Int.J.Curr.Microbiol.App.Sci (2019) *8*(6): 2983-2994

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 8 Number 06 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.806.356

Effect of Plant Growth Regulators on Growth and Yield of Seed Guar Cultivars

M. Tagore Naik, D. Srihari, A.V.D. Dorajeerao*, K. Sasikala, K. Umakrishna and D.R.S. Suneetha

Horticultural Research Station, Mahanandi, College of Horticulture, Venkataramannagudem, Andhra Pradesh, India

**Corresponding author*

A B S T R A C T

Keywords

Plant Growth Regulators, Growth and Yield and seed guar

Article Info

Accepted:
24 May 2019
Available Online:
10 June 2019

The seed cluster bean exhibited significant variations in the growth and yield due to spray of growth regulators during *kharif* and *rabi* seasons at 30, 60 and 90 days after sowing (DAS). At 90 DAS, the highest plant height (*kharif* 63.99 cm; *rabi* 59.32) was recorded by HG 365. Among the growth regulators, maximum plant height (*kharif* 85.13 cm; *rabi* 78.92 cm) was recorded by the application of triacontanol at 1500 ppm which was on par with 1000 ppm (*kharif* 82.63 cm; *rabi* 76.60 cm). The earliest occurrence of 50% flowering (*kharif* 24.65; *rabi* 22.68) was observed in the var. HG 563. Among the growth regulators, the lowest number of days to 50% flowering (*kharif* 23.09; *rabi* 21.24) was recorded by the application of CCC at 1500 ppm which was on par with CCC 1000 ppm (*kharif* 23.71; *rabi* 21.81). Among the growth regulators, maximum seed yield per plot (*kharif* 2.01 kg; *rabi* 1.91 kg) was recorded by the application of CCC at 1500 ppm which was on par with CCC 1000 ppm (*kharif* 1.98 kg; *rabi* 1.88 kg).

Introduction

The physiological efficiency including photosynthetic ability of plants are improved by plant growth regulating chemicals and therefore offer a significant role in realizing higher crop yields. The PGR's are also known to enhance the source-sink relationship and stimulate the translocation of photo-assimilates, thereby increasing the productivity. Though, the plant growth regulators have great potential, its application and assessment etc. have to be judiciously planned in terms of optimal concentration, stage of application, species specificity and seasons. In their wide spectrum of effectiveness on every aspect of plant growth, even a modest increase of 10-15 per cent could bring about an increment in the gross annual productivity by 10-15 m tons. The effect of PGRs particular new compounds on cluster bean has not been evaluated and hence the data on this aspect is scarce. Under these conditions, the spray of growth regulating chemicals on partitioning of dry weight among different parts and ultimately the seed yield is studied in the present study.

Materials and Methods

The present experiment was conducted on seed guar cultivars HG 365 and HG 563 by applying with growth regulating chemicals in a factorial experiment under Mahanandi conditions both during *Kharif*and *Rabi* seasons of two years from 2015 to 2017. Foliar sprays of chemicals *viz*., cycocel, mepiquat chloride and triacontenol were given twice at 20 and 40 days after sowing. Each of these chemicals was tried at three different concentrations i.e. 500, 1000 and 1500 ppm. The crop was spaced at 30 cm x 10 cm and applied with a uniform nutrient dose of N at 30 kg ha^{-1} + P at 40 kg ha^{-1} + K at 40 kg ha^{-1} + S at 20 kg ha^{-1}.

Results and Discussion

Plant height (cm)

The plant height differed significantly due to spray of growth regulators during *kharif* and *rabi* seasons at 30, 60 and 90 days after sowing (DAS). The mean plant height (Table 1 and 2) increased from 23.92 cm and 22.18 cm (30 DAS) to 63.19 cm and 58.58 cm (90 DAS) during *kharif* and *rabi* seasons, respectively. At 90 DAS, the highest plant height (*kharif* 63.99 cm; *rabi* 59.32) was recorded by HG 365. Among the growth regulators, maximum plant height (*kharif* 85.13 cm; *rabi* 78.92 cm) was recorded by the application of triacontanol at 1500 ppm which was on par with 1000 ppm (*kharif* 82.63 cm; *rabi* 76.60 cm). The lowest plant height was observed by the spray of MC 1500 ppm (*kharif* 47.32 cm; *rabi* 43.87 cm) preceded by MC 1000 ppm (*kharif* 50.45 cm; *rabi* 46.77 cm). The control recorded a plant height of 62.85 cm in *kharif* and 58.26 cm in *rabi* at 90 DAS. whereas CCC 1500 has shown intermediate values for plant height (*kharif* 49.58 cm; *rabi* 45.96 cm).

The height of plant was found to increase throughout the growth period in both the varieties and under the influence of all the growth regulators studied in the present investigation at various concentrations. The foliar spray of growth regulators in early stages (20 and 40 DAS) significantly influenced the plant height and resulted in either increase or decrease in plant height depending on the chemical used in the spray. Significant increase in plant height was observed when the plants were sprayed with tricantanol from 500 ppm to 1000 ppm whereas further increase in concentration of triacontenol did not show significant increase in plant height. Foliar spray of CCC and mepiquat chloride was found to decrease plant height with every increase in the concentration from 500 ppm to 1500 ppm when compared to control.

