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INFLUENCE OF PLANT POPULATION ON PLANT HEIGHT. GRAIN YIELD AND ITS COMPONENTS IN WHEAT

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Two wheat varieties wcrc sown at 4, 8 and 15 cm inter-plant spacings and in 15 and 23 cm apart rows in a randomized complete block design in factorial arrangement. As the population density increased, there was a decrease in number of tiller plant^{-1}. The plants sown at 15 cm inter-plant and 23 cm inter-row spacing produced more number of grains spike^{-1}, 1000-grain weight and grain yield. Interactions among varieties, inter-row and inter-plant distances were found significant for grain yield plant^{-1}.

INTRODUCTION

Plant population spaced within and between the rows is an important variable which affect the yield and its components. Higher crop densitics induce competition while spacing more than normal is simply the wastage of land. Grain yield reaches a maximum with increasing density, after which a further increase in density leads to a decline in grain yield. However, spacings and their interactions have no effect on plant height (Ram *et al.,* 1962; Beuerlein and Lafever, 1989). Likewise, row spacing had no effect on grain yield and grain weight (Bari, 1987). Plants grown at high sowing densities tillered less freely than those grown at low sowing densities (Levcrton, 1990; Yoon *et al.,* 1991). The higher densities are associated with lower 1000-grain weight and reduction in number of grains ear^{-1} (Mlinar, 1983). Joseph *et al.* (1985) found that grain number ear^{-1} and grain weight decreased with increasing seeding rate.

MATERIALS AND METHODS

Two spring wheat strains namely: LV-31 and 5039 henceforth called varieties were planted on November 18, 1992 in the Research Area of the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad with varied population density by planting at 4, 8 and 15 cm inter-plant and 15 and 23 cm inter-row spacings. Individual plot consisted of three rows each of 5 m length. By using a randomized complete block design in three replications with factorial arrangement. Two seeds Were planted hill^{-1} which were thinned after germination to single seedling site^{-1}. Five guarded plants were selected from each plot and data were recorded on plant height, number of tillers plant^{-1}, number of grains spike^{-1}, 1000-grain weight and grain yield plant^{-1}. The data collected wcre analyscd according to Steel and Torrie (1980) and mean comparisons were made by using Duncan's new multiple range test.

RESULTS AND DISCUSSION

Analysis of variance for various plant traits and their statistical significance is presented in Table 1.

Differences for almost all traits between varieties and among various plant and row distances were highly significant

(P~O.Ol). Differences for plant height between varieties and among inter-plant spacings were highly significant whereas the row spacings and interactions among these three were non-significant. Maximum plant height was produced in 5039 with a measurement of 99.2 cm while LV-31 attained 75.3 cm height. The plants sown at higher densities (4 cm inter-plant distance) were tall than those planted at lower plant densities.

spacing and vasicty interaction and interaction, between inter-row and inter-plant distances were highly significant for differences in number of tillers planr 1. Variety LV 31 with a mean number of 24.53 produced maximum number of branches planr'! at 15 cm inter-row and 15 cm inter-plant distances while minimum tillers (9.26 planr l) were obtained in 5039 at 4 cm inter-plant and 15 cm inter-row distances.

Table 1. Mean squares for the analysis of variance for plant height, grain yield and its components in spring wheat

Source of variation	Of	Mean squares				
		Plant height	Number of tillers plant!-	Number of grains planr 1	1OOO-grain weight (g)	Grain yield plant!- (g)
Replications	2	0.101NS	6.674**	O.527NS	1.273NS	0.595NS
Variety (V)	1	5128.947**	245.444**	1049.760**	Hi75.265 **	117.578**
Inter-row distance (R)	1	3.547NS	6.760*	33.640**	12.273**	20.100**
Inter-plant distance (P)	2	19.639**	356.968**	295.688**	11.751**	837.842**
VxR	1	0.903NS	4.551NS	5.138NS	4.396NS	19.907**
VxP	2	1.530NS	10.574**	31.823**	27.827**	32.896**
RxP	2	3.089NS	13.143**	4.663NS	34.176**	7.794**
VxRxP	2	0.0nNS	3.168NS	29.768**	33.338**	12.173**
Error	22	1.199	1.138	1.468	1.089	0.641

., •• Significant at 0.05 and 0.01 probability levels, respectively.
NS = Non-significant.

