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ASSOCIATION ANALYSIS UNDER SPACED AND DENSE SOWINGS IN WHEAT

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Segregating materials are usually space sown in early generations. However, the final evaluation for grain yield is done under thick sowings. Selection for grain yield and its components under spaced planting has been found to be of little value [1, 2]. Very little efforts are made to expose the breeding materials to varied growing conditions before bulking. The present study, therefore, aims to assess the changes in phenotypic associations of different characters with grain yield under spaced and dense plantings in three different agronomic conditions. It would be useful to find traits that could be depended upon for breeding improved varieties of wheat for various agronomic conditions.

The material comprised 15 varieties of common wheat (WL 1562, WL 2265, PBW 12, PBW 46, DL 153-2, IWP 72, HI 1011, HD 2009, HD 2285, HD 2329, HD 2349, EG 657, EG 867, Veery 5,,Bow White) 2 varieties of *durum* wheat (DWL 5023, HD 4571), and one of triticale (TL 419), representing a range of variability of cultivated *aestivum* and allied wheats. Three sets of experiments, each in spaced and dense plantings, were laid out in randomized block design with three replications. These sets were sown on October 30, November 15, and December 15 (under low fertility rainfed, high fertility irrigated timely, as well as late sown conditions, respectively) at the Punjab Agricultural University, Regional Research Station, Gurdaspur. Each experimental plot had four 2.5 m long rows. Under spaced planting, the distances between rows and plants were 30 cm and 10 cm, respectively. In dense planting, sowing was done at 23 cm row-to-row distance with seed rate 100 kg/ha. Data were recorded on 10 competitive plants from the central rows in spaced planting. Under dense sowing, data on productive tillers and grain yield were recorded on 1 m row length from the centre of the plot, and on plant height, peduncle length, extrusion length, and grains/spike on 10 productive tillers in each plot. For recording 1000-grain weight, the bulk produce of the inner two rows of the plots was used. Correlation and path-coefficient analyses were carried out according to Dewey and Lu [3].

Grain yield showed significant positive correlation with tiller number under both planting densities in high fertility irrigated late sown condition and under dense planting in rainfed environment (Tables 1, 2). Grains spike exhibited significant positive correlation with grain yield in bom planting densities under rainfed condition. Grain weight was positively associated with grain yield in spaced planting under late sown condition.

Path analysis revealed direct influence of tiller number and grains/spike on grain yield in spaced as well as dense planting under rainfed condition. Srivastava et al. [4] also found ear number to be an important character for selection of genotypes for rainfed cultivation of wheat. Peduncle length had large negative direct effect on grain yield in dense planting under rainfed condition, while under spaced planting no such effect was observed. Selection for high tillering capacity, more grains/spike, short peduncle, and greater extrusion length in spaced planting under rainfed condition may yield progenies giving high yield under such condition. Both tiller number and 1000-grain weight had substantial direct effect on grain yield under both planting densities with late sowing. These yield components had little negative indirect effect through other traits. Extrusion length had large negative direct effect and positive indirect effect through peduncle length in spaced planting under late sowing. Therefore, selection of plants with high tillering and bold seed from high fertility irrigated late sown nursery is more desirable for breeding varieties for late sown conditions.

Table 1. Correlation and path coefficients of different characters with grain yield in spaced planting under low fertility rainfed and high fertility irrigated, timely and late sown conditions

Character	Environment		Effect via						
	fertility	sowing time	tiller number	plant height	peduncle length	extrusion length	grains per spike	1000-grain weight	correlation with grain yield
Tiller number	Low	Early	0.38	0.00	0.01	−0.03	−0.10	−0.01	0.25
	High	Timely	0.53	0.03	−0.08	0.01	−0.28	−0.01	0.19
	High	Late	0.58	−0.01	−0.02	0.03	−0.04	0.00	0.54**
Plant height	Low	Early	−0.01	0.04	−0.01	0.05	0.26	−0.05	0.28
	High	Timely	−0.04	−0.34	0.36	−0.20	0.11	−0.01	−0.11
	High	Late	−0.03	0.25	0.28	0.40	0.06	0.01	0.17
Peduncle length	Low	Early	−0.07	0.02	−0.03	0.11	0.00	0.08	0.11
	High	Timely	−0.09	−0.25	0.49	−0.27	−0.08	0.17	−0.02
	High	Late	−0.04	0.20	0.35	−0.49	0.00	0.14	0.17
Extrusion length	Low	Early	−0.08	0.02	−0.02	0.12	−0.11	0.09	0.02
	High	Timely	−0.01	−0.22	0.42	−0.31	−0.23	0.15	−0.20
	High	Late	−0.04	0.19	0.33	−0.53	−0.02	0.14	0.07
Grains per spike	Low	Early	−0.05	0.02	0.00	−0.02	0.68	−0.11	0.52**
	High	Timely	−0.18	−0.05	−0.05	0.09	0.80	−0.30	0.31
	High	Late	−0.12	0.07	0.01	0.06	0.20	−0.16	0.06
000-grain weight	Low	Early	−0.02	−0.01	−0.01	0.05	−0.32	0.23	−0.08
	High	Timely	−0.01	−0.01	0.17	−0.10	−0.49	0.48	0.06
	High	Late	0.00	0.01	0.11	−0.15	−0.07	0.48	0.37*