An increase in the plant height due to application of tricontanol could be attributed to an increase in the meristematic activity of apical tissues. Tricontanol was also said to increase photosynthetic activity and improve the efficiency of translocation and utilization of photosynthates causing rapid cell elongation and cell division at growing region of the plant leading to stimulation of growth, besides increasing the uptake of nutrients (Dicks, 1980). Similar beneficial effect of growth promoters on plant height was also reported by Dashora and Jain (1994) in soybean and Neelam *et al.,* (1995) in lentil.

The lower plant height in CCC (cycocel) and mepiquatchloride applied plants may be due to retardation of transverse cell multiplication particularly in combium, which was the zone of meristimatic activity at the base of the internode as reported by (Arun kumar and Uppar, 2007). The results of the present study are in agreement with the findings of Grossman (1990) who opined that the cycocel is an antigibberellin dwarfing agent, leading to a deficiency of gibberellin in the plant and reduced the growth. Mepiquat chloride also was found to show antigibberellin like activity leading to reduced plant height as observed in case of some pulses (Jeyakumar and Thangaraj, 1996).

Number of branches per plant

The number of branches differed significantly due to spray of growth regulators during *kharif* and *rabi* seasons at various growth stages. The mean number of branches (Table 3 and 4) increased from 10.69 and 9.91 (30 DAS) to 22.50 and 26.78 (90 DAS) during *kharif* and *rabi* seasons, respectively. At 90 DAS, the highest number of branches (*kharif* 22.79; *rabi* 27.12) was recorded by HG 365. Among the growth regulators, maximum number of branches (*kharif* 28.74; *rabi* 34.20) was recorded by the application of CCC at 1500 ppm followed by CCC 1000 ppm (*kharif* 25.86; *rabi* 30.78).

The lowest number of branches was observed by the spray of TRIA 1500 ppm (*kharif*: 16.74; *rabi* 19.91) which was on par with TRIA 1000 ppm (*kharif*: 17.24; *rabi* 20.52). Foliar application of mepiquat chloride resulted in intermediary values among which the highest (*kharif* 26.41; *rabi* 31.43) was recorded by MC 1500 ppm. The control recorded 22.67 branches in *kharif* and 26.98 branches in *rabi* at 90 DAS.

Foliar spray of cycocel as well as mepiquat chloride was found to increase the number of branches significantly over the control plants. At 90 days after sowing, an increased number of branches were recorded in the plants supplied with every incremental concentration of cycocel from 500 ppm to 1500 ppm *i.e.* maximum increase was noted from the spray of 1500 ppm cycocel. Among the different concentrations of cycocel, 500 ppm was found to be significantly the least effective in increasing the number of branches. However, the concentration of 1000 ppm was on par with 1500 ppm. On the contrary, the traicontenol sprays were found to reduce the number of branches per plant with increase in its concentration. Application of triacontenol, at 500 ppm exhibited the lowest influence in reducing the number of branches i.e. in other words it had the highest number of branches when compared to the foliar application of the same chemical at 1000 and 1500 ppm concentrations. This effect of tricontanol might be due to its positive influence an elongation of plant in vertical axis. With increase in concentration, it increased plant height but reduced number of branches.

The anti-gibberellin activity of cycocel (CCC) and mepiquat chloride might have lowered the growth in vertical axis and therefore, growth correlation mechanism could have boosted more axillary growth by elongating the axillary sprouts into branches (Grossman, 1990). The association of minimum plant height with maximum number of branches under the influence of CCC was also reported by Rathod *et al.,* (2015).

The mechanism of reduction in plant height due to application of CCC and mepiquat chloride appears to be due to slowing down of cell division and reduction in cell expansion. It has been suggested that CCC and mepiquat chloride are antigibberellin dwarfing agents, leading to a deficiency of gibberellins in the plant and reduce the growth by blocking the conversion of geranyl pyrophosphate to capalyl pyrophosphate which happens to be the first step of gibberellin synthesis (Moore, 1980). Similarly, Garai and Datta (2003), Jeyakumar and Thangaraj (1996) also reported decreased plant height and increased number of branches in greengram and groundnut, respectively due to application of growth retardants, *i.e*. CCC and mepiquat chloride.

The application of CCC and mepiquat chloride increased the number of branches significantly and the increase was more pronounced at higher concentrations of the respective chemicals. The increase in the number of branches could be due to the suppression of auxin mediated apical dominance due to the application of growth retardants, thereby diverting the polar transport of auxins towards the basal buds leading to increased branching. Another probable reason could be the oxidative decarboxylation of auxins triggered by the application of these chemicals in the plant system. Such a suppression of auxin activity could have led to dwarfing of plants (Reinecke and Bunderski, 1987). Similarly, Mandal *et al.,* (1997) and Dhaka and Anamika (2003) reported that the application of CCC and mepiquat chloride increased the number of branches in greengram and broad bean, respectively.

