15 genotypes viz., PBW 343, HD 2329, PBW 443, UP 2338, UP 2425, K 9107, K 9006, K 88, Raj 3077, KRLI-4, K 78, K 8027, HUW 234, HW 147 and HD 2733 for the experiments. These genotypes/varieties had been taken on the basis of differences in maturity, plant height, grain yield and other traits with a view to incorporate the maximum desirable agronomic characters. During *rabi* 2002-03 fifteen genotypes (varieties) were grown at Kanpur , Daleepnagar and Uttaripura centres in Complete Randomized Block Design with three replications. The experiments were sown on 10, 15 and 19th December 2002 in an orchard of Ber (*Syzigium cumunia*) planted at 10x10 meter distance. Recommended doses of fertilizers @ 120 kg N + 60 kg P_20_5 + 40 kg K_20 per hectare were applied in the experimental plots along with five irrigations. The material was harvested in the end of April and first week of May 2003. The plants for observation were tagged after 50 days of sowing. Data were recorded on randomly taken ten plants in each varieties from each replication. The following observations were recorded, Days to heading, Days to maturity, Plant height, Peduncle length, Number of productive tillers per plant, Spike length, Number of spikelets per spike, Number of grains per spike, 1000 grain

weight, Grain yield per, and Harvest index by the following formula: HI (%) =(Economic yield/Biological yield) x 100.

The analysis of variance for the experimental design was based on the model described by Al-Jibouri *et al.* (1958). The data were first subjected to Complete Randomized Block Design analysis on the mean basis.

3. RESULTS AND DISCUSSIONS

Genetic advance and genetic advance in per cent over mean of the trait worked out separately for all the locations and pooled over locations. The estimates are given in Table 1.

High heritability estimates (< 30) were observed for all the characters at all the locations. On the basis of pooled estimation only days to 75 % flowering showed high heritability (37.36) but other characters exhibited moderate heritability estimates varied from 12.22 to 26.95. Highest heritability for days to 75 % flowering was estimated at Kanpur (L_1) location (98.59) followed by Uttaripura (91.14) and Daleepnagar (81.62). Days to maturity exhibited maximum heritability per cent (78.57) at Daleepnagar followed by Kanpur (76.47) and Uttaripura (72.51), plant height at Daleepnagar exhibited maximum (58.70) heritability than Uttaripura (49.35) and Kanpur (48.20). High heritability for peduncle length (56.20), number of productive tillers (81.07), spike length (72.00), number of grains per spike (68.75) and harvest index (83.54) were estimated at Daleepnagar location in this study. High heritability for number of spikelets per spike (92.10) and 1000 grain weight (93.26) were estimated at Kanpur location but high heritability in respect of grain yield (75.88) was estimated at Uttaripura. The harvest index revealed the high heritability at Kanpur (83.16), Daleepnagar (83.54) and Uttaripura (75.67).

Table 1: Heritability per cent along with genetic advance and genetic advance in per cent of mean location wise and pooled for eleven characters of 15 genotypes in wheat

Characters	Heritability				Genetic advance				Genetic advance in per cent of mean			
	L_1	L_2	L_3	Pooled	L_1	L_2	L_3	Pooled	L_1	L_2	L_3	Pooled
Days to 75 % heading	98.59	81.62	91.14	37.36	24.37	8.86	16.99	9.12	42.79	28.87	28.87	16.14
Days to maturity	76.47	78.57	72.51	12.50	0.56	0.68	0.55	0.09	25.00	33.49	23.01	4.00
Plant height	48.20	58.70	49.35	22.42	1.27	3.25	1.45	3.12	11.20	9.87	10.20	6.35
Peduncle length	41.77	56.20	34.69	21.12	1.01	3.35	0.90	0.74	8.34	28.30	7.81	6.26
Number of productive tillers per plant	59.10	81.07	49.91	19.22	46.59	77.35	43.83	27.63	11.39	17.53	11.75	6.68
Spike length	65.45	72.00	67.22	16.90	1.51	1.63	1.63	0.45	11.40	12.88	12.81	3.49
Number of spikelets per spike	92.10	41.17	57.14	18.92	0.62	0.15	0.24	0.12	138.27	10.79	15.68	7.94
Number of grains per spike	62.53	68.75	52.30	21.65	2.35	6.25	1.90	4.20	12.35	11.20	11.80	7.25
1000-grain weight	93.26	77.84	78.59	15.82	13.16	7.99	4.55	6.97	33.05	22.08	10.86	17.73
Grain yield per plant	74.70	64.74	75.88	26.95	8.98	5.33	9.20	4.02	25.90	20.35	28.45	12.49
Harvest index	83.16	83.54	75.67	12.22	6.80	7.41	4.46	0.73	13.47	16.35	9.18	1.51

L_1 = location first (Kanpur), L_2 = location second (Daleepnagar-Kanpur), L_3 location third (Uttaripura-Kanpur), P = pooled over three locations

Genetic advance was estimated with selection differential at 5 per cent (2.05) while genetic gain in per cent was estimated over mean of the attribute (Table 1). Maximum genetic gain on pooled basis was observed for number of productive tillers per plant (27.63) while maximum genetic advance for this character was estimated at all the locations [Kanpur (46.59), Daleepnagar (77.35) and Uttaripura (43.83)]. Moderate genetic gain at Kanpur (24.37) was estimated for days to 75 % flowering. Remaining other characters exhibited low genetic advance at all the locations as presented in Table 1. The highest value (17.73) genetic advance in per cent of mean for 1000 grain weight on pooled basis was estimated as moderate followed by days to 75 per cent heading (16.14) and grain yield (12.49). High genetic gain in per cent was recorded (42.79) at Kanpur for days to 75 per cent heading along with number of spikelets per spike (138.27) and 1000 grain weight (33.05). At Daleepnagar the genetic advance in per cent was high (33.49) for days to maturity. But moderate genetic gain for days to 75 per cent heading was estimated (28.87) at Uttaripura followed by grain yield (28.45) and days to maturity (23.01).

High heritability estimates were reported by Garg and Pal (1991) for number of grains per spike and grain weight per spike. While moderate heritability estimates were noted in all the traits except days to 75 % heading. These results indicated the greater role of non-fixable genetic effects. Moderate heritability estimates were reported by Kumar (1985) and Rai, for grain yield, harvest index; Singh and Rai (1991) for number of productive tillers per plant and Singh (1980).

Positive and strong associations at genotypic level for grain yield with days to 75 % heading, days to maturity, number of productive tillers, number of grains per spike and 1000 grain weight indicating thereby that this relationship might be due to either changes in the proportion of different traits and environment. Srivastava *et al.* (1971) and Pokrouskova (1975) also reported such changes due to environmental variation. Pandey and Singh (2002) and Lal *et al.* (2003) for yield and yield components due to environmental effect.

4. CONCLUSION

High heritability was observed on pooled basis for days to 75 per cent heading while moderate heritability was associated with plant height, peduncle length, number of grains per spike and grain yield per plant. Low heritability was confined to days to maturity, number of productive tillers, spike length, number of spikelets per spike, 1000-grain weight and harvest index. Similarly, the moderate genetic gain in per cent of mean was observed for 1000 grain weight, days to 75 per cent heading and grain yield per plant. Location wise high heritability and genetic gain was estimated at Kanpur location followed by Uttaripura and Daleepnagar for days to 75 per cent heading. Similarly, days to maturity revealed the high heritability and maximum genetic gain. The thousand grain weight also exhibited high heritability and maximum genetic gain. It means these traits might be rewarding for high grain yield.

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