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Effect of seed rate and nipping on growth and yield of different chickpea (*Cicer arietinum* L.) varieties in arid irrigated western plain zone

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Abstract

A field experiment entitled "Response of seed rate and nipping on different chickpea (*Cicer arietinum* L.) varieties in arid irrigated western plain zone" was laid out in split plot design with three replication assign 36 treatments combination of three varieties (GNG-1581, GNG- 1958 & GNG-2171), three seed rate (48, 64 and 80 kg⁻¹) as main plot and four levels of nipping practice (no nipping, at 30 DAS, at 45 DAS and at 60 DAS) during rabi season 2016-17 & 2017-18. Role of seed rates and nipping was the most important determinant in boosting growth and yield of chickpea varieties. Among varieties, GNG – 1958 recorded significantly higher growth parameters viz., plant height and straw yield of chickpea followed by GNG – 1581 and GNG – 2171. Significantly higher seed yield was recorded by GNG – 1581. The results showed that variety GNG-1581 had significantly number and weight of effective nodules per plant plant⁻¹ seed yield. Further, growing of chick pea by using 80 kg ha⁻¹ seed rate was produced higher straw yield followed by seed rate of 64 kg ha⁻¹ and 48 kg ha⁻¹. Nipping practices showed a significant effect on growth and yield of chickpea. Nipping at 45 DAS observed higher seed and straw yield as compared to control (No nipping), nipping at 30 DAS and 60 DAS.

Keywords: Chickpea, nipping, seed rate, varieties

Introduction

Chickpea (*Cicer arietinum* L.) is also known as "Gram" or "Bengal gram". It is the most important pulse crop in India. Chickpea belongs to family *Fabaceae* and originated from north-west India. Chickpea seeds contain about 18-22% protein, 4-10% fat and 52-70% carbohydrate and traditionally consumed after processing into various products. Madhya Pradesh is the first position in chick pea production it share was 24.63% Maharashtra is on the second rank for area and third for production 22.39 lakh tones (20.21 &). Whereas, Rajasthan has the second rank in production (23.99%) and third in the area (Ministry of Agriculture, 2019-20) [1]. Varieties play an important role in the production and selection of proper variety for a set of agro-climatic conditions is very important to achieve maximum yield potential. The use of traditional or low yielding varieties and adoption of poor management practices are of great importance. Amongst the agronomical practices, sowing methods and proper seed rate are of great importance (Nagarajiah *et al.*, 2005) [6]. As the seed rate increases the production also increases but after a point there is stagnation in yield, as more or less seed rate also affects the yield of chickpea crop. The Improvement in yield attributes at lower seed rate could be attributed to a relatively less competition for light, nutrient and moisture enabling the plant to develop better than the counter parts with higher seed rate. (Campbell *et al.* 2008) [4]. Nipping has been found to increase lateral branches of plants as a result of the removal of the 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) [8]. The crop growth and yield of varieties in the changing seed rates and nipping stages help to select the most promising varieties in terms of growth and yield potential. With this view experiment was conducted to identify the most suitable variety, appropriate seed rate and nipping stage for the growth and yield performance in chickpea.

Materials and Methods

The experiment was conducted during winter season 2016-17 and 2017-18 at Instructional Farm, College of Agriculture, Swami Keswanand Rajasthan Agricultural University, Bikaner, Rajasthan. The experimental site is located 9 km away from Bikaner on Sri-Ganganagar road.

It is located at 28.01° N latitude and 73.22° E longitude with an altitude of 234.70 meters above mean 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 site was loamy sand soil of saline reaction having pH 8.34, available nitrogen, phosphorus and potassium 85.31, 19.40 and 315.20 kg ha⁻¹, respectively in 0-30 cm soil depth. The experiment was laid out in split-plot design with three replications, assigning 36 treatments consisting three varieties (GNG-1581, GNG-1958, and GNG-2171) and three seed rates (48, 64 and 80 kg ha⁻¹) as main plot treatments and four levels of nipping practice (control (no nipping, nipping at 30, 45 and 60 DAS) as subplot treatments. For fertilizer management 20 kg N and 40 kg P₂O₅ ha⁻¹ were applied through DAP and urea, respectively as a basal dose. In the case of weed management, two hand weeding was done at 30 and 45 DAS. Two irrigations were applied at 30 and 60 DAS. The crop was raised as per standard agronomic practices during both years. Growth and yield data were recorded and were analyzed statistically for extermination of analysis of variance using standard statistical method of Panse and Sukhathme (1985)^[7].