Number of leaves per plant

The number of leaves differed significantly due to spray of growth regulators during *kharif* and *rabi* seasons at 30, 60 and 90 DAS. The mean number of leaves (Table 5 and 6) increased from 35.75 and 31.81 (30 DAS) to 61.13 and 53.99 (90 DAS) during *kharif* and *rabi* seasons, respectively. At 90 DAS, the highest number of leaves (*kharif* 61.49; *rabi 54.31*) was recorded by HG 365. Among the growth regulators, maximum number of leaves (*kharif* 75.61; *rabi 66*.78) was recorded by the application of CCC at 1500 ppm which was on par with 1000 ppm (*kharif* 73.99; *rabi 65*.34). The lowest number of leaves was observed by the spray of MC 500 ppm (*kharif* 52.79; *rabi 46.62*) preceded by MC 1000 ppm (*kharif* 56.39; *rabi 49.81*). Tricontanol concentrations recorded medium values among which the highest being recorded at TRIA 1500 ppm both in *kharif* (60.72) and *rabi* (53.63) seasons. The control recorded still lesser number of leaves both in *kharif* (52.30cm) and in *rabi* (46.19 cm) at 90 DAS.

Days to 50% flowering

The days to 50% flowering (Table 7) differed significantly due to spray of growth regulators during *kharif* and *rabi* seasons. The earliest occurrence of 50% flowering (*kharif* 24.65; *rabi* 22.68) was observed in the var. HG 563. Among the growth regulators, the lowest number of days to 50% flowering (*kharif* 23.09; *rabi* 21.24) was recorded by the application of CCC at 1500 ppm which was on par with CCC 1000 ppm (*kharif* 23.71; *rabi* 21.81). The highest delay to 50% flowering was noticed by the spray of MC 1500 ppm (*kharif* 29.02; *rabi* 26.70) which was on par with MC 1000 ppm (*kharif* 28.41; *rabi* 26.14). Foliar spray of TRIA 1500 ppm resulted in intermediary values for days to 50% flowering during both the seasons (*kharif* 24.39; *rabi* 22.44). The control recorded 26.97 days to 50% flowering in *kharif* and 24.81 days in *rabi*.

Dry pod yield per plant (g)

The spray of growth regulators influenced the weight of dry pods per plant (Table 8) significantly during *kharif* and *rabi* seasons. The highest weight of dry pods per plant (*kharif* 26.19 g; *rabi* 24.10 g) was recorded by HG 365. Among the growth regulators, maximum weight of dry pods per plant (*kharif* 28.44 g; *rabi* 26.17 g) was recorded by the application of CCC at 1500 ppm which was on par with CCC 1000 ppm (*kharif* 28.01 g; *rabi* 25.77 g).

The lowest weight of dry pods per plant was observed by the spray of MC 500 ppm (*kharif* 22.62 g; *rabi* 20.81 g) which was on par with MC 1000 ppm (*kharif* 23.16 g; *rabi* 21.31 g) whereas, TRIA 1500 ppm resulted in medium weight of dry pods per plant (*kharif* 26.29 g;

rabi 24.18 g). The control recorded a weight of dry pods per plant of 21.25 g in *kharif* and 19.55 g in *rabi*.

The pod yield is the most essential parameter contributing to the seed yield because the only difference lies in pericarps encircling the seeds. The effect of growth regulators was found significant on the pod yield per plant and per plot in both the varieties. As it was observed in case of growth, flowering and quality parameters, the pod yield was found to be highest in case of spray of CCC at 1500 ppm being significantly superior to the same chemical at 1000 ppm. This merit is also revealed from the stand point of corresponding superiority in having highest duration of pod maturity and bold sized pods and seeds ultimately leading to the highest individual weight of pods per plant with growth regulator sprays.

The next chemicals in the order were triacontanol and mepiquat chloride above the control. The highest concentration of both these chemicals was at parity with 1000 ppm concentration of the corresponding chemicals. The highest concentration of mepiquat chloride (MC 1500 ppm) was found on par with the lowest concentration of traiacontenol (TRIA 500 ppm) and similarly the highest of triacontenol (TRIA 1500 ppm) was at parity with the lowest concentration of CCC (cycocel 500 ppm).

The additional concentration beyond 1000 ppm in mepiquat chloride and triacontanol was not resulting in significant superiority in the weight of dry pods per plant as well as per plot. This was not true in case of CCC. The differences in the pod yield or weight of dry pods per plant can be attributed to the similar differences in growth parameters, growth rates and flowering periods as well as pod maturity duration.

Similar observations were made by Prabhavathi (2005) who reported that the application of lihocin (1000 ppm) resulted in significantly higher pod yield followed by miraculan @ 1000 ppm and mepiquat chloride @ 1000 ppm as compared to control in cluster bean. These effects were attributed to their corresponding effect on growth parameters and growth rates as also evident in the present study.

Seed yield per plant (g)

The seed yield per plant (Table 9) differed significantly due to spray of growth regulators during *kharif* and *rabi* seasons. The highest seed yield per plant (*kharif* 16.88 g; *rabi* 16.04 g) was recorded by HG 365. Among the growth regulators, maximum seed yield per plant (*kharif* 18.33 g; *rabi* 17.42 g) was recorded by the application of CCC at 1500 ppm which was on par with CCC 1000 ppm (*kharif* 18.05 g; *rabi* 17.15 g). The lowest seed yield per plant was observed by the spray of MC 500 ppm (*kharif* 14.58 g; *rabi* 13.85 g) which was on par with MC 1000 ppm (*kharif* 14.93 g; *rabi* 14.18 g). TRIA 1500 ppm produced moderate quantities of seed per plant during both *kharif* (16.94 g) and *rabi* (16.10 g). The control recorded a seed yield per plant of 13.70 g in *kharif* and 13.01 g in *rabi*.