It is apparent from the data that differences for number of tillers plant'! were highly significant (P~O.Ol) between varieties and inter-plant distances while inter-row spacings was significant for this trait. Plant

For number of grains spikc"'; the differences between varieties and row and plant densities were highly significant whereas variety X inter-plant densities and variety X inter-row X inter- plant distances

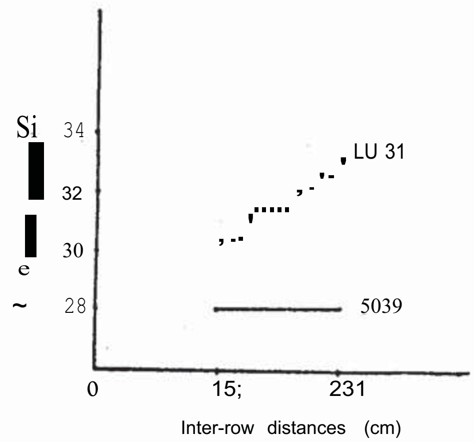

Fig. 1 a. Variety x inter-row distances interaction for grain yield plant^{-1}.

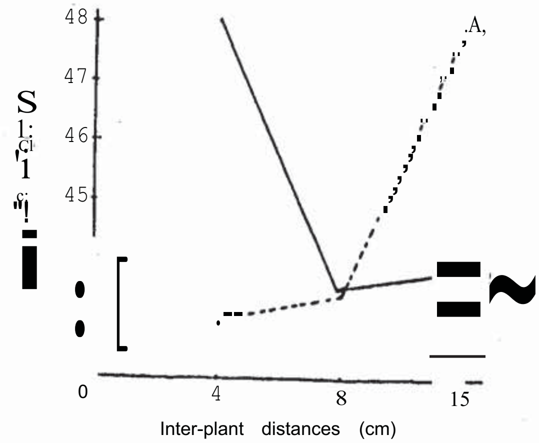

Fig. 1 b. Inter-plant x Inter-row distances interaction for number of tiller plant^{-1}.

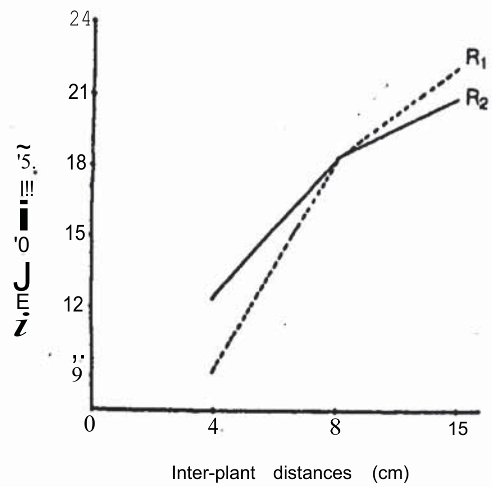

Fig. 1 c. Inter-row x inter-plant distances interaction for 1000-grain weight.

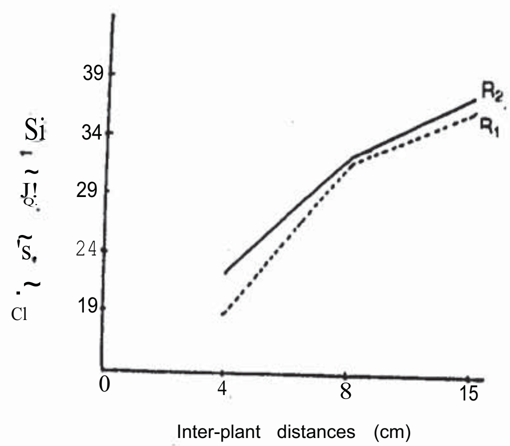

Fig. 1 d. Inter-row x inter-plant distances interaction for grain yield plant^{-1}.

