



Growth and Productivity of Chickpea (*Cicer arietinum* L.) Varieties as Influenced by Seed Rate and Nipping in the Irrigated Arid Western Plain Zone

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ABSTRACT

Background: Chickpea plays a greater role in national food and nutritional security and sustaining the economy of the farming community in a variety of ways. As a result of stagnated production and continuous increasing in population, the per capita availability of pulses has decreased considerably. Since very little scope exists for horizontal expansion of area, the alternative seems to be by adopting innovative agronomic practices like nipping, selection of proper seed rate and variety for a set of agro-climatic conditions to overcome from decreasing production potential. In view of above consideration, the present investigation entitled "Response of seed rate and nipping on different chickpea (*Cicer arietinum* L.) varieties in arid irrigated western plain zone" was carried out.

Methods: The field experiment was conducted at SKRAU, Bikaner during two consecutive *Rabi* seasons of 2016-17 and 2017-18. The experiment was laid out in split-plot design with three replications, assigning 36 treatments consisting of three varieties (GNG-1581, GNG-1958 and GNG-2171) and three seed rates (48, 64 and 80 kg/ha) as main plot treatments and four levels of nipping practice (control, nipping at 30, 45 and 60 DAS) as subplot treatments.

Result: Variety GNG-1581 had significantly shorter plant stature with higher number of branches/plant (13.94), pods/plant (40.14), seeds/pod (1.78), seed yield (2142 kg/ha), whereas, variety GNG-1958 showed significantly higher plant height (52.53 cm) and straw yield (3720 kg/ha). Number of branches per plant, number of pods per plant and seed index were found significantly higher in the seed rate of 48 kg/ha. Maximum plant population, plant height, seed yield (2111 kg/ha), straw yield (3657 kg/ha) were recorded with the seed rate of 80 kg/ha but on par with the seed rate of 64 kg/ha. Nipping had a significant effect on growth, yield attributes and yield of chickpea. The highest number of branches/plant (13.32), pods/plant (39.61), seed/pod (1.78), seed index (19.16 g), seed yield (2121 kg/ha) and straw yield (3695 kg/ha) were obtained when nipping was practiced at 45 DAS.

Key words: Chickpea, Nipping, Seed rate, Varieties.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) popularly known as "Gram" or "Bengal gram" is most important and premier *rabi* season pulse crop of India. It is cultivated in 105.73 lakh ha area with 111.58 lakh ton production and 1055 kg/ha productivity in India. Rajasthan ranked 3rd after M.P. and Maharashtra in chickpea production with 13.75 lakh ha area and 14.71 lakh ton production (Annual report, Directorate of Pulse Development, GOI; 2017-18). Its acreage is increasing in irrigated areas of the arid region of western Rajasthan but its productivity is quite low than its potential yield. Lack of suitable cultivar, improper plant stand and excessive vegetative growth under irrigated situation are of some important reasons for the poor yield. Selection of high yielding varieties helps increasing the productivity (Meena and Yadav, 2015; Meena *et al.* 2015). In recent years the development of early varieties of chickpea has enabled its successful cultivation. Inadequate plant population is one of the important factors responsible for poor grain yields of chickpea (Nagarajaiah *et al.*, 2005). Adequate plant population may be maintained by using cultivar specific optimum seed rate. In chickpea, there is a strong apical dominance and it is believed that apical meristem/shoot apex produce auxin, which inhibits the axillary buds into actively growing shoots (Campbell *et al.* 2008). Nipping has been

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found to increase lateral branches of plants as a result of the removal of apical dominance of auxin. It promotes the lateral branching, helps to have vigorous plant and produce more flowers and pods. More branches will possibly initiate more flower buds and possibly more yield. (Reddy, 2009). Keeping these facts under consideration the present study was undertaken.

MATERIALS AND METHODS

The experiment was conducted at College of Agriculture,

Swami Keswanand Rajasthan Agricultural University, Bikaner, during *rabi* seasons of 2016-17 and 2017-18. The crop was sown during 08th Nov., 2016 and 11th Nov., 2017 and harvested on 25th March, 2017 and 23rd March 2018. The experimental site is situated at 28.01° N latitude and 73.22° E longitude with an altitude of 234.70 meters above sea level. This region falls under agroclimatic zone Ic [Hyper Arid Partially Irrigated Western Plain Zone] of Rajasthan and agroclimatic zone XIV [Western Dry Region] of India. The soil of the experiment site was loamy sand in texture, low in organic carbon (0.10%), available nitrogen (85.31 kg/ha) and available phosphorus (19.40 kg/ha) and medium in potassium (298.20 kg/ha) in 0-30 cm soil depth with pH 8.34. The experiment was laid out in split-plot design with three replications, assigning 36 treatments consisting of three varieties (GNG-1581, GNG-1958 and GNG-2171) and three seed rates (48, 64 and 80 kg/ha) as main plot treatments and four levels of nipping practice {control (no nipping), nipping at 30, 45 and 60 DAS} as sub plot treatments. The experimental crop was raised as per the recommended package of practices. Growth and yield parameters were recorded as per standard practice and data were statistically analyzed for estimation of analysis using standard statistical methods of Panse and Sukhatme, (1985).