Seed yield per ha (q)

The seed yield per hectare (Table 10) differed significantly due to spray of growth regulators during *kharif* and *rabi* seasons. The highest seed yield per hectare (*kharif* 21.38 q; *rabi* 20.31q) was recorded by HG 365. Among the growth regulators, maximum seed yield per hectare (*kharif* 23.22 q; *rabi* 22.06 q) was recorded by the application of CCC at 1500 ppm which was on par with CCC 1000 ppm (*kharif* 22.87 q; *rabi* 21.73 q).

Table.1 Plant height (cm) as influenced by growth regulators in cluster bean varieties during *kharif*

Growth regulators (ppm) (B)	Variety (A)								
	30 DAS			60 DAS			90 DAS		
	HG 365	HG 563	***Mean***	HG 365	HG 563	***Mean***	HG 365	HG 563	Mean
CCC 500	24.00	23.40	**23.70**	51.12	49.84	**50.48**	63.39	61.80	**62.60**
CCC 1000	21.12	20.59	**20.86**	44.99	43.86	**44.42**	55.78	54.39	**55.08**
CCC 1500	19.01	18.53	**18.77**	40.49	39.47	**39.98**	50.20	48.95	**49.58**
MC 500	22.00	21.45	**21.73**	46.87	45.70	**46.28**	58.11	56.66	**57.39**
MC 1000	19.34	18.86	**19.10**	41.20	40.17	**40.69**	51.09	49.81	**50.45**
MC 1500	18.14	17.69	**17.92**	38.65	37.68	**38.16**	47.92	46.72	**47.32**
TRIA 500	30.24	29.48	**29.86**	64.41	62.80	**63.61**	79.87	77.87	**78.87**
TRIA 1000	31.68	30.89	**31.28**	67.48	65.79	**66.63**	83.67	81.58	**82.63**
TRIA 1500	32.64	31.82	**32.23**	69.52	67.79	**68.65**	86.21	84.05	**85.13**
Control	24.10	23.49	**23.79**	51.32	50.04	**50.68**	63.64	62.05	**62.85**
Mean	**24.23**	**23.62**	**23.92**	**51.60**	**50.31**	**50.96**	**63.99**	**62.39**	**63.19**
Factor	***S Em+***	***CD***		***S Em+***	***CD***		***S Em+***	***CD***	
Variety (A)	*0.071*	*0.21*		*0.152*	*0.44*		*0.189*	*0.55*	
Growth regulators (B)	*0.357*	*1.03*		*0.761*	*2.20*		*0.944*	*2.73*	
Interaction (A x B)	*-*	*NS*		*-*	*NS*		*1.076*	*3.11*	

CD: CD at 5% level of significance DAS: Days after sowing CCC: Cycocel MC: Mepiquat chloride TRIA: Triacontanol

Table.2 Plant height (cm) as influenced by growth regulators in cluster bean varieties during *rabi*

Growth regulators (ppm) (B)	Variety (A)								
	30 DAS			60 DAS			90 DAS		
	HG 365	HG 563	***Mean***	HG 365	HG 563	***Mean***	HG 365	HG 563	Mean
CCC 500	22.25	21.69	**21.97**	47.39	46.21	**46.80**	58.77	57.30	**58.03**
CCC 1000	19.58	19.09	**19.34**	41.71	40.66	**41.18**	51.71	50.42	**51.07**
CCC 1500	17.62	17.18	**17.40**	37.53	36.60	**37.07**	46.54	45.38	**45.96**
MC 500	20.40	19.89	**20.14**	43.45	42.36	**42.91**	53.88	52.53	**53.20**
MC 1000	17.93	17.49	**17.71**	38.20	37.24	**37.72**	47.37	46.18	**46.77**
MC 1500	16.82	16.40	**16.61**	35.83	34.93	**35.38**	44.43	43.32	**43.87**
TRIA 500	28.04	27.33	**27.68**	59.71	58.22	**58.97**	74.05	72.19	**73.12**
TRIA 1000	29.37	28.64	**29.00**	62.56	60.99	**61.78**	77.57	75.63	**76.60**
TRIA 1500	30.26	29.50	**29.88**	64.45	62.84	**63.65**	79.92	77.92	**78.92**
Control	22.34	21.78	**22.06**	47.58	46.39	**46.99**	59.00	57.53	**58.26**
Mean	**22.46**	**21.90**	**22.18**	**47.84**	**46.65**	**47.24**	**59.32**	**57.84**	**58.58**
Factor	***S Em+***	***CD***		***S Em+***	***CD***		***S Em+***	***CD***	
Variety (A)	*0.066*	*0.19*		*0.141*	*0.41*		*0.175*	*0.51*	
Growth regulators (B)	*0.331*	*0.96*		*0.706*	*2.04*		*0.875*	*2.53*	
Interaction (A x B)	*-*	*NS*		*-*	*NS*		*-*	*NS*	

