www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(3): 1611-1613

www.thepharmajournal.com
Received: 18-12-2021
Accepted: 28-02-2022

Effect of spacing and sulphur levels on growth and yield of chickpea (*Cicer arietinum* L.)

Jonnala Pujitha, Vikram Singh, Shruti G George and Vivek

Jonnala Pujitha
Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Vikram Singh
Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Shruti G George
Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Vivek
Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Corresponding Author:
Jonnala Pujitha
Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Abstract
The field experiment was conducted during *Rabi*, 2020 at Central Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P.). To study the "Effect of Spacing and Sulphur levels on growth and yield of Chickpea (*Cicer arietinum* L.)". There were 9 treatments each replicated thrice. The treatment consists of 3 levels of Spacing (30, 40, 50 cm × 15 cm) and 3 levels of Sulphur (20,30,40 kg/ha) as basal application, whose effect was observed on chickpea. The experiment was laid out in Randomized Block Design. The results revealed that growth parameters *viz.* plant height (56.58 cm) at 140 DAS, number of nodules per plant (42.65) at 60 DAS, dry weight (22.85 g/plant) at 140 DAS and crop growth rate (1.91 g/m^2/day) at 120-140 DAS were recorded superior with the application of Spacing 30 cm + Sulphur 40 kg/ha. Similarly, significantly higher yield and yield parameters *viz.* number of pods/plant (48.74), number of seeds/pod (1.50), seed yield (3.18 t/ha) and B:C ratio (1.76) were recorded with application of treatment Spacing 30 cm + Sulphur 40 kg/ha.

Keywords: Chickpea, spacing, sulphur, growth, yield

Introduction
Chickpea (*Cicer arietinum* L.) belongs to family fabaceae, Gram is mostly consumed in the form of processed whole seed and dal but also used for preparing a variety of snacks and sweets. Chickpea contains 18-22 per cent protein, 52-70 per cent carbohydrate, 4-10 per cent fat and sufficient quantity of minerals, calcium, phosphorus, iron and vitamins. Besides, it is also important for sustainable agriculture as it improves the physio-chemical and biological properties of the soil. Its deep roots also open the soil, which ensure better aeration and heavy leaf drop increases the organic matter in the soil. It can fix about 25-30 kg N/ ha through symbiosis and these minimize dependency on chemical fertilizers. Thus, chickpea plays a vital role in improving the soil health. Chickpea is grown in about 50 countries around the world covering an area of 149.66 lakh ha with an average global productivity of 1252 kg/ha. India is the leading producer of chickpea contributing to about 70 per cent of the world's chickpea production. In India, Madhya Pradesh (39%), Maharashtra (14%), Rajasthan (14%), Uttar Pradesh (7%), Karnataka (6%), and Gujarat (5%) are the major chickpea growing states.

Optimum plant population density is an important factor to realize the potential yields as it directly affects plant growth and development. Earlier studies show that chickpea yields are remarkably stable over a wide range of population densities. The plants are able to fill available space by initiating lateral branches and, thus, can compensate for poor emergence and thin stands. Increasing row spacing significantly influenced of growth, yield attributes and yield characters. Number of plants per unit area influences plant size, yield components and ultimately the seed yield. Both over and under plant densities resulted significant yield decrease.

Sulphur deficiency is becoming more critical with each passing year which is severely restricting crop yield, produce quality, nutrient use efficiency and economic returns on millions farms. Use of high analysis fertilizers, less use of organic manures, heavy sulphur (S) removal by the crops under intensive cultivation & neglect of S replenishment contributed to widespread S deficiencies in India. Sulphur has a great role in N fixation by influencing active nodulation in legume. It is a part of nitrogenase enzyme, promotes nodulation in legumes, which enhances biological N-fixation (BNF) and the productivity of pulses may drastically be reduced by an inadequate supply of sulphur. It is also necessary for chlorophyll formation. and helps in biosynthesis of oil and metabolism of carbohydrates, proteins and fats.

