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Gnyandev B
Agricultural Research Station Bidar, Univercity of Agricultural Sciences Raichur, Karnataka, India

MB Kurdikeri
Agricultural Research Station Bidar, Univercity of Agricultural Sciences Raichur, Karnataka, India

PM Salimath
Agricultural Research Station Bidar, Univercity of Agricultural Sciences Raichur, Karnataka, India

Correspondence
Gnyandev B
Agricultural Research Station Bidar, Univercity of Agricultural Sciences Raichur, Karnataka, India

Effect of nipping and foliar spray of growth regulators on plant growth, seed yield and quality in chickpea varieties

Gnyandev B, MB Kurdikeri and PM Salimath

Abstract
The field experiments were conducted at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *rabi* 2007-08 and 2008-09 to ascertain the effect of nipping growth regulators spray on chickpea varieties A-1 and ICCV-2. The varieties, A-1 recorded lower plant height, higher number of branches, number of pods (47.75) per plant, seed yield per plant and per ha (28.75 q) compared to ICCV-2 (25.52 q/ha). The seed quality parameters *viz*., 100 seed weight, seedling length (27.54 cm), dry weight (180.37 mg), vigour index (2301) were more in ICCV-2 compared to A-1. Among foliar sprays of growth regulators, the plants sprayed with NAA 50 ppm resulted in increase of plant height, number of productive branches (26.13), number of pods per pant (46.76), seed yield per ha (29.91 q) and was followed by triacontanol(1 ml/lit) with higher seed quality parameters. The interaction effect of varieties and growth regulators (VxS) indicated that, A-1 variety sprayed with 50 ppm NAA (V_1S_1)recorded relatively higher number of branches, pods per plant, pod weight per pant and seed yield per ha (32.29) and the other parameters were no significant.

Keywords: Nipping, growth regulators sprays

Introduction
Chickpea is an important leguminous crop of our country, grown mainly under rainfed conditions. In recent year several Kabuli and Desi types of Bengal gram varieties are released for cultivation. The area under chickpea is increasing every year but the required quantity of quality seeds are not available for sowing mainly because of lesser area under seed production. The seed yield and quality needs to be enhanced by adopting certain agronomic practices and scientific seed production techniques. Hence the experiment is studied on influence of nipping and growth regulators sprayes on chickpea varieties is studied, The field experiment consisted of 16 treatments combinations involving two varieties (A-1and ICCV-2), two levels of nipping (N_1- nipping and N_2 – no nipping) at 30 DAS and four foliar spray of growth regulators *viz*., S_1- NAA (50 ppm), S_2 (Triacontanol 1 ml/ L), S_3 – *Panchagauya* (3%) and S_4- Control (water spray) in this context, a field study was conducted on effect of nipping and growth regulators sprays on plant growth, seed yield and quality In chickpea varieties in department of seed science and technology, UAS, Dharwad during 2007-08.

Material and Methods
The field experiments were conducted to study the influence of nipping, growth regulators in chickpea varieties during *rabi* 2007 and 2008 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. Genetically pure seeds of chickpea cv. A-1 and ICCV-2 was obtained from the department of Genetics and Plant Breeding, University of Agricultural Sciences, Dharwad. The bulk seeds were graded using 5x5 mm (R) metal sieve and were used for the study. The seeds were sown by dibbling in 30 cm rows at 15cm intra row spacing in well prepared seed plots of 2.25 x 1.50 m gross plots with 1.65 x 1.20 m net plots during rabi seasons of 2007 and 2008. The recommended does of fertilizer (20:50:00 kg NPK/ha) was applied as basal dose for each plots in the form of urea and diammonium phosphate at the time of sowing. Soon after sowing plots were lightly irrigated. The necessary after care operations such as thinning, hand weeding, inter cultivation and need based plant protection measures were carried out. The plants are nipped after 30 days after sowing and plants are sprayed with different folier sprayes. The experiment was laid out in RCBD with

factorial concept in three replications. The field observations recorded on plant height number of branches at 60 DAS and at harvest, number of pods per plants, seeds per pods and seed yield per hectare were recorded. The seed quality parameters viz., 100 seed weight, germination percentage, vigour index (germination (%) x seedling length) and electrical conductivity were recorded by adopting ISTA Rules (Anon., 1996) [1].

Results and Discussion

Influence of varieties

In the present study, varietal differences with respect to field performance have been noticed in chickpea. Significant variation in plant height at 60 DAS and at harvest were observed in chickpea varieties irrespective of nipping and growth regulators. In general ICCV-2 (V_2) variety registered more plant height (38.63 cm and 44.30 cm) at 60 DAS and at harvest respectively which may be mainly due to efficient accumulation of photosynthates in the vegetative plant parts. Besides the plant height is also a genetic character of varieties (Poma *et al*., 1990). On the contrary, the number of branches were maximum (25.58) in A-1 compared to ICCV-2 (21.97) such varietal differences in number of branches were also reported by Merwade (2000) [11] in chickpea.

