www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(4): 550-553

www.thepharmajournal.com
Received: 02-01-2022
Accepted: 05-03-2022

Katara Akshay R
Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India

Patel Prerak M
Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India

Patel Rutul S
Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India

Sumanth Kumar GV
Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India

Corresponding Author:
Katara Akshay R
Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India

Effect of spacing and fertilizer management on growth and yield of *kabuli* chickpea

Katara Akshay R, Patel Prerak M, Patel Rutul S and Sumanth Kumar GV

Abstract
A field experiment entitled, "Effect of spacing and fertilizer management in *kabuli* chickpea" was conducted during *rabi* season of 2015-16 at college farm, Navsari Agricultural University, Navsari. Twelve treatment combination consisting of three spacing i.e., S_1 (30 × 20 cm), S_2 (45 × 20 cm) and S_3 (60 × 20 cm) and four levels of fertilizer i.e., F_1 (Control), F_2 (75% RDF + *Rhizobium ciceri* + PSB), F_3 (100% RDF + *Rhizobium ciceri* + PSB) and F_4 (125% RDF + *Rhizobium ciceri* + PSB) were tested in factorial randomized block design (FRBD) with three replication. Between the different spacing S_1 (30 × 20 cm) and S_2 (45 × 20 cm) outrightly dominated and established its significant performance with respect to almost all growth and yield attributes for individual plant. S_1 (30 × 20 cm) registered significantly higher plant height, seed and haulm yield and remained statistically at par with spacing S_2 (45 × 20 cm). In case of different levels of fertilizer management treatment all growth attributes (Plant height, number of branches per plant, number and dry weight of nodules per plant and dry matter production per plant) and yield attributes (number of pods per plant, seeds per pod, seed and haulm yield) were recorded higher with application of F_4 (125% RDF + *Rhizobium ciceri* + PSB) and almost followed by the application of F_3 (100% RDF + *Rhizobium ciceri* + PSB) and F_2 (75% RDF + *Rhizobium ciceri* + PSB).

Keywords: *Kabuli* chickpea, spacing, fertilizer, growth and yield attributes

1. Introduction
Pulses are an integral part of Indian dietary system due to richness in protein and other important nutrients such as calcium, iron and vitamins. Indian population is predominantly vegetarian and protein requirement for growth and development of the human being is mostly met with pulses. They are said to be poor man's meat and rich man's vegetables. The availability of pulses per capita per day has proportionately declines from 60.70 g in 1951 to 47.20 g in 2014 against the minimum requirement of 70 g per capita per day (Anon., 2014) [1]. The production of the pulses has to be increase internally to meet the demand.

Among the grain legumes, (*Cicer arietinum* L.) commonly known as Bengal gram and locally Chana is an important and unique food legumes because of its use in variety of food products like snacks and sweets. Condiments and vegetables are prepared from it world-wide. It is also consumed in the form of processed whole seed (boiled, roasted, parched, fried and steamed sprouted) or as dal flour (Besan). Gram is source of protein (18 to 22%), carbohydrates (52 to 70%), fat (4 to 10%), mineral and vitamins. It is an excellent animal feed. Its stover has good forage value. India is a premier chickpea growing country in the world, accounting about 76% of total area and 67% production of the world. In India, it occupies about 8.25 million hectare area with total production of 7.33 million tonnes and an average productivity of 889 kg/ha (Anon., 2015) [2]. While in Gujarat chickpea is grown in an area of 161 thousand hectares, producing 199 thousand tonnes with productivity of 1236 kg/ha (Anon., 2015a) [3].

In spite of the importance of this crop in our daily diet and in agricultural production, productivity of this crop is very low in India as well as in the Gujarat. The low production of this crop is due to improper use of fertilizers, weed competition, improper time of sowing, not used recommended seed rate, not properly adopted spacing, pest and disease management and negligible/very limited use of farm yard manure as well as bio fertilizers such as *Rhizobium* and PSB.

2. Material and Methods
The present study was conducted on College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari throughout *rabi* season of 2015-16.