RESULTS AND DISCUSSION

Effect on growth attributes

The plant population, plant height and number of branches per plant, were significantly influenced by chickpea varieties

(Table 1). The highest plant population (3.11 lac/ha) and the number of branches (13.94) were recorded in variety GNG 1581. However, significantly taller plants (52.53 cm) were recorded in variety GNG 1958. The higher plant population of variety GNG- 1581 was due to its small seed size than bold seeded variety GNG-1958. The variation in plant height and production of branches/plant were due to differences in genetic makeup and growth behaviour of varieties as also reported by Prakash *et al.* (2006) and Tiwari (2016). The plant population and plant height were significantly higher in seed rate of 80 kg ha⁻¹ Table 1. However, the number of branches was found significantly higher at low seed rate, *i.e.*, 48 kg/ha over 64 and 80 kg/ha. Seed rate of 80 kg/ha resulted in the significantly tallest plant (51.28 cm). It was mainly due to the fact that a higher number of plants per unit area led to more competition among plants especially for light, which enhanced plant height.

Plant height and number of branches were influenced significantly due to nipping practice; however, the plant population remained indifferent. Plant height at harvest was recorded significantly highest in control treatment Table 1. As nipping directly reduces plant height and suppressed the apical dominance and facilitates more lateral branches, owing to that, control treatment (no nipping) produced taller plant as compared to the nipping at different growth stages as recorded by Baloch and Zubair (2010) and Sharma *et al.* (2003). At each growth stage, the number of branches increased which were continued up to harvest. The treatment of nipping at 45 DAS produced a significantly higher mean

Table 1: Effect of different chickpea varieties, seed rate and nipping on different growth and yield attributes (Pooled data 2016-17 and 2017-18).

Treatment	Plant population (lac/ha)	Plant height (cm)	Number of branches/plant	Pods/ plant	Seeds /pod	Seed index (g)
Variety						
GNG-1581	3.11	40.00	13.94	40.14	1.78	16.76
GNG-1958	2.50	52.53	11.59	36.93	1.55	22.30
GNG-2171	3.09	50.70	10.18	35.97	1.66	16.11
S.E.m±	0.03	0.72	0.14	0.32	0.02	0.12
CD (5%)	0.09	2.15	0.41	0.91	0.05	0.35
Seed rate						
48 kg ha ⁻¹	2.28	45.86	12.93	40.96	1.69	19.01
64 kg ha ⁻¹	2.87	46.79	11.92	36.89	1.65	18.46
80 kg ha ⁻¹	3.55	50.58	10.86	35.20	1.64	17.69
S.E.m±	0.03	0.72	0.14	0.32	0.02	0.12
CD (5%)	0.09	2.15	0.41	0.91	NS	0.35
Nipping stage						
Control	2.93	50.02	11.04	36.26	1.56	17.60
Nipping at 30 DAS	2.92	44.27	11.29	38.00	1.68	18.64
Nipping at 45 DAS	2.86	48.34	13.32	39.61	1.78	19.16
Nipping at 60 DAS	2.88	48.33	11.97	36.85	1.63	18.16
S.E.m±	0.03	0.59	0.12	0.25	0.01	0.11
CD (5%)	NS	1.68	0.34	0.71	0.03	0.30

NS: Non-significant.

number of branches per plant over no nipping, nipping at 30 and 60 DAS.

Effect on yield attributes and yield

Variety GNG-1581 produced significantly more number of pods/plant (40.14) and seeds/pod (1.78) as compared to GNG-1958 and GNG-2171. The variation in pods/plant and seeds/pod bearing ability of varieties may be due to their genetic differences. A seed rate of 48 kg/ha significantly improved the pods/plant with 11.0 and 15.6 per cent and seed index by 3.0 and 7.5 per cent over 64 kg and 80 kg/ha, respectively. However, seeds/pod did not differ due to seed rate used. This may be due to the fact that the number of pods is positively correlated with the number of branches per plant. The results are in closed association with the finding of Nihaluddin *et al.* (2005), Panchariya and Lidder (2000). Nipping practice had a significant positive effect on all yield attributes. Nipping practiced at 45 DAS significantly increased pods/plant (39.31), seeds/pod (1.78) and seed index (19.16 g) over control, nipping at 30, 60 DAS. The higher seeds/pod with nipping at 45 DAS may be due to increase in the photosynthetic area leading to higher photosynthetic rate, better assimilation and accumulation of more photosynthates resulting into better seed development Gnyandev (2009) and Sujatha *et al.* (2016). Variety GNG-1958 recorded significantly higher seed index as compared to GNG-1581 and GNG-2171 with increase 33.05 and 38.42 per cent over GNG-1581 and GNG-2171, respectively. This may be due to varietal characters. Similar results were obtained by Tiwari (2016) and Singh and Sekhon (2006).