CD: CD at 5% level of significance DAS: Days after sowing CCC: Cycocel MC: Mepiquat chloride TRIA: Tria contanol

Table.3 Number of branches per plant as influenced by growth regulators in cluster bean varieties during *kharif*

Growth regulators (ppm) (B)	Variety (A)								
	30 DAS			60 DAS			90 DAS		
	HG 365	HG 563	***Mean***	HG 365	HG 563	***Mean***	HG 365	HG 563	Mean
CCC 500	10.94	10.67	**10.81**	21.34	20.81	**21.07**	23.05	22.47	**22.76**
CCC 1000	12.44	12.13	**12.28**	24.25	23.64	**23.95**	26.19	25.54	**25.86**
CCC 1500	13.82	13.47	**13.65**	26.95	26.27	**26.61**	29.10	28.37	**28.74**
MC 500	10.47	10.21	**10.34**	20.42	19.91	**20.16**	22.05	21.50	**21.78**
MC 1000	11.91	11.61	**11.76**	23.23	22.65	**22.94**	25.08	24.46	**24.77**
MC 1500	12.70	12.38	**12.54**	24.76	24.14	**24.45**	26.74	26.07	**26.41**
TRIA 500	8.69	8.47	**8.58**	16.94	16.51	**16.73**	18.29	17.83	**18.06**
TRIA 1000	8.29	8.08	**8.19**	16.17	15.76	**15.97**	17.46	17.02	**17.24**
TRIA 1500	8.05	7.85	**7.95**	15.69	15.30	**15.50**	16.95	16.52	**16.74**
Control	10.90	10.63	**10.76**	21.26	20.72	**20.99**	22.96	22.38	**22.67**
Mean	**10.82**	**10.55**	**10.69**	**21.10**	**20.57**	**20.84**	**22.79**	**22.22**	**22.50**
Factor	***S Em±***	***CD***		***S Em±***	***CD***		***S Em±***	***CD***	
Variety (A)	*0.026*	*0.08*		*0.051*	*0.15*		*0.055*	*0.16*	
Growth regulators (B)	*0.130*	*0.38*		*0.254*	*0.73*		*0.274*	*0.79*	
Interaction (A x B)	*-*	*NS*		*-*	*NS*		*0.312*	*0.90*	

CD: CD at 5% level of significance DAS: Days after sowing CCC: Cycocel MC: Mepiquat chloride TRIA: Triacontanol

Table.4 Number of branches per plant as influenced by growth regulators in cluster bean varieties during *rabi*

Growth regulators (ppm) (B)	Variety (A)								
	30 DAS			60 DAS			90 DAS		
	HG 365	HG 563	***Mean***	HG 365	HG 563	***Mean***	HG 365	HG 563	Mean
CCC 500	10.15	9.89	**10.02**	22.12	21.57	**21.84**	27.43	26.74	**27.08**
CCC 1000	11.53	11.24	**11.39**	25.13	24.51	**24.82**	31.17	30.39	**30.78**
CCC 1500	12.81	12.49	**12.65**	27.93	27.23	**27.58**	34.63	33.76	**34.20**
MC 500	9.71	9.46	**9.59**	21.16	20.63	**20.90**	26.24	25.59	**25.91**
MC 1000	11.04	10.77	**10.90**	24.07	23.47	**23.77**	29.85	29.10	**29.48**
MC 1500	11.77	11.48	**11.63**	25.66	25.02	**25.34**	31.82	31.03	**31.43**
TRIA 500	8.05	7.85	**7.95**	17.55	17.12	**17.33**	21.77	21.22	**21.50**
TRIA 1000	7.69	7.49	**7.59**	16.76	16.34	**16.55**	20.78	20.26	**20.52**
TRIA 1500	7.46	7.27	**7.37**	16.26	15.86	**16.06**	20.17	19.66	**19.91**
Control	10.11	9.85	**9.98**	22.03	21.48	**21.75**	27.32	26.63	**26.98**
Mean	**10.03**	**9.78**	**9.91**	**21.87**	**21.32**	**21.59**	**27.12**	**26.44**	**26.78**
Factor	***S Em±***	***CD***		***S Em±***	***CD***		***S Em±***	***CD***	
Variety (A)	*0.024*	*0.07*		*0.053*	*0.15*		*0.065*	*0.19*	
Growth regulators (B)	*0.121*	*0.35*		*0.263*	*0.76*		*0.326*	*0.94*	
Interaction (A x B)	*-*	*NS*		*-*	*NS*		*0.371*	*1.07*	

CD: CD at 5% level of significance DAS: Days after sowing CCC: Cycocel MC: Mepiquat chloride TRIA: Triacontanol

Table.5 Number of leaves per plant as influenced by growth regulators in cluster bean varieties during *kharif*