Results and Discussion

Growth parameters

Effect of variety

Chickpea variety GNG-1581 significantly recorded higher number of plant (ha⁻¹) at harvest as compared to GNG-1958 and remained at par with GNG-2171 during both the year as well as pooled mean. Plant height was significantly highest in GNG-1958 (55.70 cm) than other varieties. It is observed from the data that the plant height increased up to maturity stage. Similar results were also reported by Tiwari (2016)^[10]. Variety GNG-1581 produced highest number and weight of effective root nodules per plant than the other varieties. Nodulation in the variety is governed by certain genetic factors associated with micro climatic conditions of the soil in which plant grow; hence it varies from variety to variety. The response of varieties in respect of root nodules was also reported by Solanki (2008).

Effect of seed rate

Different seed rates showed significant impact on plant population of chickpea. Seed rate of 80 kg produced tallest plant. It was mainly due to the fact that higher number of plants per unit area led to more competition among plants especially for light, which enhanced plant height. These finding are in agreement with the results of Sharma *et al.* (2003)^[9]. The number and weight of effective root nodules per plant differed significantly due to seed rates. However, seed rate of 48 kg per hectare produced higher number of

nodules per plant. It may be resultant of competitive stress for various nutrients as well as for space congestion among plants at higher density, which restricted root development, and finally number of root nodules were affected. These results are in agreement with the findings of Bharathi (2014)^[2].

Effect of nipping practice

The plant population, number and weight of effective nodules was not significantly influenced due to nipping practice. As nipping suppressed the apical dominance and facilitates more lateral branches, the treatment of no nipping (N0) produced taller plant as compared to the treatment of nipping. Similar observations were also recorded by Khan *et al.* (2003)^[5], Baloch *et al.* (2010)^[3] and Sharma *et al.* (2003)^[9].

Yield parameters

Effect of varieties

Variety GNG-1581 produced significantly higher seed yield and harvest index as compared to GNG-1958 and GNG-2171. This yield variation in respect of various varieties may be due to variation in pod bearing ability, number of seeds per pod. Similar results were also reported by Nagarjaiah *et al.* (2005). However, variety GNG-1958 produced significantly higher straw yield. The increase in straw yield indirectly related to increase vegetative growth and to a negligible extent the increase in the reproduction portion of the plants. Tiwari (2016)^[10] also reported significantly higher straw yield in variety GNG-1958.

Effect of seed rate

A seed rate of 80 kg per hectare recorded significantly higher seed yield (2111 kg ha⁻¹) than 48 kg kg ha⁻¹ seed rate but it was found at par with 64 kg seed rate (2072 kg ha⁻¹). The increase in yield attributing characters and yield per plant under lower plant density (seed rate) was not sufficient enough to compensate to higher plant density for higher seed yield. The increase in yield due to higher seed rate has been also reported by Nagarajaiah *et al.* (2005)^[6]. The straw yield increased significantly due to seed rates.

Effect of nipping

Nipping at 45 DAS recorded highest seed yield of 2121 kg ha⁻¹ which was significantly superior over the treatment of no nipping, nipping at 30, 60 DAS. Similar results were also found by Sharma *et al.* (2003)^[9] and Khan *et al.* (2003)^[5]. The mean straw yield was influenced significantly due to the treatment of nipping. The treatment of nipping at 45 DAS recorded significantly higher straw yield which was significantly superior to the rest of the treatments. Beneficial effect of nipping on biological yield was also reported by Bharathi *et al.* (2014)^[2].

Table 1: Effect of seed rate and nipping on plant population, plant height, number and weight of effective nodules at 50 DAS of chickpea varieties

Treatment	Plant population lac ha ⁻¹ (at harvest)			Plant height (cm)			Number of effective nodules			Weight of effective nodules		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
(I) Variety												
GNG-1581	3.06	3.17	3.11	40.00	42.55	41.27	15.75	16.13	15.94	55.40	61.13	58.27
GNG-1958	2.48	2.51	2.50	52.53	58.88	55.70	15.03	15.40	15.22	50.61	58.90	54.75
GNG-2171	3.11	3.08	3.09	50.70	46.33	48.52	13.72	15.31	14.51	51.65	53.38	52.52
S.Em±	0.05	0.04	0.03	0.72	0.73	0.51	0.17	0.19	0.13	0.49	0.70	0.43
CD (5%)	0.14	0.13	0.09	2.15	2.20	1.48	0.51	0.58	0.37	1.48	2.08	1.23
(II) Seed rate												

