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Research article

Studies on growth and yield characters of chickpea (*Cicer arietinum* L.) varieties suitable for mechanical harvesting

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Abstract: The growth and yield characters of chickpea varieties suitable for mechanical harvesting were evaluated through field experiment conducted for three consecutive years (2016–17 to 2018–19) during rabi season on vertisols under rainfed conditions at Regional Agricultural Research Station, Nandyal, Andhra Pradesh. The investigation was carried out in split plot design with three replications. Two plant geometries (30.0 × 10.0 cm and 22.5 × 10.0 cm) were assigned to main plots and six chickpea varieties (*viz.*, GBM 2, Dheera, CSJ 515, HC 5, Phule G 08108 and BRC 1) were assigned to sub plots. Pooled analysis of experimental results indicated that significantly higher number of branches per plant (8.7) and number of pods per plant (31.1) and test weight (24.3 g) were observed under 30.0 × 10.0 cm when compared to 22.5 × 10.0 cm. Higher plant height (44.8 cm), height of lowest pod bearing branch (30.0 cm), lower days to 50 % flowering (42.1 days) and higher test weight (31.2 g) were observed in Dheera. Higher number of branches per plant (9.2) and number of pods per plant (34.2) were observed in GBM 2. Higher seed yield was observed in Phule G 08108 (1708 kg ha^{-1}) which is followed by GBM 2 (1675 kg ha^{-1}) Dheera (1569 kg ha^{-1}) and BRC 1 (1493 kg ha^{-1}). Higher harvest index (56.4%) was also observed in Phule G 08108. Chickpea varieties GBM2, Dheera and BRC1 were best suitable for mechanical harvesting and higher seed yield due to their excellent morphology.

Keywords: Chickpea - Plant geometry - Varieties - Mechanical harvesting - Seed yield.

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INTRODUCTION

India is the largest producer and consumer of chickpea (*Cicer arietinum* L.) in the world. It is grown an area of about 9.85 million hectares with a production of 10.32 million tonnes and a productivity of 1048 kg ha^{-1} (Directorate of Economics and Statistics, 2019). Currently chickpea farming is partially mechanized by manual harvesting and then fed into threshing machine. The total mechanization of harvesting is cost effective and quicker, reducing the risk of the ripened crop's exposure to untimely rain or other extreme weather conditions. Chickpea is harvested manually as the existing varieties possess inadequate height, semi-spreading growth habit and height of first pods from the ground is about 15–20 cm, thus these varieties are not suitable for mechanical harvesting. Delay in harvesting due to unfavourable conditions at the time of harvesting may lead to pod drop and shattering. Expensive labour further burdens the manual harvesting process and adds to the cost of cultivation. Availability of varieties suitable for mechanical harvesting in crops like pigeonpea, wheat and rice have witnessed tremendous advantage in terms of time and reduced cost per unit production. However, non-availability of chickpea cultivar suitable for mechanization has increased the cost of cultivation. In the developing countries, lack of chickpea varieties suitable to mechanizations in contrast to fully mechanized cereal crop cultivation is a major constraint in the expansion of the chickpea growing area across the globe. The increased productivity of chickpea in developed countries like Australia, Canada and USA is mainly attributed to the mechanized harvesting (Oram & Belaie 1990, Osrnan *et al.* 1990). Hence there is an increasing demand for developing chickpea cultivar suitable for mechanisation. Therefore development of varieties suitable for

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machine harvesting is in current need of the chickpea breeding programme. The advanced generation lines of the cross could produce stabilized population and knowledge about the amount, kind and magnitude of variability among the varieties could be very useful tool in crop improvement strategies (Kumar & Arora 1992). The soaring variation for different qualitative and quantative traits in chickpea could help breeders to release better and superior lines and varieties (Malik *et al*. 2010, Rozina & Hamayoon, 2011). The higher productivity in chickpea could be achieved through manipulation in plant population depending on variety, its growth habit and agro climatic condition (Kumar *et al.* 2015). A very few information on the genetic variability for the varieties related to mechanical harvesting has cut short the investigation, hence the evaluation of these varieties would enable in identification of variety suitable for mechanical harvesting.