Growth regulators (ppm) (B)	Variety (A)								
	30 DAS			60 DAS			90 DAS		
	HG 365	HG 563	*Mean*	HG 365	HG 563	*Mean*	HG 365	HG 563	Mean
CCC 500	38.30	37.84	**38.07**	68.95	68.12	**68.53**	65.50	64.71	**65.11**
CCC 1000	43.53	43.00	**43.27**	78.35	77.41	**77.88**	74.43	73.54	**73.99**
CCC 1500	44.22	43.69	**43.95**	79.59	78.64	**79.12**	75.61	74.71	**75.16**
MC 500	31.06	30.68	**30.87**	55.90	55.23	**55.57**	53.11	52.47	**52.79**
MC 1000	33.18	32.78	**32.98**	59.72	59.00	**59.36**	56.73	56.05	**56.39**
MC 1500	34.67	34.25	**34.46**	62.40	61.65	**62.02**	59.28	58.57	**58.92**
TRIA 500	33.06	32.67	**32.86**	59.51	58.80	**59.16**	56.54	55.86	**56.20**
TRIA 1000	35.12	34.70	**34.91**	63.21	62.45	**62.83**	60.05	59.33	**59.69**
TRIA 1500	35.72	35.29	**35.51**	64.30	63.53	**63.91**	61.08	60.35	**60.72**
Control	30.77	30.40	**30.58**	55.38	54.72	**55.05**	52.61	51.98	**52.30**
Mean	**35.96**	**35.53**	**35.75**	**64.73**	**63.95**	**64.34**	**61.49**	**60.76**	**61.13**
Factor	***S Em±***	***CD***		***S Em±***	***CD***		***S Em±***	***CD***	
Variety (A)	*0.063*	*0.18*		*0.113*	*0.33*		*0.107*	*0.31*	
Growth regulators (B)	*0.313*	*0.90*		*0.563*	*1.63*		*0.535*	*1.55*	
Interaction (A x B)	*-*	*NS*		*-*	*NS*		*0.610*	*1.76*	

CD: CD at 5% level of significance DAS: Days after sowing CCC: Cycocel MC: Mepiquat chloride TRIA: Triacontanol

Table.6 Number of leaves per plant as influenced by growth regulators in cluster bean varieties during *rabi* 2015-16

Growth regulators (B)	Variety (A)								
	30 DAS			60 DAS			90 DAS		
	HG 365	HG 563	*Mean*	HG 365	HG 563	*Mean*	HG 365	HG 563	Mean
CCC 500	34.09	33.68	*33.89*	61.36	60.63	*60.99*	57.85	57.16	**57.50**
CCC 1000	38.74	38.27	*38.51*	69.73	68.89	*69.31*	65.74	64.95	**65.34**
CCC 1500	39.35	38.88	*39.12*	70.84	69.99	*70.41*	66.78	65.98	**66.38**
MC 500	27.64	27.31	*27.47*	49.75	49.15	*49.45*	46.90	46.34	**46.62**
MC 1000	29.53	29.17	*29.35*	53.15	52.51	*52.83*	50.11	49.51	**49.81**
MC 1500	30.85	30.48	*30.67*	55.53	54.87	*55.20*	52.35	51.73	**52.04**
TRIA 500	29.43	29.07	*29.25*	52.97	52.33	*52.65*	49.93	49.33	**49.63**
TRIA 1000	31.25	30.88	*31.07*	56.26	55.58	*55.92*	53.04	52.40	**52.72**
TRIA 1500	31.79	31.41	*31.60*	57.23	56.54	*56.88*	53.95	53.30	**53.63**
Control	27.38	27.05	*27.22*	49.29	48.70	48.99	46.47	45.91	**46.19**
Mean	**32.01**	**31.62**	**31.81**	**57.61**	**56.92**	**57.27**	**54.31**	**53.66**	**53.99**
Factor	***S Em±***	***CD at 5%***		***S Em±***	***CD at 5%***		***S Em±***	***CD at 5%***	
Variety (A)	*0.058*	*0.17*		*0.126*	*0.37*		*0.157*	*0.45*	
Growth regulators (B)	*0.290*	*0.84*		*0.632*	*1.83*		*0.784*	*2.27*	
Interaction (A x B)	*-*	*NS*		*-*	*NS*		*0.894*	*2.58*	

CD: CD at 5% level of significance DAS: Days after sowing CCC: Cycocel MC: Mepiquat chloride TRIA: Triacontanol

Table.7 Days to 50% flowering as influenced by growth regulators in cluster bean varieties during *kharif* and *rabi*

Growth regulators (ppm) (B)	Variety (A)					
	Kharif			*Rabi*		
	HG 365	HG 563	***Mean***	HG 365	HG 563	***Mean***
CCC 500	25.47	23.43	**24.45**	23.43	21.56	**22.49**
CCC 1000	24.70	22.72	**23.71**	22.72	20.90	**21.81**
CCC 1500	24.05	22.13	**23.09**	22.13	20.36	**21.24**
MC 500	29.36	26.42	**27.89**	27.01	24.31	**25.66**
MC 1000	29.90	26.91	**28.41**	27.51	24.76	**26.14**
MC 1500	30.55	27.49	**29.02**	28.10	25.29	**26.70**
TRIA 500	27.62	24.86	**26.24**	25.41	22.87	**24.14**
TRIA 1000	26.65	23.98	**25.31**	24.52	22.06	**23.29**
TRIA 1500	25.67	23.10	**24.39**	23.62	21.26	**22.44**
Control	28.48	25.46	**26.97**	26.20	23.42	**24.81**
Mean	**27.24**	**24.65**	**25.95**	**25.06**	**22.68**	**23.87**
Factor	***S Em±***	***CD***		***S Em±***	***CD***	
Variety (A)	*0.028*	*0.08*		*0.025*	*0.07*	
Growth regulators (B)	*0.138*	*0.40*		*0.127*	*0.37*	
Interaction (A x B)	*0.157*	*0.46*		-	*NS*	