48 kg ha ⁻¹	2.24	2.31	2.28	45.86	47.00	46.43	15.89	16.28	16.08	54.74	60.81	57.78
64 kg ha ⁻¹	2.84	2.91	2.87	46.79	48.77	47.78	14.59	15.58	15.09	52.19	57.86	55.02
80 kg ha ⁻¹	3.57	3.53	3.55	50.58	51.99	51.28	14.02	14.97	14.50	50.74	54.74	52.74
S.Em±	0.05	0.04	0.03	0.72	0.73	0.51	0.17	0.19	0.13	0.49	0.70	0.43
CD (5%)	0.14	0.13	0.09	2.15	2.20	1.48	0.51	0.58	0.37	1.48	2.08	1.23
III) Nipping stage												
Control	2.92	2.95	2.93	50.02	51.81	50.92	14.79	15.65	15.22	52.39	57.53	54.96
Nipping at 30 DAS	2.90	2.94	2.92	44.27	48.50	46.38	14.76	15.69	15.22	52.23	57.61	54.92
Nipping at 45 DAS	2.84	2.88	2.86	48.34	48.95	48.65	15.03	15.72	15.38	53.14	58.10	55.62
Nipping at 60 DAS	2.87	2.90	2.88	48.33	47.76	48.04	14.74	15.39	15.07	52.45	57.97	55.21
S.Em±	0.04	0.03	0.03	0.59	0.64	0.43	0.18	0.15	0.11	0.53	0.42	0.34
CD (5%)	NS	NS	NS	1.68	1.80	1.22	NS	NS	NS	NS	NS	NS

Table 2: Effect of seed rate and nipping on seed yield, straw yield and harvest index of chickpea varieties

Treatment	Seed yield (kg ha ⁻¹)			Straw yield (kg ha ⁻¹)			Harvest index (%)		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
(I) Variety									
GNG-1581	2033	2252	2142	3247	3398	3323	38.36	39.82	39.09
GNG-1958	1843	1983	1913	3569	3870	3720	33.85	33.80	33.83
GNG-2171	1787	1891	1839	3397	3755	3576	34.31	33.53	33.92
S.Em±	21.63	19.96	14.71	37.88	35.94	26.11	0.23	0.34	0.20
CD (5%)	64.83	59.84	42.39	113.55	107.74	75.20	0.68	1.01	0.58
(II) Seed rate									
48 kg ha ⁻¹	1660	1764	1712	3324	3604	3464	33.09	32.91	33.00
64 kg ha ⁻¹	1991	2152	2072	3354	3641	3498	37.19	37.22	37.21
80 kg ha ⁻¹	2012	2210	2111	3536	3777	3657	36.23	37.02	36.62
S.Em±	21.63	19.96	14.71	37.88	35.94	26.11	0.23	0.34	0.20
CD (5%)	64.83	59.84	42.39	113.55	107.74	75.20	0.68	1.01	0.58
(III) Nipping stage									
Control	1777	1925	1851	3317	3523	3420	34.89	35.23	35.06
Nipping at 30 DAS	1854	2100	1977	3391	3654	3522	34.76	36.62	35.69
Nipping at 45 DAS	2083	2159	2121	3543	3847	3695	36.95	36.01	36.48
Nipping at 60 DAS	1837	1985	1911	3368	3673	3521	35.42	35.01	35.22
S.Em±	19.33	19.79	13.83	34.89	36.53	25.26	0.27	0.36	0.22
CD (5%)	54.81	56.10	38.77	98.94	103.58	70.81	0.76	1.02	0.63

Conclusion

On the basis of two years study GNG-1581 was found to be better variety of chickpea than GNG-1958 and GNG-2171 for Western Irrigated Plain Zone of the state of Rajasthan. It recorded highest yield by 2142 kg ha⁻¹ compared with other varieties. Appropriate seed rate for GNG-1581 was found to be 80 kg ha⁻¹ less seed rate led to significant reduction in yield and net return. Nipping practice at 45 DAS was found to be suitable for chickpea in Bikaner region.

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