Significant differences were seen between the chickpea varieties with respect to number of pods per plant, number of seeds per pod, seed yield per plant, per plot and per hectare irrespective of nipping and foliar spray of growth regulators. Between varieties, A-1(V_1) recorded significantly more number of pods per plant (47.75), number of seed per pod (1.46), pod yield per plot (16.78 g), seed yield per plant (14.66 g), per plot (1.03 kg) and per ha (28.75 q). The differences on seed yield and yield parameters observed between varieties in the present study may be attributed to their differences in growth habit and genetic yielding ability. Similar varietal difference in chickpea with respect to plant growth was reported by Aziz and Rahman (1996) [3] and on seed yield and yield attributes by Siag and Verma (1995) [16] and Mewade (2000) [11] in chickpea and in cowpea by Reddy (2005) [13].

It is an established fact that seed quality attributes are reported to vary among varieties of several crop species owing to genetic and environmental factors. In the present investigation, all the seed quality parameters were found to differ between chickpea varieties. The 100 seed weight (21.66 g), seedling length (27.54 cm), dry weight (180.37 g), vigour index (2301) and electrical conductivity (0.491 dSm^{-1}) were more in ICCV-2 (V_2) compared to A–1 (V_1). While, A-1 recorded relatively more germination (94.38%) and lower EC (0.395dSm^{-1}) compared to ICCV-2. The differences in seed quality attributes observed between chickpea varieties may be attributed to varietal differences in seed development and accumulation of reserved food material. The similar results were reported by Ramteke (1995) [12] and Merwade (2000) [11] in chickpea.

Influence of nipping

The terminal shoot tip of plant was nipped at 30 DAS to restrict growth and enhance horizontal growth and to derive such added benefits of nipping. Between nipping and no nipping treatments, non-nipped (N_2) plants recorded significantly more plant height at 60 DAS and at harvest (37.78 and 44.23 cm, respectively) compared to nipped plant (N_1). While, nipped plants (N_1) recorded significantly higher number of pod bearing branches (22.44 and 25.12) at 60 DAS and at harvest respectively compared to non-nipped plant (19.81 and 22.43) The higher plant height noticed with non-nipping (N_2) treatment was mainly due to the fact that plants were not nipped and as such seeds plants grew to their original height without reduction unlike nipped plants. While, number of branches per plant were more in case of nipped plants. This may be due to nipping effect of apical buds which resulted in production of more secondary branches and cessation of vertical growth on account of effective translocation of growth regulators particularly auxins being diverted to the potential and tertiary shoot buds which in normal conditions remain dormant (Robert 1983). Sing and Singh (1992) [17] indicated that the energy which was provisionally used by the plant was diverted towards branching.

The seed yield is a function of plant population, number of pod bearing branches, number of pod per plant, number of seeds per pod, test weight *etc*. Arresting of vertical growth of plants by nipping apical bud always results in production of more number of productive branches. In the present study, plants nipped (N_1) at 30 DAS recorded significantly highest values for all the seed yield parameters. The number of pods per plant (46.04), pod yield per plant (18.22 g), seed yield per plant (12.65 g), per plot (1.02 kg) and per ha (28.50 q) were more with nipping treatment. While, number of seeds per pod and 100 seed weight did not show significant difference on account of genetic factor but were numerically higher (1.40 and 23.19 g respectively) in nipped plants.

The increase in seed yield and yield attributing parameters noticed with nipping was mainly due to production of more number of productive branches (Khan *et al*., 2006) [9] in chickpea. The nipping is known to accumulate more photosynthates which are utilized for production of more number of pod bearing branches and more number of seeds per pod in pea (Singh and Singh,). Seed yield itself is a complex genetic trait and several other parameters like branches per plant, days to flowering, number of pods per plant *etc*. have significant role on final yield. Khan *et al*. (2006) [9] opined that although the correlation between number of branches and seed yield is always positive and their magnitude has been increased considerably in chickpea with nipping. Similar increase in seed yield and yield parameters with nipping were also reported by Aziz (2002) [4] in chickpea. Plants nipped at 30 DAS (N_1 recorded significantly highest seed quality parameters like germination (93.68%), seedling length (27.06 cm), seedling dry weight (179.12 mg) and vigour index (2282) while, electrical conductivity was significantly the lowest (0.426 dSm^{-1}) compared to no nipping treatment. The higher seed quality parameters noticed with nipping at 30 DAS may be due to increase in photosynthetic area leading to higher photosynthetic rate, better assimilation and accumulation of more photosynthates resulting into better seed development as evident with higher test weight. Similar increase in germination and lesser electric conductivity of seed leachate with apical bud nipping was earlier revealed Sajjan *et al*. (2003) [15] in okra, Sudarshan (2004) [18] in fenugreek and Iyyanagouda (2003) [8] in coriander.