According to agro-climatic condition, Navsari is located in south Gujarat heavy rainfall zone. The soil of the experimental field was clayed in texture and showed low, medium and fairly high rating for available nitrogen (197.26 kg/ha), phosphorus (30.93 kg/ha) and potassium (369.80 kg/ha). The soil was slightly alkaline with normal electric conductivity (0.36 dS/m). The experiment comprising of twelve treatment combination and tested in factorial randomized block design (FRBD) with three replication. Recommended dose of fertilizer (RDF) was 20:40:00 NPK kg/ha. The seeds of *kabuli* chickpea variety PKV-2 was received from Pulse Farm, Navsari Agricultural University, Navsari were used for this experiment. Seed were treated with *rhizobium ciceri* and PSB. The seeds were dibbled 5-8 cm deep in the furrows. Seeds were covered properly with soil and light irrigation was applied to each plot immediately after sowing. The experimental plot was fertilized with organic manuare and inorganic fertilizers. FYM was applied @ 5 t/ha before sowing. The required quantity of inorganic fertilizer was applied through urea and DAP as per treatment at the time of sowing.

Table 1: Treatment details

Factor A	Spacing (cm)
S_1	30 × 20 cm
S_2	45 × 20 cm
S_3	60 × 20 cm
Factor B	**Levels of fertilizer**
F_1	Control
F_2	75% RDF + *Rhizobium ciceri* + PSB
F_3	100% RDF + *Rhizobium ciceri* + PSB
F_4	125% RDF + *Rhizobium ciceri* + PSB

3. Results and Discussion

3.1 Effect of spacing

The data presented in Table 2 and 3 indicated that different treatments had a significant influence on growth, yield attributes and yield of *kabuli* chickpea.

Significantly higher plant height was recorded under S_1 (30 × 20 cm) but it was remained at par with S_2 (45 × 20 cm). This was apparently because individual plant from the plot with narrow spacing did not get the opportunity to proliferate laterally due to the less lateral space. Hence plants were compelled to grow more in upward direction for the fulfilment of light requirement for photosynthesis.

The maximum number of branches per plant, number and dry weight of root nodules per plant at 50 DAS and dry matter production per plant were observed with the plot having wider spacing S_3 (60 × 20 cm) and remain statistically at par with S_2 (45 × 20 cm) as compared to S_1 (30 × 20 cm). This might be due to plants grown with wider spacing got better opportunity of availing maximum space, light, water and nutrient. The above findings are in complete agreement with earlier work of Goyal *et al*., (2010) [5] and Naik *et al.,* (2012) [6] in chickpea.

Higher number of pods per plant (41.03), number of seeds per pod (1.55) and test weight (31.63 g) were observed in spacing S_3 (60 × 20 cm) as compared to spacing S_1 (30 × 20 cm) and S_2 (45 × 20 cm). The maximum number of pods per plant, number of seeds per pod and test weight (g) in wider row spacing may be attributed relatively less inter-plant competition because of more space availability to individual plants for reproductive growth. These findings are substantiated with those reported by Goyal *et al*., (2010) [5] and Naik *et al.,* (2012) [6] in chickpea.

Seed and haulm yield was significantly influenced by different spacing. Spacing S_1 (30 × 20 cm) recorded significantly higher seed and haulm yield (1027 and 1648 kg/ha) than spacing S_2 (45 × 20 cm) and S_3 (60 × 20 cm). The remarkable increase in seed and haulm yield under spacing S_1 (30 × 20 cm) was mainly due to increased in plant population per unit area. Similar observation also recorded by Bavalgave *et al*., (2009) [4] and Goyal *et al*., (2010) [5] in chickpea.

When, the harvest index was not significantly affected by different spacing. Similar result was found by Nawange *et al*., (2016) [7] in chickpea.

