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PERFORMANCE OF CHICKPEA (*Cicer arietinum* L.) UNDER DIFFERENT SOWING BED METHODS AND IRRIGATION LEVELS

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ABSTRACT

A field experiment was conducted to study the growth and yield of chickpea (*Cicer arietinum* L.) under different sowing beds, on sandy loam soils at College Farm, Agricultural College, Mahanandi campus of Acharya N.G. Ranga Agricultural University during *rabi*, 2021-2022. The experiment was laid out in split-plot design with nine treatments and replicated thrice. The results revealed that sowing beds didn't show any significant influence on plant height, 100 seed weight, haulm yield and harvest index. Significantly higher number of branches and dry matter production was registered with broad bed and furrow with paired rows than flat bed and ridge and furrow. Broad bed & furrow with paired rows recorded significantly greater number of pods per plant and seed yield than flatbed and was at par with ridge and furrow. Two irrigations each at 30 and 50 DAS found significant influence on plant height and number of branches plant^{-1}, dry matter production, number of pods plant^{-1}, seed yield and haulm yield than one irrigation at 30 DAS and rainfed.

KEYWORDS: Chickpea, sowing beds, irrigation levels, *rabi*, yield.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is an important *rabi* pulse crop grown in India for its economic importance besides maintaining soil fertility and often known as "king of pulses". In general chickpea is known as gram or Bengal-gram. In India, chickpea is cultivated an area of 9.69 million hectares with a production of 11.07 million tonnes and with a productivity of 1142 kg ha^{-1} (Anonymous, 2021a). In Andhra Pradesh, it is cultivated in an area of 0.45 million hectares with a production of 0.55 million tonnes and with a productivity of 1218 kg ha^{-1} (Anonymous, 2021b).

Chickpea is generally cultivated as rainfed sole crop and many times it experiences moisture stress during its growth stages that results in low productivity. Many times, the crop is also damaged due to either heavy rainfall or improper irrigation.

Modified land configuration such as furrow irrigated raised bed has shown good promise in enhancing chickpea performance and water productivity (Jat *et al.,* 2005). Raised bed planting prevented excess moisture problem in heavy soils. Chickpea is very sensitive to water logging condition and flatbed sowing results in heavy plant mortality. Sowing the Bengal gram crop on raised bed and ridge and furrow method was found to be advantageous compared to flatbed method of sowing (Ravindra *et al*., 2016).

Maintenance of optimum plant population is important parameter for enhancing productivity of Bengal gram. Changes in plant geometry and plant population per unit area due to different planting layouts leads to different pattern for utilization of growth resources viz., nutrients, moisture, radiation energy and space. Pairing of rows were more productive than conventional single-row system. Sowing in paired-row has been found advantageous in many rainfed crops. Better root dry weight, greater intercepted photosynthetically active radiation, high leaf photosynthesis and high nutrient uptake are noticed under paired-row than traditional flat-bed method (Mandal *et al*., 2019). Change in crop geometry keeping the seed rate same is a non-monetary input, that fetches additional yields (Mandal *et al*., 2019). Hence, the present experiment was proposed to find out the performance of chickpea (*Cicer arietinum* L.) under different irrigation regimes and sowing beds.

MATERIAL AND METHODS

A field trail was carried out at Agricultural College Farm, Mahanadi campus of Acharya N.G. Ranga Agricultural University during *rabi* 2021-2022. The design adopted was split-plot design and replicated thrice. The main plots consisted of three types of sowing beds *viz.,* Flat bed (45 cm × 10 cm) (P_1), Ridge and furrow (45 cm × 10 cm) (P_2) and broad bed and furrow in paired rows (60-30 × 10 cm) (P_3) assigned to main plots and irrigation levels *viz.,* rainfed (I_1), one irrigation

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Table 1. Plant height, number of branches plant^{-1}, dry matter accumulation in chickpea as influenced by different sowing bed methods and irrigation levels

Treatments	Plant height (cm)	Number of branches plant^{-1}	Dry matter production (kg ha^{-1})
Sowing beds			
P_1 : Flat-bed (45 cm × 10 cm)	38.3	15.6	721
P_2 : Ridge and furrow (45 cm × 10 cm)	37.4	18.0	1085
P_3 : Broad bed and furrow with paired rows (60-30 cm × 10 cm)	39.8	21.3	1373
SEm+	**1.14**	**0.61**	**44.70**
CD (P=0.05)	**NS**	**2.410**	**175.510**
Irrigation levels			
I_1 : Rainfed	36.3	16.6	801
I_2 : One irrigation at 30 DAS	37.8	18.5	1083
I_3 : Two irrigations each at 30 and 50 DAS	41.4	19.8	1295
SEm+	**0.57**	**0.84**	**33.76**
CD (P=0.05)	**1.76**	**2.59**	**104.03**

of 30 mm depth at 30 DAS (I_2) and two irrigations each of 30 mm depth at 30 and 50 DAS (I_3) were allotted to sub plots.