The seed yield and straw yield of chickpea were significantly influenced by individual and interaction effect of variety, seed rate and nipping practice (Table 2, 3 and 4). The combined effect of variety and seed rate indicated that significantly higher seed yield (2305 kg ha⁻¹) of chickpea variety GNG-1581 was recorded with seed rate 80 kg ha⁻¹ in comparison to other treatment combinations but remained on par with combination of GNG-1581 with 64 kg/ha seed rate (2248 kg/ha). This yield variation in respect of interaction effect of variety and seed rate may be due to variation in pod bearing ability, number of seeds per pod (Nagarajaiah *et al.* 2005) and it also shows that increase in yield attributing characters and yield per plant under lower plant density (seed rate) with any of selected variety was not sufficient enough to compensate to higher plant density for higher seed yield. Similar results were reported by Nagarajaiah *et al.* (2005) who found higher seed yield with increasing seed rate. Nipping at 45 DAS in variety GNG-1581 produced significantly higher seed yield (2369 kg/ha), which was significantly superior to seed yield of variety GNG-1958 and GNG-2171 with same and different level of nipping practice. It is apparent from data (Table 4) that nipping at 45 DAS in seed rate of 80 kg/ha produced significantly higher seed yield (2371 kg/ha), which was significantly superior over rest of all possible treatment combination of nipping and seed rate. Beneficial effect of nipping on yield was also reported by Bharathi *et al.* (2014).

Nipping at 45 DAS in variety GNG-1958 produced highest (3942 kg ha⁻¹) straw yield over all possible treatment combinations of variety, seed rate and nipping. The straw yield increased significantly due to seed rates. Variety GNG-

Table 2: Interaction effect of varieties and seed rate on seed and straw yield (Pooled data 2016-17 and 2017-18).

Variety	Seed rate (kg/ha)					
	Seed yield (kg/ha)			Straw yield (kg/ha)		
	48	64	80	48	64	80
GNG-1581	1873	2248	2305	3408	3218	3341
GNG-1958	1742	1980	2018	3625	3679	3854
GNG-2171	1520	1988	2010	3359	3596	3774
S.Em±		25			45	
CD at 5%		73			130	

Table 3: Interaction effect of different varieties and nipping on seed and straw yield (Pooled data 2016-17 and 2017-18).

Variety	Nipping (DAS)							
	Seed yield (kg/ha)				Straw yield (kg/ha)			
	0*	30	45	60	0*	30	45	60
GNG-1581	1906	2148	2369	2146	3240	3472	3434	3144
GNG-1958	1895	1868	2038	1852	3604	3611	3942	3721
GNG-2171	1753	1914	1955	1735	3415	3484	3708	3697
V x S (V at same level of S)								
	S.Em±		24				44	
	CD at 5%		67				123	
V x S (S at same/ different level of V)								
	S.Em±		21				38	
	CD at 5%		58				107	

*Control (No nipping)

Table 4: Interaction effect of different seed rate and nipping on seed and yield (Pooled data 2016-17 and 2017-18).

Seed rate(kg/ha)	Nipping (DAS)							
	Seed yield (kg/ha)				Straw yield (kg/ha)			
	0*	30	45	60	0*	30	45	60
48	1717	1533	1836	1762	3278	3599	3465	3514
64	1935	2253	2155	1944	3433	3361	3749	3448
80	1902	2144	2371	2027	3549	3607	3871	3600
S x N (S at same level of N)	S.Em±		24				44	
	CD at 5%		67				123	
S x N (N at same/ different level of S)	S.Em±		21				38	
	CD at 5%		58				107	

1958 with seed rate of 80 kg/ha produced significant higher (3854 kg/ha) straw yield, which was significantly superior to straw yield of variety GNG-1581 and GNG-2171 with same and different level of seed rates but remained at par with combination of GNG-2171 with 80 kg ha⁻¹ seed rate (3774 kg/ha). Tiwari (2016) also reported significantly higher straw yield in variety GNG-1958. The interaction of 80 kg/ha with nipping at 45 DAS also noted higher straw yield over any other interaction of nipping and seed rates. These results were in conformity with the findings of Bharathi *et al.* (2014) and Reddy *et al.* (2009). This might be due to cumulative effect in favour of growth contributing characters which have been clearly exhibited on the final produce, i.e., seed and straw yield.

CONCLUSION

Based on two years study it is concluded that GNG-1581 was found to be a better variety of chickpea than GNG-1958 and GNG-1581 for the western irrigated plain zone of Rajasthan state. Appropriate seed rate for GNG-1581 was found to be 80 kg/ha, less seed rate led to a significant reduction in seed and straw yield. Nipping practice at 45 DAS in chickpea was also found profitable for Bikaner region.

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