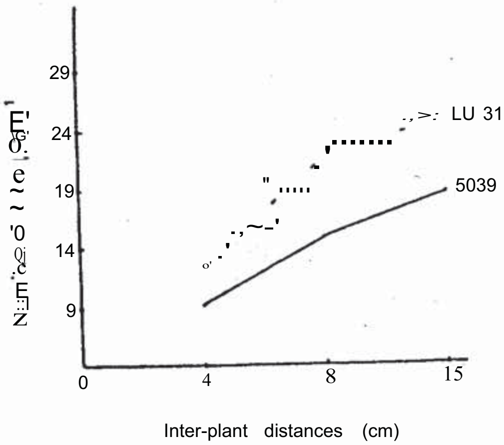

Fig. 2 a. Variety x inter-plant distances interaction for number of tillers plant^{-1}.

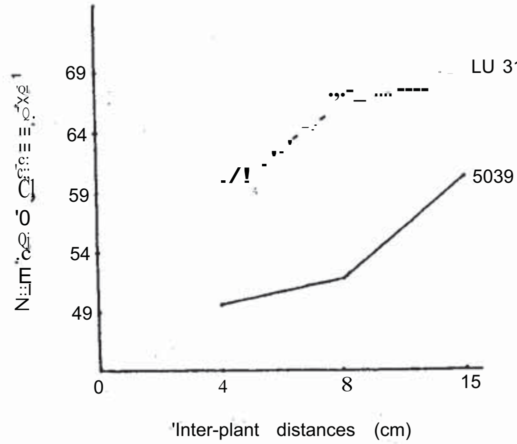

Fig. 2.b. Variety x inter-plant distances interaction for the number of grains spike^{-1}

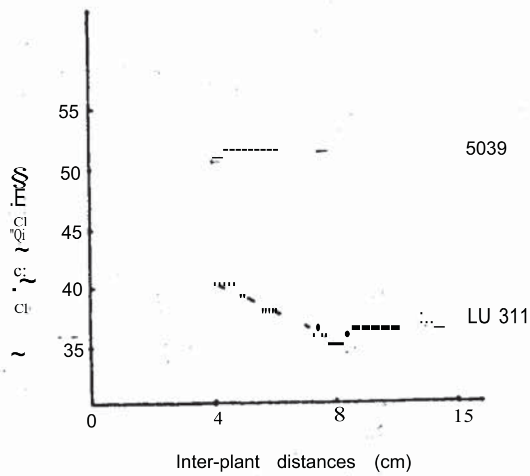

Fig. 2 c. variety x inter-plant distances interaction for 1000-grain weight.

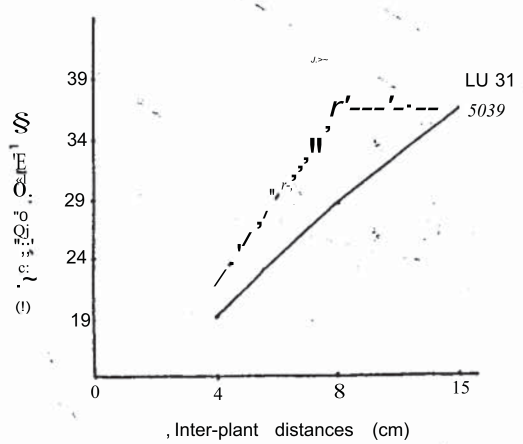

Fig. 2 d. Variety x inter-plant distance interaction for grain yield plant^{-1}.