Table 2: Effect of spacing and levels of fertilizer on growth attributes and growth of *kabuli* chickpea

Treatments	Plant height (cm)	No. of branches/plant	No. of root nodules/plant at 50 DAS	Dry weight of root nodules/plant at 50 DAS (mg)	Dry matter production/plant (g/plant)
A. Spacing (S)					
S_1: 30 × 20 cm	52.37	20.89	25.72	32.77	14.30
S_2: 45 × 20 cm	49.56	21.92	26.38	33.49	15.37
S_3: 60 × 20 cm	46.85	22.97	27.07	34.22	16.45
S.Em. ±	1.32	0.56	0.22	0.27	0.20
C.D. at 5%	3.87	1.64	0.66	0.78	0.59
B. Fertilizer (F)					
F_1: Control	46.30	20.42	25.28	31.94	12.15
F_2: 75% RDF + *Rhizobium ciceri* + PSB	48.45	21.38	26.01	32.97	14.30
F_3: 100% RDF + *Rhizobium ciceri* + PSB	51.43	22.77	27.01	34.36	17.17
F_4: 125% RDF + *Rhizobium ciceri* + PSB	52.19	23.13	27.25	34.70	17.89
S.Em. ±	1.52	0.64	0.26	0.31	0.23
C.D. at 5%	4.47	1.89	0.76	0.90	0.68
C. Interaction					
S x F	NS	NS	NS	NS	NS
C. V.%	9.21	8.82	2.95	2.76	4.50

Table 3: Effect of spacing and levels of fertilizer on yield attributes and yield of *kabuli* chickpea

Treatments	No. of pods/plant	No. of seeds/pod	Test weight (g)	Seed yield (kg/ha)	Haulm yield (kg/ha)	Harvest Index (%)
A. Spacing (S)						
S_1: 30 × 20 cm	39.34	1.45	31.12	1027	1648	38.46
S_2: 45 × 20 cm	40.19	1.50	31.38	980	1559	38.66
S_3: 60 × 20 cm	41.03	1.55	31.63	937	1476	38.89
S.Em. ±	0.27	0.03	0.80	24	46	0.52
C.D. at 5%	0.79	0.08	NS	70	135	NS
B. Fertilizer (F)						
F_1: Control	37.66	1.42	30.61	923	1420	39.44
F_2: 75% RDF + *Rhizobium ciceri* + PSB	39.34	1.47	31.12	961	1514	38.87
F_3: 100% RDF + *Rhizobium ciceri* + PSB	41.60	1.55	31.80	1014	1639	38.25
F_4: 125% RDF + *Rhizobium ciceri* + PSB	42.16	1.56	31.97	1027	1671	38.13
S.Em. ±	0.31	0.03	0.92	27	53	0.60
C.D. at 5%	0.91	0.09	NS	81	156	NS
C. Interaction						
S x F	NS	NS	NS	NS	NS	NS
C. V.%	2.32	6.05	8.81	8	10	4.65

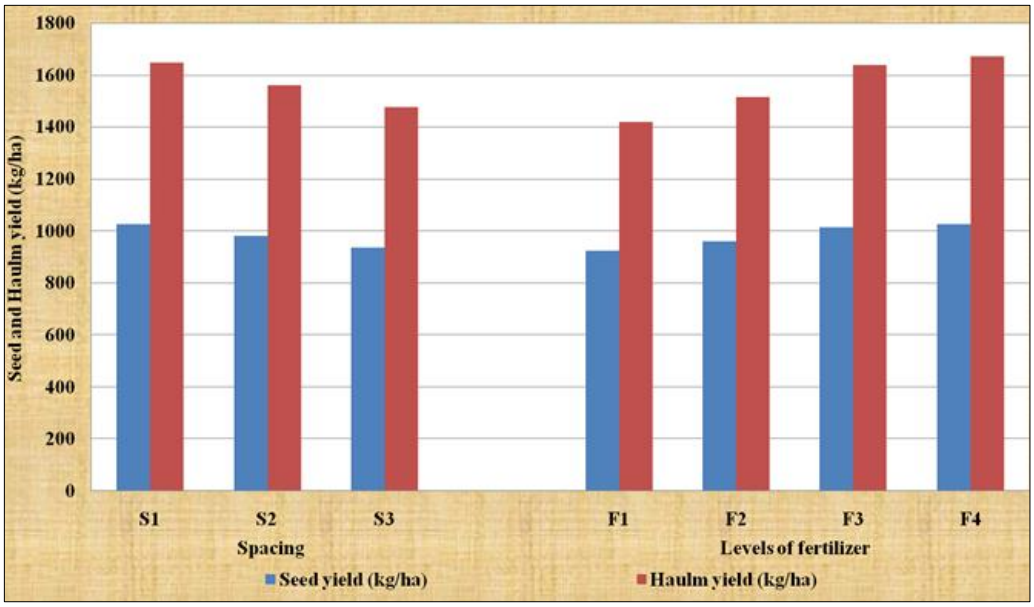

Fig 1: Effect of spacing and levels of fertilizer on seed and haulm yield (kg/ha) of *kabuli* chickpea

3.2 Effect of levels of fertilizer

Almost all the parameters related to growth and yield was significantly influenced by various levels of fertilizer except test weight (g) and harvest index.