Influence of growth regulators

In the present study, the foliar spray of growth regulators showed significant differences on seed yield and yield attributes. The maximum number of pods (46.76), pod weight

per plant (19.19 g), seed yield per plant (15.67 g), per plot (1.06 kg) and per ha (29.91 q) with higher test weight (24.48 g) were observed in plant sprayed with 50 ppm NAA followed by triacontanol 1ml/l (43.34, 17.84 g, 14.96 g, 1.01 kg, 27.80 q and 23.57 g, respectively) compared to control (35.26, 15.84 g, 12.05 g, 0.89 kg, 24.68 q and 21.32 g, respectively). The significant increased seed yield and yield attributes obtained with the application of growth regulators may be attributed to more number of productive branches per plant, pods per plant and 100 seed weight. Further, growth regulators influence carbon cycle in plant with higher CO_2 fixation and efficient translocation of synthates towards developing seed (Menon and Shrivastava, 1984 [10] in chickpea. The similar higher seed yield due to application of growth regulators in different pulses was related to the increased vegetative growth, number of branches, flowers and pod numbers, seeds per pod, seed weight reduced plant height, delayed leaf senescence, Increased lateral branches, seeds per pod and 100 seed weight (Hunje *et al*., 1995) [6]. Further, NAA has beneficial role on preventing flower drop in chickpea which may be due to creation of favourable balance of endogenous hormone related to flowering which inturn results in increase of seed yield in chickpea. (Upadhayay 2002) [19]

The seed quality parameters like seed germination, seedling length, seedling dry weight, vigour index were markedly maximum with minimum electrical conductivity with foliar spray of NAA followed by triacontanol and panchagavya compared to control. These growth regulators are known to increase sink and source relationship due to increase translocation of assimilates towards the seeds leading to more number of well developed, matured pods per plant with higher test weight and germination. Similar benefits were also reported in pegionpea (Deshpande, 1983) [5]

Influence of interaction of variety, nipping and growth regulators spray (VxNxS)

The three way interactions of varieties, nipping and growth regulators spray was found significant on plant height at harvest but not on flowering, seed yield and yield attributes and seed quality parameters. However, the results of the present study has shown relatively beneficial influence of nipping and growth regulators spray in both the chickpea varieties on all these parameters. Similar beneficial effects were reported with nipping by Sudarshan (2004) [18] in fenugreek, Iyyangouda (2003) [8] in coriander and Merwade (2000) [11] with growth regulators spray in chickpea.

Table 1: Effect of nipping, growth regulators spray on Plant height, Number of branches and Seed yield per hectare in chickpea varieties (Pooled analysis)**

Treatments		Plant height (cm) at Harvest					Number of branches at Harvest					Seed yield per ha (q/ha)				
		V x N x S				V x N	V x N x S				V x N	V x N x S				V x N
		S_1	S_2	S_3	S_4		S_1	S_2	S_3	S_4		S_1	S_2	S_3	S_4	
V_1	N_1	44.68	43.25	39.33	36.17	40.86	28.88	27.63	26.30	24.67	26.87	34.07	30.72	27.86	28.24	30.22
	N_2	47.67	45.18	41.58	39.55	43.50	26.73	24.52	23.67	22.22	24.29	30.52	27.57	26.34	24.67	27.28
V_2	N_1	47.25	45.87	42.60	38.85	43.64	25.97	24.35	22.70	20.43	23.36	28.84	27.68	26.34	24.25	26.78
	N_2	50.27	47.53	42.63	39.43	44.97	22.93	22.05	19.20	18.10	20.57	26.20	25.23	24.03	21.57	24.26
V x S	V_1	46.17	44.21	40.45	37.86	42.18	27.80	26.07	24.98	23.44	25.58	32.29	29.14	27.10	26.45	28.75
	V_2	48.76	46.70	42.61	39.14	44.30	24.45	23.20	20.95	19.26	21.97	27.52	26.45	25.18	22.91	25.52
N x S	N_1	45.96	44.56	40.96	37.51	42.25	27.42	25.99	24.50	22.55	25.12	31.45	29.20	27.10	26.24	28.50
	N_2	48.97	46.35	42.10	39.49	44.23	24.83	23.28	21.43	20.16	22.43	28.36	26.40	25.18	23.12	25.77
	Mean	47.47	45.46	41.54	38.50	43.24	26.13	24.64	22.97	21.36	23.77	29.91	27.80	26.14	24.68	27.13
For comparison means of				S.Em±	CD at 5%				S.Em±	CD at 5%				S.Em±	CD at 5%	
Varieties(V)			0.19	0.53				0.209	0.59				0.185	0.53		
Nipping (N)			0.19	0.53				0.209	0.59				0.185	0.53		
Sprays (S)			0.26	0.75				0.296	0.84				0.263	0.75		
V x N			0.26	0.75				0.296	NS				0.263	NS		
V x S			0.37	NS				0.418	NS				0.372	1.06		
N x S			0.37	NS				0.418	NS				0.372	NS		
V x N x S			0.53	NS				0.592	NS				0.743	NS		