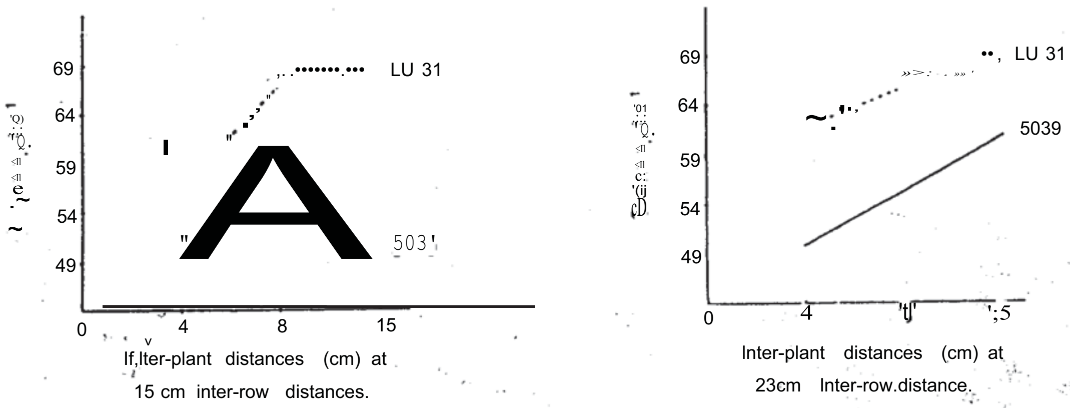

Fig. 3 a. VarietY'xioter:plant distances interaction at 15 and 23 cm row distances for number of grains spike

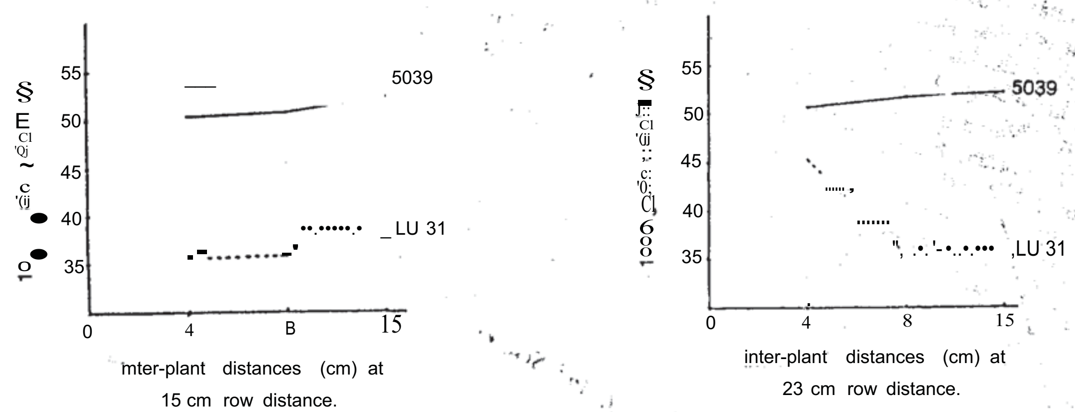

Fig 3 b. Variety x inter-plant distances interaction at 15 and 23 cm row distances.q~ 1000-grain weight.