MATERIAL AND METHODS

The present investigation was carried out for three consecutive years (2016−17 to 2018−19) with six chickpea varieties (*viz.*, GBM 2, Dheera, CSJ 515, HC 5, Phule G 08108 and BRC 1) sown at two plant geometry (30.0 × 10.0 cm and 22.5 × 10.0 cm) during rabi crop season following split-plot design and replicated thrice at Regional Agricultural Research Station, Nandyal, Andhra Pradesh. The soil of the experimental field is moderately alkaline (pH- 8.3), non-saline (EC-0.15 dSm^{-1}). The research field was prepared by applying artificial fertilizers as available nitrogen (113 kg ha^{-1}) is low, available phosphorus (48.5 kg ha^{-1}) is medium and available potassium (366 kg ha^{-1}) is high. The crop was raised by adopting the recommended package of practices. Five randomly selected plants from each cultivar in each replication were used for recording the observations to estimate the growth and yield parameters among varieties. The data were recorded on eight quantitative traits such as plant height (cm), height of lowest pod bearing branch (cm), number of branches per plant, days to 50 % flowering, number of pods per plant, test weight (g), seed yield(kg ha^{-1}) and harvest index (%). The mean values of all the quantitative characters were subjected to statistical analysis by adopting Fisher's method of analysis of variance as outlined by Gomez & Gomez (1984).

RESULTS AND DISCUSSION

The analysis of variance was significant for all quantitative traits due to varieties. This indicates varieties (Table 1) selected for study were quite variable and considerable amount of variability exists among them. Plant spacing influence the number of branches per plant and number of pods per plant. Pooled analysis of experimental results indicated that significantly higher number of branches per plant (8.7) and number of pods per plant (31.1) was observed under 30.0 × 10.0 cm (33 plants m^{-2}) when compared to 22.5 × 10.0 cm (44 plants m^{-2}). Increased plant density to an extent of 44 plants m^{-2} from 33 plants m^{-2} could not compete for sunlight due to its erect morphology. Similar results were found for various characters studied in chickpea by Ramanappa *et al*. (2013), Munirathnam *et al.* (2015) and Surabh *et al*. (2017). Higher plant height (44.8 cm), height of lowest pod bearing branch (30.0 cm), lower days to 50 % flowering (42.1 days) and higher test weight (31.2 g) were observed in Dheera. The present findings were in accordance with Parameshwarappa *et al.* (2012) for plant height and days to 50% flowering and with Alkadev *et al.* (2017) for 100-seed weight. Higher number of

Table 1. Growth parameters, yield attributes and seed yield as influenced by plant geometry and varieties in chickpea (Average of three years).

Treatments	Plant height (cm)	Height of lowest pod bearing branch (cm)	No of branches /plant	Days to 50 % flowering	No. of pods/ plant	Test weight (g)	Seed yield (kg ha^{-1})	Harvest index (%)
Main plots - Plant geometry								
30.0 × 10.0 cm	38.5	26.4	8.7	62.1	31.1	24.3	1430	47.9
22.5 × 10.0 cm	40.2	28.6	7.6	63.3	25.2	23.5	1504	49.7
S.Em±	0.9	0.6	0.2	0.3	0.8	0.4	25	1.2
CD (P=0.05)	NS	NS	0.8	NS	2.2	NS	NS	NS
Sub plots - Variety								
GBM 2	41.5	29.5	9.2	66.7	34.2	23.4	1675	50.1
Dheera	44.8	30.0	8.6	42.1	26.0	31.2	1569	44.3
CSJ 515	29.8	26.5	8.0	74.9	25.3	21.1	1163	46.3
HC 5	42.2	28.0	7.9	71.1	25.8	17.9	1194	42.0
Phule G 08108	38.1	24.4	7.7	57.0	30.3	22.9	1708	56.4
BRC 1	39.7	26.7	7.3	64.4	26.8	27.9	1493	53.7
S.Em±	0.8	0.9	0.7	0.7	2.8	1.1	92	2.5
CD (P=0.05)	2.3	2.7	NS	2.0	8.2	3.3	270	7.3
Interactions	NS	NS	NS	NS	NS	NS	NS	NS

branches per plant (9.2) and number of significantly higher pods per plant (34.2) were recorded in GBM 2. Higher seed yield (1708 kg ha^{-1}) and harvest index (56.4%) were noted for Phule G 08108. Similar results were also reported by Basha *et al.* (2018).

Interaction effect between varieties and plant geometry on yield parameters and yield was found to be non-significant. However, it exerted significant influence on seed yield of chickpea. Higher seed yield (1753 kg ha^{-1}) was obtained with Phule G 08108 sown at 22.5 cm × 10.0 cm whereas, lower seed yield (1110 kg ha^{-1}) was observed in HC5 sown at 30.0 cm × 10.0 cm (Table 2). Highly significant differences for traits under study indicate the importance of chickpea varieties in the crop improvement programme. A wide range of variation was observed for growth and yield traits under study suggesting variability exist among the varieties. Results of the present investigation are in conformity with Ramanappa *et al*. (2013). The estimates of variability revealed that genetic variability was significant among the varieties under study. Therefore selection has to be precisely made based on the per-se performance of the varieties under replicated trails (Akanksha *et al*. 2016). Major threats of Indian agriculture *i.e.* variability in rainfall and shortage of farm labours could be overcome through cultivation of varieties suitable for mechanical harvesting.