CD: CD at 5% level of significance CCC: Cycocel MC: Mepiquat chloride TRIA: Triacontanol

Table.8 Dry pod yield per plant (g) as influenced by growth regulators in cluster bean varieties during *kharif* and *rabi*

Growth regulators (ppm) (B)	Variety (A)					
	Kharif			*Rabi*		
	HG 365	HG 563	***Mean***	HG 365	HG 563	***Mean***
CCC 500	27.23	24.49	**25.86**	25.05	22.53	**23.79**
CCC 1000	29.49	26.53	**28.01**	27.13	24.41	**25.77**
CCC 1500	29.95	26.94	**28.44**	27.55	24.78	**26.17**
MC 500	23.82	21.43	**22.62**	21.92	19.71	**20.81**
MC 1000	24.39	21.94	**23.16**	22.44	20.18	**21.31**
MC 1500	24.50	22.04	**23.27**	22.54	20.28	**21.41**
TRIA 500	24.96	22.45	**23.70**	22.96	20.65	**21.81**
TRIA 1000	27.23	24.49	**25.86**	25.05	22.53	**23.79**
TRIA 1500	27.68	24.90	**26.29**	25.46	22.90	**24.18**
Control	22.69	19.82	**21.25**	20.87	18.24	**19.55**
Mean	**26.19**	**23.50**	**24.85**	**24.10**	**21.62**	**22.86**
Factor	***S Em±***	***CD***		***S Em±***	***CD***	
Variety (A)	*0.032*	*0.09*		*0.029*	*0.08*	
Growth regulators (B)	*0.160*	*0.46*		*0.147*	*0.42*	
Interaction (A x B)	-	*NS*		-	*NS*	

CD: CD at 5% level of significance CCC: Cycocel MC: Mepiquat chloride TRIA: Triacontanol

Table.9 Seed yield per plant (g) as influenced by growth regulators in cluster bean varieties during *kharif* and *rabi*

Growth regulators (B)	Variety (A)					
	Kharif			*Rabi*		
	HG 365	HG 563	***Mean***	HG 365	HG 563	***Mean***
CCC 500	17.55	15.78	**16.67**	16.67	14.99	15.83
CCC 1000	19.01	17.10	**18.05**	18.06	16.24	17.15
CCC 1500	19.30	17.36	**18.33**	18.34	16.49	17.42
MC 500	15.35	13.81	**14.58**	14.59	13.12	13.85
MC 1000	15.72	14.14	**14.93**	14.93	13.43	14.18
MC 1500	15.79	14.20	**15.00**	15.00	13.49	14.25
TRIA 500	16.09	14.47	**15.28**	15.28	13.74	14.51
TRIA 1000	17.55	15.78	**16.67**	16.67	14.99	15.83
TRIA 1500	17.84	16.05	**16.94**	16.95	15.24	16.10
Control	14.62	12.78	**13.70**	13.89	12.14	13.01
Mean	**16.88**	**15.15**	**16.01**	**16.04**	**14.39**	**15.21**
Factor	***S Em±***	***CD***		***S Em±***	***CD***	
Variety (A)	***0.02***	***0.06***		***0.02***	***0.06***	
Growth regulators (B)	***0.10***	***0.30***		***0.10***	***0.28***	
Interaction (A x B)	***0.12***	***0.34***		***0.11***	***0.32***	

CD: CD at 5% level of significance CCC: Cycocel MC: Mepiquat chloride TRIA: Triacontanol

Table.10 Seed yield per hectare (q) as influenced by growth regulators in cluster bean varieties during *kharif* and *rabi*

Growth regulators (ppm) (B)	Variety (A)					
	Kharif			*Rabi*		
	HG 365	HG 563	***Mean***	HG 365	HG 563	***Mean***
CCC 500	22.23	19.99	**21.11**	21.12	18.99	20.05
CCC 1000	24.08	21.66	**22.87**	22.87	20.58	21.73
CCC 1500	24.45	21.99	**23.22**	23.23	20.89	22.06
MC 500	19.45	17.49	**18.47**	18.48	16.62	17.55
MC 1000	19.91	17.91	**18.91**	18.92	17.01	17.96
MC 1500	20.00	17.99	**19.00**	19.00	17.09	18.05
TRIA 500	20.37	18.33	**19.35**	19.36	17.41	18.38
TRIA 1000	22.23	19.99	**21.11**	21.12	18.99	20.05
TRIA 1500	22.60	20.33	**21.46**	21.47	19.31	20.39
Control	18.52	16.18	**17.35**	17.60	15.37	16.48
Mean	**21.38**	**19.19**	**20.29**	**20.31**	**18.23**	**19.27**
Factor	***S Em±***	***CD***		***S Em±***	***CD***	
Variety (A)	***0.03***	***0.08***		***0.02***	***0.07***	
Growth regulators (B)	***0.13***	***0.38***		***0.12***	***0.36***	
Interaction (A x B)	***0.15***	***0.43***		***0.14***	***0.41***	

CD: CD at 5% level of significance CCC: Cycocel MC: Mepiquat chloride TRIA: Triacontanol

The lowest seed yield per hectare was observed by the spray of MC 500 ppm (*kharif* 18.47 q; *rabi* 17.55 q) which was on par with MC 1000 ppm (*kharif* 18.91 q; *rabi* 17.96 q) whereas, TRIA 1500 ppm resulted in a medium seed yield per ha (*kharif* 21.46 q; *rabi* 20.39 q).The control recorded a seed yield per hectare of 17.35 q in *kharif* and 16.48 q in *rabi*.