** (2007 and 2008 *rabi* season) NS- Non Significant

Varieties (v) :	V_1- A-1	V_2- ICCV-2	**Nipping (N):**	N_1-Nipping	N_2-No nipping
Sprays (S) :	S_1- NAA 50 ppm	S_2- Triacontanol (1ml/lit)	S_3- Panchagavya	S_4- Water spray (Control)	

Table 2: Effect of nipping, growth regulators spray on seeds per pod, 100 seed weight, Germination percentage and Vigour index in chickpea varieties

Treatments		100 Seed weight (g)					Germination %					Vigour index				
		V x N x S				V x N	V x N x S				V x N	V x N x S				V x N
		S_1	S_2	S_3	S_4		S_1	S_2	S_3	S_4		S_1	S_2	S_3	S_4	
V_1	N_1	23.92	23.20	21.80	21.15	22.52	97.55 (80.96)	95.96 (78.37)	94.55 (76.47)	92.11 (73.66)	95.04 (77.10)	2688	2527	2395	2227	2459
	N_2	23.30	22.55	21.64	20.80	22.07	96.09 (78.56)	94.29 (76.14)	93.67 (75.40)	90.84 (72.35)	93.72 (75.46)	2593	2458	2370	2202	2405
V_2	N_1	26.00	24.55	22.79	22.08	23.86	96.55 (79.56)	95.03 (77.09)	93.85 (75.01)	91.81 (73.34)	94.31 (76.17)	2919	2652	2509	2338	2604
	N_2	24.70	23.97	22.34	21.24	23.06	95.28 (77.42)	93.78 (75.53)	92.89 (74.51)	90.38 (74.90)	93.08 (74.72)	2618	2522	2402	2264	2451
V x S	V_1	23.61	22.87	21.72	20.97	22.30	96.82 (79.70)	95.12 (77.21)	94.11 (75.92)	91.47 (72.90)	94.38 (76.26)	2640	2492	2382	2214	2432
	V_2	25.35	24.26	22.56	21.66	23.46	95.91 (78.31)	94.40 (76.26)	93.37 (75.05)	91.09 (72.67)	93.70 (75.43)	2768	2587	2455	2301	2528

N x S	N_1	24.96	23.87	22.29	21.61	23.19	96.05 (80.08)	94.49 (77.71)	93.20 (76.03)	90.96 (73.50)	93.68 (76.63)	2803	2589	2452	2282	2531
	N_2	24.00	23.26	21.99	21.02	22.57	94.68 (77.98)	93.03 (78.83)	92.28 (74.95)	89.61 (72.13)	92.40 (75.09)	2605	2490	2386	2233	2428
	Mean	24.48	23.57	22.14	21.32	22.88	96.37 (78.98)	94.77 (76.74)	93.74 (75.48)	91.29 (70.80)	94.04 (75.84)	2704	2539	2419	2257	2480
For comparison means of					S.Em±	CD at 5%				S.Em±	CD at 5%		S.Em±	CD at 5%		
Varieties (V)				0.232	0.66				0.262	NS			18.30	52.07		
Nipping (N)				0.232	NS				0.262	0.75			18.30	52.07		
Sprays (S)				0.328	0.93				0.371	1.06			25.88	73.64		
V x N				0.328	NS				0.371	NS			25.88	NS		
V x S				0.463	NS				0.525	NS			36.60	NS		
N x S				0.463	NS				0.525	NS			36.60	NS		
V x N x S				0.655	NS				0.742	NS			51.76	NS		

** (2007 and 2008 *rabi* season) NS- Non Significant

Varieties (v) :	V_1- A-1	V_2- ICCV-2	**Nipping (N):**	N_1-Nipping	N_2-No nipping
Sprays (S) :	S_1- NAA 50 ppm	S_2- Triacontanol (1ml/lit)	S_3- Panchagavya	S_4- Water spray (Control)	

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