Table 2. Interaction effect of plant geometry and varieties on seed yield (kg ha^{-1}) of chickpea (Average of three years).

Treatments	**Varieties**						
	GBM 2	**Dheera**	**CSJ 515**	**HC 5**	**PhuleG 08108**	**BRC 1**	**Mean**
Plant geometry							
30.0 cm × 10.0 cm	1683	1501	1125	1110	1662	1496	1430
22.5 cm × 10.0 cm	1666	1636	1200	1278	1753	1490	1504
Mean	1675	1569	1163	1194	1708	1493	
	S.Em±	CD (P=0.05)					
Plant geometry	25	NS					
Varieties	92	271					
Interactions	120	NS					

CONCLUSION

Experimental results revealed that the some of the varieties are having good qualities like height of the lowest pod bearing branches, days to 50% flowering, seed yield etc. suitable for mechanical harvesting. It can be concluded that chickpea varieties *i.e.* GBM 2, Dheera, Phule G08108 and BRC1 could be suitable for mechanical harvesting due to their plant stature, height of the lowest pod bearing branches and seed yield.

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REFERENCES

Akanksha T, Anita B & Namita P (2016) Genetic variability, correlation and path analysis in yield and yield components in chickpea (*Cicer arietinum* L.) varieties under late sown condition. *International Journal of Agriculture Science* 54(8): 2884–2886.

Alkadev, Preeti V & Bherulal K (2017) Genetic variability studies in desi chickpea (*Cicer arietinum* L) varieties. *International Journal of Microbiology and Applied Science* 6(4): 20–25.

Basha SJ, Jayalakshmi V, Reddy AT, Kamakshi N & Ahammed SK (2018) Estimate of growth and yield parameters of chickpea (*Cicer arietinum* L.) cultivars amenable to mechanical harvesting. *Journal of Pharmacognosy and Phytochemistry* 7(5): 2089–2091.

Directorate of Economics and Statistics (2019) Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India, New Delhi. Available from http://www. agricoop.nic.in (accessed: 30 Mar. 2020).

Gomez KA & Gomez AA (1984) *Statistical Procedures for Agricultural Research, 2nd edition*. John Wiley and Sons, New York.

Kumar L & Arora PP (1992) Multivariate analysis in chickpea. *Indian Journal of Pulses Research* 5(1): 1–5.

Kumar N, Singh MK, Praharaj CS, Singh U & Singh SS (2015) Performance of chickpea under different planting method, seed rate and irrigation level in indo-gangetic plains of India. *Journal of Food Legumes* 28: 40–44.

Malik SR, Bakhsh A, Asif MA, Iqbal U & Iqbal SM (2010) Assessment of genetic variability and interrelationship among some agronomic traits in chickpea. *International Journal of Agricultural Biology*

12: 81–85.

Munirathnam P, Ashok KK, Jayalakshmi V & Padmalatha Y (2015) Suitability of chickpea 'NBeG 47' for mechanical harvesting under rainfed condition. *Journal of Food Legumes* 28(2): 1–3

Oram P & Belaie A (1990) *Legumes in Farming Systems*. ICARDA/IFI'RI Report. Aleppo, Syria: International Center for Agricultural Research in the Dry Areas. International Food Policy Research Institute. Washington DC, USA.

Osrnan AE, Ibrahirn MH & Jorres MA (1990) The role of legumes in the farming systems of the Mediterranean Areas. In: *Proceedings of the Workshop, 20–24 Jun 1988, ICARDA, Aleppo, Syria*. Dordrecht, Netherlands: Kluwrr Academic Publishers.

Parameshwarappa SG, Salimath PM, Upadhaya HD, Patil SS & Kajjidoni ST (2012) Genetic variability studies in minicore collection of chickpea (*Cicer arietinum* L.) under different environments. *Karnataka Journal of Agricultuaral Sciences* 25(3): 305–308.

Ramanappa TM, Chandrashekara K & Nuthan D (2013) Analysis of variability for economically important traits in chickpea (*Cicer arietinum* L.). *International Journal of Research in Applied Natural and Social Science* 1(3): 133–140.

Rozina KF & Hamayoon K (2011) Dissection of genetic variability and heritability estimates of chickpea germplasm for various morphological markers and quantitative traits. *Sarhad Journal of Agriculture* 27(1): 67–72.

Surabh S, Roopa LG & Lal GM (2017) Genetic variability and character association for seed yield in chickpea (*Cicer arietinum* L). *Journal of Pharmacognosy and Phytochemistry* 6(4): 748–750.