Materials and Methods

The experiment was conducted during *rabi* season 2020, at the Crop Research farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (7.4), available N (225 kg/ha), available P (32.30 kg/ha), available K (350 kg/ha). The treatment consists of levels of Spacing and Sulphur. There were 9 treatments each replicated thrice. The experiment was laid out in Randomised Block Design and the crop was sown on 09 November 2020. The recommended dose of 20 kg N, 40 kg P, 20 kg K per ha was applied according to treatment details through urea, DAP, and MOP. The full dose of nitrogen, phosphorous, and potassium were applied as basal along with Sulphur. Five random plants were selected from each plot to record observations on plant growth attributes. Similarly, five random plant samples were collected from each plot at the time of harvest for recording observations on plant growth and yield attributes. Experimental data collected was subjected to statistical analysis by adopting Fishers method of Analysis of Variance (ANOVA) as outlined by Gomez and Gomez (2010). Critical Difference (CD) value were calculated whenever the 'F' test was found significant at 5% level.

Results and Discussion

The growth parameters like plant height, number of nodules, dry weight and crop growth rate was significantly affected by application of spacing and sulphur at different stages.

Plant height (cm)

The analysed data presented in (Table No.1) shown significant variation among all other treatments. At 140 DAS, significantly highest plant height (56.58 cm) was recorded in Spacing 30 cm + Sulphur 40 kg/ha. However, Spacing 40 cm + Sulphur 40 kg/ha (56.01 cm), Spacing 30 cm + Sulphur 30 kg/ha (55.58 cm), Spacing 50 cm + Sulphur 40 kg/ha (55.11 cm) which are statistically at par with Spacing 30 cm + Sulphur 40 kg/ha. The increase in plant height might be due to the fact that as the spacing among plants decreased the interplant competition for light increased while sparsely populated plants intercepted sufficient sunlight that enhanced the lateral growth. These results are in conformity with Bavalgave *et al.* (2009), Melak (2018) and Vinayak *et al.* (2012) [2, 4, 9]. It was reported that Plant height was taller in higher plant population treatments due to more competition for light. These results are in conformity with Alihan (2012) and Sharar *et al.* (2001) [1, 7].

Table 1: Effect of Spacing and Sulphur levels on growth attributes of Chickpea

S. No	Treatment Combinations	Plant height (cm) at 140 DAS	No. of Nodules at 60 DAS	Dry Weight (g) at 140 DAS	Crop growth rate (g/m^2/day) at 120-140 DAS
1	30 cm ×15 cm + 20 kg S/ha	54.91	36.80	17.23	1.10
2	30 cm ×15 cm + 30 kg S/ha	55.48	38.14	20.14	1.78
3	30 cm ×15 cm + 40 kg S/ha	56.58	42.65	22.85	1.91
4	40 cm ×15 cm + 20 kg S/ha	54.62	35.86	16.70	0.94
5	40 cm ×15 cm + 30 kg S/ha	54.98	37.45	19.73	1.68
6	40 cm ×15 cm + 40 kg S/ha	56.01	41.20	22.13	1.73
7	50 cm ×15 cm + 20 kg S/ha	53.91	34.73	14.83	0.47
8	50 cm ×15 cm + 30 kg S/ha	53.97	35.10	15.37	0.64
9	50 cm ×15 cm + 40 kg S/ha	55.11	37.31	18.07	1.31
	F-test	S	S	S	S
	S.Em (±)	0.529	1.462	0.425	0.074
	CD (P=0.05)	1.59	4.38	1.28	0.22

Number of Nodules per plant

The analysed data presented in (Table No.1) shown significant variation among all other treatments. At 60 DAS, significantly highest number of nodules/plant (42.65) was recorded in Spacing 30 cm + Sulphur 40 kg/ha. However Spacing 40 cm + Sulphur 40 kg/ha (41.20) was statistically at par with Spacing 30 cm + Sulphur 40 kg/ha. The improvement in crop growth and nodulation due to sulphur could be ascribed to its pivotal role in regulating the metabolic and enzymatic processes including photosynthesis and legume-*Rhizobium* symbiotic nitrogen fixation. These results are in conformity with Sher *et al.* (2005) [5].