The soil of the experimental field was sandy loam in texture, with neutral in reaction (pH 7.33), low in organic carbon (0.49%), available nitrogen (258 kg ha^{-1}) and available phosphorus (49 kg ha^{-1}) and high in available potassium (584 kg ha^{-1}). Diammonium phosphate (DAP) was applied to the experimental plots @ 125 kg ha^{-1} as basal to supply N and P_2O_5 required as per the recommendation. The chickpea variety NBeG-49 having duration of 90-105 days was taken as test variety. The row to row spacing was taken as 45 cm in flatbed and ridge and furrow sowing bed. The spacing adapted for broad bed and furrow was 60 cm between paired rows. The spacing was 60 cm between pairs and 30 cm between paired rows. Plant to plant spacing was 10 cm and gap filling was done at 10 DAS. Pre-emergence application of pendimethalin 1.0 kg ha^{-1} was sprayed one day after sowing. Observations on plant height, number of branches plant^{-1}, dry matter accumulation, number of pods plant^{-1}, 100 seed weight, seed yield, haulm yield and harvest index were recorded by following standard procedure. The critical difference was correlated at 5 per cent level of significance to compare different treatment means as suggested by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Growth parameters

The growth parameters in chickpea were influenced by different sowing bed methods. The sowing beds didn't show any significant influence on plant height. But the tall plants were recorded in broad bed and furrow with paired rows than flatbed and ridge and furrows. Significantly higher number of branches were registered with broad bed and furrow with paired rows than flatbed and ridge and furrow. These results are in line with the findings of Archana *et al*. (2021) and Tomar *et al*. (2020). Higher dry matter production registered with broad bed and furrow with paired rows than flatbed and ridge and furrow (Table 1). These results are in line with findings of Bharade *et al*. (2019) and Baraker *et al*. (2017). It might be due to better soil structure and maintenance of air-water regime as well as good supply of nutrients and water in the root zone of crop, availability of wider spacing, the plant get sufficient space above the ground and below the ground grow as well as increased light

Table 2. Yield attributes and yield parameters of chickpea as influenced by different sowing bed methods and irrigation levels

Treatments	No. of pods plant^{-1}	100 seed weight (g)	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest index (%)
Sowing beds					
P_1 : Flat-bed (45 cm × 10 cm)	34.1	30.1	957	1000	49.5
P_2 : Ridge and furrow (45 cm × 10 cm)	37.6	30.4	1083	1071	50.2
P_3 : Broad bed and furrow with paired rows (60-30 cm × 10 cm)	44.2	30.4	1168	1074	51.3
SEm+	1.86	0.37	53.07	30.39	1.13
CD (P=0.05)	7.31	NS	208.39	NS	NS
Irrigation levels					
I_1 : Rainfed	32.8	29.8	845	844	49.3
I_2 : One irrigation at 30 DAS	38.9	30.4	1041	1047	50.3
I_3 : Two irrigations each at 30 and 50 DAS	44.0	30.7	1322	1253	51.4
SEm+	**1.80**	**0.35**	**29.14**	**52.10**	**1.12**
CD (P=0.05)	**5.53**	**NS**	**89.78**	**160.54**	**NS**

transmission in the canopy, leading to greater vegetative growth which enable high foliage. The irrigation levels found significant effect on growth parameters. Two irrigations each at 30 & 50 DAS found significant influence on plant height and number of branches per plant and dry matter production than One irrigation at 30 DAS and rainfed (Table 1). These results are in line with the findings of Ravindra *et al*. (2016) and Narendra *et al*. (2015).

Yield attributes

Maximum number of pods plant^{-1} were recorded in broad bed and furrow with paired row as compared to flatbed and was on par with ridge and furrow (Table 2). It might be due to better root development, greater intercepted photosynthetically active radiation, rate of leaf photosynthesis in turn gave high number of branches, dry matter production, more number of flowers contributed to higher number of pods per plant. These findings were in accordance with the results of Mandal *et al*. (2019) and Joshi *et al*. (2018). The effect of sowing beds and irrigation levels on 100 seed weight (g) found non-significant (Table 2). Two irrigations each at 30 & 50 DAS found significant influence on yield attributes like number of pods per plant than One irrigation at 30 DAS and rainfed (Table 2). These findings were in accordance with the results of Kemal *et al*. (2018) and Patel *et al*. (2016).

Yields

Significantly highest seed yield (kg ha^{-1}) was recorded with broad bed and furrow with paired rows than flatbed and was at par with ridge and furrow (Table 2). It might be due to more number of branches and good aeration, good drainage and mobilisation of nutrients intensified. The similar findings are in agreement with the results of Shaikh *et al*. (2019) and Joshi *et al*. (2018). The sowing beds didn't show any significant influence on haulm yield. The high haulm yield was recorded with broad bed & furrow with paired rows than flatbed and ridge and furrow (Table 2). Irrigation levels found significant effect on seed and haulm yield. Two irrigations each at 30 and 50 DAS found superior yields than one irrigation at 30 DAS and rainfed conditions. The similar findings in line with Ravindra *et al*. (2016) and Narendra *et. al*. (2015). The response of sowing beds and irrigation levels on harvest index was found to be non-significant.

The broad bed and furrow in paired rows (60-30 × 10 cm) (P_3) and two irrigations each at 30 and 50 DAS (I_3) recorded higher plant height, greater number of branches, dry matter production, number of seeds per plant, maximum seed yield, haulm yield and harvest index as compared to other treatments. Hence, broad bed and furrow in paired rows (60-30 × 10 cm) (P_3) and two irrigations each at 30 and 50 DAS (I_3) was found superior in recording higher growth parameters and yields of chickpea.

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