Crop yield depend not only on the accumulation of photosynthates during the crop growth and development, but also on its partitioning into the desired storage organs. These in turn, are influenced by the efficiency of metabolic processes within the plant. The growth retardants are capable of redistribution of dry matter in the plant thereby bringing about improvement in yield (Chetti, 1991 and Chandrababu *et al.*, 1995). The pod yield in cluster bean depends on the accumulation of photo assimilates and partitioning in different plant parts. The yield in cluster bean was found to be strongly influenced by the application of different growth regulators and thus indicating the importance of these compounds in increasing the yield potential through their effect on various morpho-physiological and biochemical traits.

Similar opinion was expressed by Prabhavathi (2005) who reported that the application of lihocin (1000 ppm) resulted in significantly higher pod yield followed by miraculan @ 1000 ppm and mepiquat chloride @ 1000 ppm as compared to control in cluster bean. The increased yield was attributed to higher dry matter production and its accumulation in reproductive parts, higher AGR, CGR and enhanced chlorophyll and nitrate reductase activity.

References

Arunakumar, S. H. and Uppar, D.S. 2007. Influence of Integrated Nutrient Management on Seed Yield and Quality of Mothbean (*Vigna aconitifolia* (Jacq.) Marchel). *Karnataka Journal of Agricultural Sciences.* 20(2): 394-96.

Chandrababu, R, Manian, K, Nagarajan, M. and Ramachandran, T.K. 1995. Effect of mepiquat chloride on growth and yield of groundnut. *Madras Agricultural Journal*. 82 (3): 229-30.

Chetti, M.B. 1991. Evaluation of chamatkar on groundnut. *Pestology*. 15: 43-50.

Dashora, L.D. and Jain, P.M. 1994. Effect of growth regulators and phosphorus levels on growth and yield of soybean. *Madras Agricultural Journal*. 81: 235-37.

Dhaka, T.V.S. and Anamika, 2003. Effect of mepiquat chloride DPC and urea on growth and yield attributes of broad bean (*Vicia faba* L.). *Plant Archives*. 3(2): 291-93.

Dicks, J. W. 1980. Mode of action of growth retardants. In *Research Development on the Use of Plant Growth Retardants*, Ed. Clifford, D.R. and Lenton, J.R., British Plant Growth Regulator Group. *Monograph*. 4: 1-14.

Garai, A.K. and Datta, J.K. 2003. Effect of phosphorus sources and cycocel spray on greengram (*Vigna radiata* L.).*Legume Research*. 26 (1): 15-19.

Grossman, K. 1990. Plant retardants as tools in physiological research. *Physiologia Plantarum.* 78: 642-48.

Jeyakumar, P. and Thangaraj, M. 1996. Effect of mepiquat chloride on certain physiological and yield characteristics of groundnut (*Arachis hypogaea* L.). *Journal of Agronomy and Crop Science*. 176 (3): 159-64.

Mandal, S, Chakraborty, T. and Datta, J.K. 1997. Influence of growth retardant and rock phosphate on growth and development of greengram (*Vigna radiata* L.). *Indian Journal of Plant*

Physiology. 2: 32-35.

Neelam, S, Sangeeta, S.R.C. and Setia, N. 1995. Effect of triacontanol on lentil yield and yield components. *Lens Newsletter*. 22 (1-2): 24-27.

Prabhavathi, V.H. 2005. Effect of plant growth regulators, organics and nutrients on growth, physiology and yield in cluster bean (*Cyamopsis tetragonoloba* L.Taub.). *M.Sc. (Agri.) Thesis*. University of Agricultural Sciences Dharwad.

Rathod, R. R, Gore, R. V. and Bothikar, P. A. 2015. Effect of growth regulators on growth and yield of French bean (*Phaseolus vulgaris* L.) Var. Arka Komal. *Journal of Agriculture and Veterinary Science.* 8 (5): 36-39.

Reinecke, D. M. and Bandurski. 1987. Auxin biosynthesis and metabolism in Devies, P.J.. (ed.) *Plant Hormones and Their Role in Plant Growth and Development*, Boston publishers, Martinus, Nijhoff, pp. 24-42.

How to cite this article:

Tagore Naik, M., D. Srihari, A.V.D. Dorajeerao, K. Sasikala, K. Umakrishna and Suneetha, D.R.S. 2019. Effect of Plant Growth Regulators on Growth and Yield of seed guar cultivars. *Int.J.Curr.Microbiol.App.Sci.* 8(06): 2983-2994. doi: https://doi.org/10.20546/ijcmas.2019.806.356