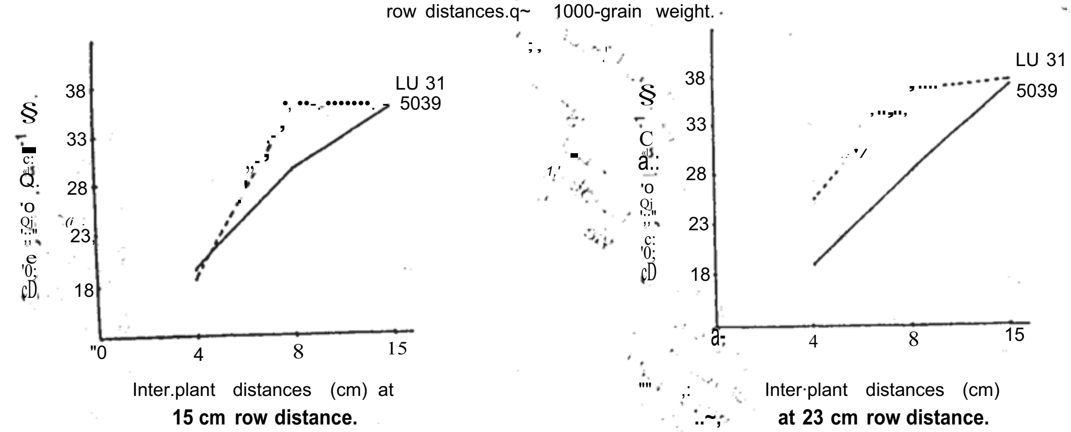

Fig. 3 c. Variety x inter-plant distances inril;ictrofl,at 15and 23 cm row distances for graip yield pranr~.

were also high significant. variety LV-31 produced highest number of grains spike'! with a mean value of 68.73 when row and plant distances both wcre 15 cm. Minimum number was given by the line 5039 producing 48.46 grains at 8 cm inter-plant and 23 cm row spacings. It is evident from the data (Table 1) that the differences between varieties, row and plant densities were highly significant. Interaction of varicty with inter-plant distances between inter-row and inter-plant distances and among all the three factors were highly significant while variety x row spacing was non-significant.. Heaviest grains were obtained for strain 5039 with a weight or 52.10 g 1000-grains·I while the maximum grains were produced by the variety LV 31, the mean values being 35.25 g. The plant spaced at 15 cm within the rows and plants produced the heaviest grains (52,10 g) as compared to other row and plant densities. •

row and inter-plant distances. All first order and second order interactions were also highly significant for grain yield planr", Variety LU 31 at 15 cm inter-row and 4 cm inter-plant distances produced maximum grain yield planr! (37.52 g) while minimum yicld of 18.74 g was produced at 4 cm inter-plant and 15 cm inter-row distances,

Results obtained from these studies indicatcd that with the increase in density, there was a decrease in number of tillers plant"; number of grains spike", 1000-grain weight and grain yicld plant'! while plant height increased with an increase in population density the expression of characters was decreased as a result of increased compction. Tall variety 5039 and, dwarf variety LV 31 responded similarly for grain weight spike"- whereas the varieties have variation in their expression for all other traits. Interaction between variety x inter-row distances show non-significant differences for plant

Table 2. Mean values for 1)JI,"t height, yield and its components of two wheat varictics planted ut two inter-row and three inter-plant dlstunces

Genotype	Plant height	Number of tillers planr!	Number of grains spikc-I	HXX)-grain weight (g)	Grain yield plant'!
Varieties					
LV-31	75.34 b	20.60 a	64.72 a	37.70 b	31,77 a
5039	99.21 a	19.93 b	53.92 b	51.34 a	28.15 b
Inter-row distance					
15 cm	86.96	20.06 b	58.35 b	43.94 b	29.21 b
23 cm	87,59	20.46 a	60.28 a	45.11 a	30.71 a
Inter-plant distance					
4cm	88.70 a	10.80 c	54,50 c	45.47 a	20.67 c
8cm	86.92 b	18.05 b	59.05 b	43.05 b	32.34 b
15 cm	86.21 b	21,48 a	64,41 a	44.60 a	36.86 a

There were highly significant differences for yield plant"! among varieties, inter-

height, number of tillers plant"; number of grains spike"! and 1000-grain weight while highly significant for grain yield plant-to Variety x inter-plant spacings interaction was significant for all other traits except plant height while interaction of inter-row x inter-plant spacings showed non-significant differences for plant height and number of grains spike"! whereas significant for all other traits. Second order interaction among three factors was non-significant for plant height and number of tillers planet while significant for other' characters under study. Similar results have also been reported by Ram *et al.* (1962), Beuerlein and Lafcver (1989), Yoon *et al.* (1991) and Joseph *et al. (1985).* The results indicate that increased row and plant spacings resulted in higher grain yield. Wider spacings between plants and within the rows resulted in lesser competition. So, by providing the 23 cm row and 15 cm plant spacings the plants may express their full potential.

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