The plant height, number of branches per plant, number and dry weight of root nodules per plant at 50 DAS and dry matter production per plant were observed significantly higher with the treatment F_4 (125% RDF + *Rhizobium ciceri* + PSB) which was statistically at par with 75% RDF + *Rhizobium ciceri* + PSB (F_2) and 100% RDF + *Rhizobium ciceri* + PSB (F_3) as compared to control. This might be due to adequate supply of nitrogen and phosphorous under higher levels. Moreover, nitrogen being essential constituent of various amino acids and protein as well as structural constituent of cell influenced different physiological processes such as cell division and elongation. Phosphorous plays important role in conversion of solar energy into chemical energy and it has also beneficial effect on root proliferation that increases the absorption of plant nutrient and moisture from the soil. These results confirm the findings of Goyal *et al.*, (2010) [5], Singh and Singh (2014) [8] and Nawange *et al.*, (2016) [7] in chickpea. The treatment receiving 125% RDF + *Rhizobium ciceri* + PSB (F_4) recorded significantly higher number of pods per plant (42.16), number of seeds per pod (1.56), seed (1027 kg/ha) and haulm yield (1671 kg/ha) which was statistically at par with 100% RDF + *Rhizobium ciceri* + PSB (F_3) and 75% RDF + *Rhizobium ciceri* + PSB (F_2). This was largely attributed to better growth of plant in terms of plant height, number of branches and dry matter production which resulted due to adequate supply of photosynthates for development of sink under higher levels of fertilizer. Positive response of *kabuli* chickpea crop in terms of yield attributes and yield to levels of fertilizer have also been reported by Goyal *et al.*, (2010) [5], Singh and Singh (2014) [8], Nawange *et al.*, (2016) [7]. In case of test weight and harvest index in *kabuli* chickpea was not significantly differing under various levels of fertilizer. Similar result was found by Nawange *et al.*, (2016) [7] in chickpea.

3.3 Interaction effect

The combination of spacing and levels of fertilizer was not significantly influenced. None of the interaction found significant for any of the characters studied.

4. Conclusions

From result of one year experimentation, it can be concluded that *kabuli* chickpea (PKV-2) may be grown with spacing 30 × 20 cm or 45 × 20 cm and fertilized with 75% RDF (15:30:00 N:P_2O_5:K_2O kg/ha) along with *Rhizobium ciceri* and PSB seed treatment under South Gujarat condition for getting higher yield.

5. References

1. Anonymous. Economic Survey, Government of India, 2014.
2. Anonymous. Ministry of Agriculture and Farmers Welfare, Government of India. (ON1299) and Past Issues, 2015.
3. Anonymous. Ministry of Agriculture and Farmers welfare, Government of India. (ON1151), 2015a.
4. 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.
5. Goyal S, Verma HD, Nawange DD. Studies on growth and yield of *kabuli* chickpea (*Cicer Arietinum* L.) genotypes under different plant densities and fertility levels. Legume Research. 2010;33(3):221-223.
6. Naik V, Pujari BT, Halepyati AS, Koppalkar BG. Growth and yield of late sown chickpea as Influencd by irrigation methods, genotypes and planting densities. Karnataka Journal of Agricultural Science. 2012;25(2):267-269.
7. Nawange DD, Verma HD, Verma H. Relative performance of *kabuli* chickpea (*Cicer arietinum* L.) genotypes under different plant densities and fertility levels. Agricultural Science Digest. 2016;36(2):160-162.
8. Singh U, Singh B. Effect of basal and foliar application of diammonium phosphate in cognizance with phosphate-solubilizing bacteria on growth, yield and quality of rainfed chickpea (*Cicer arietinum*). Indian journal of Agronomy. 2014;59(3):427-432.