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Effect of Inter and Intra Row Spacing on the Yield and Yield Components of Chickpea

Yousaf Ali, M. Ahsanul Haq, G.R. Tahir and N. Ahmad*
Nuclear Institute for Agriculture and Biology (NIAB), P.O. Box 128, Faisalabad
*Department of Crop Physiology, University of Agriculture, Faisalabad-38040, Pakistan

Abstract
The investigation was carried out to evaluate the influence of plant population on the seed yield and its components of a chickpea mutant (CM 2). Three each of inter (10, 20, 30 cm) and intra (5, 10, 15 cm) row spacings with plant population of 200, 100, 67, 50, 33 and 23 plants per m^2 were included. The results indicated that increase in inter and intra row spacings significantly increased the plant height, number of pods per plant, seed yield per plant and per plot. It is suggested that for obtaining better yield in (CM 2) the crop should be sown at 23 plants per m^2 instead of previously reported, optimum population of 33 plants per m^2.

Introduction
The adoption of improved technology coupled with sowing time, row spacing and high yielding varieties can improve the productivity substantially. Plant manifest a remarkable capacity to exploit the environment with varying competitive stresses. Too wide row spacing may not utilize the natural resources efficiently, whereas narrower row spacing may result in severe inter an intra-row spacing competition. Therefore there is a need to manipulate the row spacing competition and to increase plant productivity. If plant growth is restricted by an unfavorable aerial environment, the response to plant population varies with the availability of soil moisture. Yield increased with increase in plant population upto 50 and 25 plants per m^2 respectively of irrigated and unirrigated spring sown chickpea in Tabriz, Iran (Anonymous, 1976).

An investigation was carried out to know the optimum plant density of new chickpea mutant under Faisalabad conditions for getting maximum yield.

Materials and Methods
The experiment was conducted to evaluate the effect of inter and intra-row spacing on the yield and yield components of chickpea at postgraduate Research Station, University of Agriculture, Faisalabad. Mutant CM-2 was planted in 5 x 2 m plot area in a split-plot design with three replications. Main row spacings were 10, 20, 30 cm and subplot spacings 5, 10, 15 cm. As a result of these spacings 200, 100, 67, 50, 33 and 23 plants per m^2 were maintained. A basal fertilizer dose of 100 kg/ha diammonium phosphate was applied before sowing. All the cultural practices were adopted in all the plots throughout the growing period uniformly. Normal looking ten plants in each subplot were tagged and data on plant height, number of pods per plant, seed yield per plant and yield per plot were recorded. The data were subjected to analysis of variance. The treatment means were compared by Duncan's new multiple range test by Gomez and Gomez (1984).

Results and Discussion
The mean squares for all the traits are given in Table 1 the analysis of variance depicted that mean plant height varied significantly ($p = 0.01$) due to different row and plant spacings. Their interaction (RxP) was also highly significant (Table 1) increase in row spacing 30 cm resulted in taller plants (83.78 cm), followed by 20 cm row spacing with plant height of 66.67 cm, whereas closer row spacing (10 cm) had minimum plant height of 59.89 cm per plant (Table 2). These findings agree to those of earlier workers Pramanik *et al*. (1990) and Qayyum *et al*. (1989). It was further observed from the data that plant to plant spacing of 15 cm recorded maximum plant height (76.56 cm) followed by 10 cm (71.67 cm), whereas minimum plant height (62.11 cm) was observed under closer plant spacing of 5 cm, Mohammed (1989) also observed reduction in plant height under close spacing.

The results revealed that mean number of pods per plant differed significantly ($p = 0.01$) due to change in inter and intra row spacings. Their interaction (RxP) was also highly significant. Plants with wider row spacing of 30 cm resulted in higher No. of pods per plant (83.7) followed by 20 cm row spacing (73.1) and 10 cm row spacing (68.1) respectively (Table 2). Similar results were reported by El-Fahal (1989).