Residual effect: Low fertility, early = 0.555; high fertility, timely = 0.534; and high fertility, late sown = 0.429.
**, *Significant at $P \leq 0.01$ and $P \leq 0.05$, respectively.

Table 2. Correlation and path coefficients of different characters with grain yield in dense planting under low fertility rainfed and high fertility irrigated, timely and late sown conditions

Character	Environment		Effect via						
	fertility	sowing time	tiller number	plant height	peduncle length	extrusion length	grains per spike	1000-grain weight	correlation with grain yield
Tiller number	Low	Early	0.26	0.02	−0.03	0.03	0.06	0.00	0.34*
	High	Timely	0.05	0.11	0.03	0.00	−0.02	−0.10	0.07
	High	Late	0.44	−0.01	0.02	0.00	−0.01	−0.10	0.35*
Plant height	Low	Early	0.03	0.19	−0.21	0.10	−0.05	0.01	0.16
	High	Timely	0.01	0.69	−0.41	0.01	0.00	−0.07	0.27
	High	Late	0.03	0.08	−0.10	0.03	0.00	−0.01	−0.02
Peduncle length	Low	Early	0.01	0.07	−0.53	0.34	−0.09	−0.02	−0.22
	High	Timely	0.00	0.48	−0.59	0.01	−0.03	−0.11	−0.02
	High	Late	−0.07	0.05	−0.15	0.05	−0.01	0.11	0.02
Extrusion length	Low	Early	0.02	0.05	−0.51	0.36	−0.11	−0.02	−0.20
	High	Timely	0.00	0.44	−0.54	0.01	−0.06	0.09	−0.05
	High	Late	−0.04	−0.05	−0.14	0.05	−0.02	0.13	0.04
Grains per spike	Low	Early	0.05	0.03	0.17	−0.13	0.29	0.01	0.41*
	High	Timely	0.00	0.11	0.07	0.00	0.27	−0.24	0.21
	High	Late	−0.02	0.00	0.01	−0.01	0.01	−0.17	−0.09
1000-grain weight	Low	Early	−0.01	−0.03	−0.12	0.08	−0.04	0.07	−0.19
	High	Timely	−0.01	−0.09	−0.13	0.00	−0.13	0.48	0.12
	High	Late	−0.12	0.00	−0.04	0.02	−0.04	0.38	0.20

Residual effect: Low fertility, early = 0.709; high fertility, timely = 0.686; and high fertility, late sown = 0.779.
*Significant at $P \leq 0.05$.

Breeding high yielding wheat varieties for high fertility irrigated timely sown condition needs special attention. Path analysis revealed high positive direct effect (0.53) of tiller number on grain yield under spaced planting but under thick sowing no such effect was observed. Grain weight and grains/spike also had a direct effect on grain yield in spaced and dense plantings with timely sowing. These components, however, had indirect negative effect on each other under both densities. For breeding high yielding wheat genotypes for high fertility timely sown condition with high crop density, selection of semidwarf plants from spaced population having high grain weight per spike and adequate spikes per unit area is suggested. Wang [5] also reported similar observations in wheat.

REFERENCES

1. R. C. McGinnis and L. H. Shebeski. 1968. The reliability of single plant selection for grain yield in F_2. Proc. 3rd Intern. Wheat Genet. Symp., Canberra: 410–415.

2. D. R. Knott. 1972. Effects of selection for F_2 plant yield on subsequent generations in wheat. Can. J. Plant Sci., **52:** 721–726.

3. D. R. Dewey and K. H. Lu. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agron. J., **51:** 515–518.

4. S. N. Srivastava, D. K. Sarkar and M. H. Mallic. 1980. Association analysis in rainfed wheat. Indian J. Genet., **40:** 512–514.

5. H. L. Wang. 1986. Varietal improvement of wheat in the plains of the Yellow river and Huai river valleys. Ann. Wheat Newsletter, **32:** 60–65.