Dry eight (g/plant)

Theanalysed data presented in (Table No.1) shown significant variation among all other treatments. At 140 DAS, significantly highest dry weight (22.85 g) was recorded in Spacing 30 cm + Sulphur 40 kg/ha. However Spacing 40 cm + Sulphur 40 kg/ha (22.13 g) was statistically at par with Spacing 30 cm + Sulphur 40 kg/ha. The result obtained on dry weight per plant exhibited on increasing trend up to harvest stages. It may be due to gradual accumulation of food material in different vegetative and reproductive phase of the plant. These results are in conformity with Sathyamoorthi *et al*. (2008) [6] in greengram.

Crop Growth Rate (g/m^2/day)

The analysed data presented in (Table No.1) shown significant variation among all other treatments. At 120-140 DAS, significantly highest crop growth rate (1.91 g/m^2/day) was recorded in Spacing 30 cm + Sulphur 40 kg/ha. However, Spacing 30 cm + Sulphur 30 kg/ha (1.78 g/m^2/day), Spacing 40 cm + Sulphur 40 kg/ha (1.73 g/m^2/day) was statistically at par with Spacing 30 cm + Sulphur 40 kg/ha. The CGR was significantly higher with closer crop geometry at all the growth stages, which was mainly due to more population per unit area. These results are in conformity with Sathyamoorthi *et al.* (2008) [6] in greengram.

Yield and Yield Attributes

The Yield and Yield parameters like number of pods per plant, number of seeds per pod, seed yield and B:C ratio were significantly affected by application of spacing and sulphur.

Number of pods per plant

(Table No.2) represents that significantly highest number of pods/plant (48.74) was recorded in Spacing 30 cm + Sulphur 40 kg/ha. However Spacing 50 cm + Sulphur 40 kg/ha

(45.97), Spacing 40 cm + Sulphur 40 kg/ha (46.83) was statistically at par with Spacing 30 cm + Sulphur 40 kg/ha. Growth and yield indicators were directly proportional to sulphur rates. Number of pods per plant increased from 5 to 10% when different rates of sulphur applied as compared to control. These results are in conformity with Fayaz *et al.* (2020) [3].

Table 2: Effect of Spacing and Sulphur levels on Yield, Yield attributes and B:C ratio of Chickpea

S. No	Treatment Combinations	No. of pods / Plant	No. of seeds / pod	Seed yield (t/ha)	Benefit cost ratio (B:C)
1	30 cm ×15 cm + 20 kg S/ha	39.28	1.27	2.75	1.50
2	30 cm ×15 cm + 30 kg S/ha	42.12	1.31	2.98	1.65
3	30 cm ×15 cm + 40 kg S/ha	48.74	1.50	3.18	1.76
4	40 cm ×15 cm + 20 kg S/ha	40.39	1.25	2.61	1.37
5	40 cm ×15 cm + 30 kg S/ha	43.23	1.30	2.87	1.55
6	40 cm ×15 cm + 40 kg S/ha	46.83	1.43	3.09	1.68
7	50 cm ×15 cm + 20 kg S/ha	36.68	1.20	2.22	1.02
8	50 cm ×15 cm + 30 kg S/ha	37.70	1.23	2.39	1.12
9	50 cm ×15 cm + 40 kg S/ha	45.97	1.29	2.79	1.42
	F-test	S	S	S	
	S.Em (±)	1.718	0.057	0.125	
	CD (P=0.05)	5.15	0.17	0.38	

Number of seeds per pod

(Table No.2) represents that significantly higher number of seed/pod (1.50) was observed in Spacing 30 cm + Sulphur 40 kg/ha. However Spacing 40 cm + Sulphur 40 kg/ha (1.43) is statistically at par with Spacing 30 cm + Sulphur 40 kg/ha.