The wider plant spacing of 15 cm also produced greater No. of pods per plant (81.7) followed by 10 and 5 cm plant spacings with 74.2 and 68.2 pods per plant respectively. These results are in line with the findings of Belayneth (1986) and Singh and Das (1987).

Mean seed yield per plant varied significantly ($p = 0.01$) due to different row and plant spacings. Their interaction (R x P) was also highly significant (Table 1). Single plant yield increased to 17.4 gm as row spacing increased to 30 cm apart, whereas reduced inter row spacing of 20 to 10 cm significantly depressed the single plant yield i.e. 13.4 to 12.5 gm respectively (Table 2). Results further indicated that wider plant spacings i.e. 15 and 10 cm caused significantly higher yield of 16.2 and 14.2 gm respectively.

Table 1: Mean squares for plant height, yield and yield components in induced mutant of Chickpea, CM 2

SOF	df	Plant Height (cm)	No. of pods per plant	Yield per plant (gm)	Yield per plot (gm)
Replication	2	40.11*	21.81**	0.432**	12.93 NS
Row spacing (R)	2	1364.11**	516.76**	60.63	99026.81**
Main plot error	4	4.72	6.37	0.013	189.87
Plant spacing (P)	2	485.78**	415.26**	74.72**	29007.37**
(R x P)	4	12.22**	109.82**	0.59**	2346.81**
Subplot error	12	1.241	0.407	0.024	114.78
Total	26				

*significant (p = 0.05); **Highly significant (p = 0.01); NS = Non significant

Table 2: Mean plant height (cm), pods per plant, yield per plant and yield per plot of induced mutant of chickpea, as influenced by inter and intra-row spacings

	Plant spacing			
Row spacing (cm)	5 cm	10 cm	15 cm	Mean for row spacing
		Plant height (cm)		
10	52.0	60.0	26.0	59.89C
20	59.0	70.0	70.0	66.67B
30	75.3	84.7	91.33	83.78A
Mean for plant spacing	62.11C	71.67B	76.56A	
		No. of pods per plant		
10	62.7	68.0	73.7	68.1C
20	64A	79.0	76.0	73.1B
30	77.7	75.7	95.7	83.7A
Mean for plant spacing	68.2C	74.2B	81.7A	
		Yield per plant (gm)		
10	11.1	12.6	13.8	12.5C
20	11.6	13.1	15.6	13.4B
30	16.1	16.8	19.2	17.4A
Mean for plant spacing	12.90	14.2B	16.2A	
		Yield per plot (gm)		
10	750.0	788.3	818.3	785.5C
20	801.7	881.7	930.0	871.1B
30	939.3	961.7	1081.7	994.2A
Mean for plant spacing	830.3C	877.2B	943.3A	

However close plant spacing of 5 cm had lesser single plant yield (12.9 gm). Our results are in accordance with the findings of Iqbal (1987).

Mean yield per plot differed significantly (p=0.01) due to varying inter and intra-row spacings and their interaction (R x P) was also significant (Table 1). Reduction in row spacing to 10 cm gave yield per plot of 785.5 gms. The row spacings of 20 and 30 cm resulted higher yield of 871.1 and 994.2 gm respectively. The results indicated that closer plant spacing of 5 cm gave minimum grain yield per plot (830.3 gm) followed by 10 and 15 cm plant spacing with yield of 877.2 and 943.3 grn respectively by Singh *et al*. (1992), Mohapatra *et al*. (1995) and Ortega *et al*. (1996) also reported increase in yield by increasing the row and plant spacings. However these results differed from the findings of Saxena (1979), Singh (1983) and Mohapatra *et al*. (1995) who reported that the optimum plant population appeared to be about 33 plants per m^2. The differences in findings might be due to different genetic material and variation in the environment under which the steps were undertaken.

On the basis of above results it is suggested that obtaining better yield in an induced mutant of chickpek· 2) the crop should be sown at 23 plants per m^2 instead previously reported optimum population of 33 plant m^2.

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