Seed yield (t/ha)

(Table No.2) represents that significantly highest seed yield (3.18 t/ha) was observed in Spacing 30 cm + Sulphur 40 kg/ha. However Spacing 40 cm + Sulphur 40 kg/ha (3.09 t/ha), Spacing 30 cm + Sulphur 30 kg/ha (2.98 t/ha), Spacing 40 cm + Sulphur 30 kg/ha (2.87 t/ha) was statistically at par with Spacing 30 cm + Sulphur 40 kg/ha. Maximum seed yield was found with application of sulphur might its role in regulating the metabolic and enzymatic processes. It also might be role of chlorophyll synthesis by increasing the activity of herematin enzyme consequently more photosynthetic occurs which translocated from leaves to sink site (pods and grain) resulting into robust pods and grain. These results are in conformity with Patel *et al.* (2013) [5].

B:C ratio

(Table No.2) represents that maximum B:C was recorded in Spacing 30 cm + Sulphur 40 kg/ha (1.76) and minimum was observed in Spacing 50 cm + Sulphur 20 kg/ha (1.02).

Conclusion

Based on the findings of experimentation in one season in a year, it is concluded that application of spacing 30cm as well as sulphur 40 kg/ha was found more helpful for attaining better growth and yield in chickpea under Eastern U.P. climatic condition.

Acknowledgement

Authors are thankful to the Department of Agronomy, Sam Higginbottom University of Agriculture and Sciences, Prayagraj, Uttar Pradesh, for providing us facilities and support for undertaking the research study.

References

1. Alihan C. Botanical characteristics of chickpea genotypes (*Cicer arietinum* L.) under different plant densities in organic farming. Scientific Research and Essays. 2012;**7**(4):498-503.
2. Bavalgave VG, Gokhale DN, Waghmare MS, Jadhav PJ. Growth and yield of Kabuli Chickpea Varieties as influenced by different Spacing. International Journal of Agricultural Sciences. 2009;5(1):202-204.
3. Fayaz HM, Allah Wadhayo G, Abdul Hameed M, Sadam Hussain J, Jawad Ahmed A, Imran Ali B. Effect of Sulphur application on growth and yield of chickpea (*Cicer arietinum* L.) under rice chickpea cropping system. Journal of Applied Research in Plant Sciences. 2020;1(1):9-12.
4. Melak A. Effect of Spacing on Yield Components and Yield of Chickpea (*Cicer arietinum* L.) at Assosa, Western Ethiopia. Agriculture, Forestry and Fisheries. 2018;7(2):39-51.
5. Patel HK, Patel PM, Patel MR. Effect of sulphur and phosphorus management on growth and yield of chickpea. Advance Research Journal of Crop Improvement. 2013;4(2):103-105.
6. Sathyamoorthi K, Amanullah MM, Vaiyapuri K, Somasundaram E. Physiological parameters and yield of green gram (*Vigna radiata* L.) as influenced by increased plant density and fertilizer levels. Indian Journal of Crop Science. 2008;3(1):115-122.
7. Sharar MS, Ayub M, Nadeem MAxX, Noori SA. Effect of different row spacings and seeding densities on the growth and yield of gram (*Cicer arietinum* L.). Pakistan Journal of Agricultural Sciences, 2001, 38 (3-4).
8. Sher S, Punia S, Parvender S. Effect of Irrigation, Sulphur and Seed inoculation on Chickpea (*Cicer arietinum* L.). Haryna Journal of Agronomy. 2005;21(1):21-23.
9. Vinayak N, Pujari BT, Halepyati AS, Koppalkar BJ. Growth and Yield of late sown Chickpea as influenced by Irrigation methods, Genotypes and Planting densities. Karnataka Journal of Agricultural Science. 2012;25(2):267-269.