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Influence of Plant Growth Regulators on Seed Characters of Guar Varieties

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

Horticultural Research Station, Mahanandi

College of Horticulture, Venkataramannagudem (Andhra Pradesh), India

*Corresponding Author E-mail: dorajeerao@gmail.com

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ABSTRACT

The effect of growth regulator on seed characters of guar cultivars viz., HG 365 and HG 563 were analyzed under Mahanandi conditions. The seed cluster bean exhibited significant variations on seed characters of guar varieties for growth regulators. The highest seeds per pod, hundred seed weight and seed yield per plot showed highest in the HG 365 variety. Among the growth regulators the maximum number of seeds per pod, hundred seed weight and seed yield per plot was recorded by the application of CCC at 1500 ppm which was on par with CCC 1000 ppm over the seasons and also kharif found the superior in in all seed characters compare to rabi season.

Key words: *PGR, Influence, Seed characters and Guar cultivars*

INTRODUCTION

Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub.) is renowned as drought hardy, being deep rooted and having a low water requirement. It requires a low annual rainfall of about 400 mm to 500 mm. Guar tolerates high temperature and dry conditions, thus gaining popularity in arid and semi arid climates[11]. Plant growth regulators (PGRs) are known to improve physiological efficiency including photosynthetic ability of plants and offer a significant role in realizing higher crop yields. The PGRs are known to influence the source-sink relationship and stimulate the translocation of photosynthetic assimilates, thereby increasing the productivity in various crops[8]. Though, the plant growth regulators have great potential, their application has to be judiciously planned in terms of optimal concentration.

Kumar and Kaushik[5] explained that the use of growth substances is one of the effective means of delaying the senescence of leaves as well as retarding the abscission of reproductive organs.

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Application of growth regulators also increase flower, fruit setting, grain filling and test weight in different crops where seed is economic product[7], Certain growth regulating chemicals like triacontanol are known to influence photosynthesis, nutrient uptake, enzymatic activity and gene regulation and is proved to be beneficial in various crops[4]. Chloremquat chloride popularly known as CCC or cycocel, is known to alter the plant architecture and boost flowering response in several crops[3]. One of the similar growth regulating chemical mepiquat chloride was found to be readily absorbed by the leaves and inhibit the biosynthesis of gibberellins, but promote root growth and improve drymatter assimilation in spite of reducing vertical growth *i.e.* height of plant. Studies on the influence of growth regulator chemicals specifically on seed cluster bean are limited and therefore considered for inclusion in the present study.

MATERIAL AND METHODS

Seed guar cultivars HG 365 and HG 563 were applied with growth regulating chemicals in a factorial experiment under Mahanandi conditions both during *Kharif*and *Rabi* in the year 2015-16. Foliar sprays of chemicals *viz.*,cycocel, Mepiquat chloride and triacontanol 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 plants were 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

Number of seeds per pod

The number of seeds per pod (Table 1) differed significantly due to spray of growth regulators during *kharif*and *rabi*seasons. The highest number of seeds per pod (*kharif*8.51; *rabi*7.83) was recorded by HG 365. Among the growth regulators, maximum number of seeds per pod (*kharif*9.24; *rabi*8.50) was recorded by the application of CCC at 1500 ppm which was on par with CCC 1000 ppm (*kharif*9.10; *rabi*8.37). The lowest number of seeds per pod was observed by the spray of MC 500 ppm (*kharif* 7.35; *rabi*6.76) which was on par with MC 1000 ppm (*kharif* 7.53; *rabi*6.92). TRIA 1500 ppm resulted in moderate number of seeds per pod (*kharif*8.54; *rabi* 7.86). The control recorded 7.00 numbers of seeds per pod in *kharif*and 6.44 in *rabi*.

Hundred seed weight (g)

The hundred seed weight (Table 2) differed significantly due to spray of growth regulators during *kharif*and *rabi*seasons. The highest hundred seed weight (*kharif*3.05 g; *rabi*2.81 g) was recorded by HG 365. Among the growth regulators, maximum hundred seed weight (*kharif*3.20 g; *rabi*2.94 g) was recorded by the application of CCC at 1500 ppm which was on par with CCC 1000 ppm (*kharif*3.15 g; *rabi*2.90 g) (Plate 13). The lowest hundred seed weight was observed by the spray of MC 500 ppm (*kharif* 2.55 g; *rabi*2.34 g) which was on par with MC 1000 ppm (*kharif* 2.61 g; *rabi*2.40 g) whereas, TRIA 1500 ppm treated plants exhibited moderate values (*kharif* 2.96 g; *rabi* 2.72 g). The control recorded a hundred seed weight of 2.39 g in *kharif*and 2.20 g in *rabi*.

The pod and seed quality parameters in terms of size, weight, number of seeds and test weight were found to vary significantly due to growth regulator sprays in both the varieties under study. The best quality heavier pods with greater length and width as well as more number of seeds with higher individual seed weight were produced from the variety HG 365 as compared to HG 563 which may be a varietal character and also due to contribution from an enlarged duration of time taken from flowering to pod drying on the plants. Among the individual effects of growth regulating chemicals, the foliar spray of CCC at 1500 ppm exhibited the highest quality of pod with bold size of both pod as well as seed. This treatment resulted in an extended time

from flowering to pod maturity and therefore gained lot of possibility to sink their photosynthetic assimilates into their pods which might be the reason for good growth of individual pods with more number of bold seeds in them. The spray of CCC at 1500 ppm was found non-significant over 1000 ppm concentration, however, it was significantly superior to the application of traicontanol and mepiquat chloride in the decreasing order. Non-significant increase in pod size with additional concentrations might be due to the corresponding non- significant increase in majority of growth parameters and the growth rates.

Similar points were noted in the investigations made by Mishriky*et al.*[6], who reported that there was significant increase in the number and weight of pods and the total yield in peas due to the application of CCC (500 ppm). The highest number of green pods per plant in pea was observed in the treatment with CCC at 200 ppm which was attributed due to the corresponding increase in the dry matter accumulation and early flowering coupled with extended period spent in pod maturation as explained by Mishriky*et al.*[6]. These results are in conformity with above findings.

In chick pea, Arora*et al.*[1], observed that there was increase in number of pods, number of seeds, seed size and yield per plant due to application of cycocel (chloremquat) at 50 per cent flowering stage.

Sharma and Lashkari[9], obtained maximum number of tender pods per plant, length and width of pods, volume of pods and total crude protein content with the application of CCC 1000 ppm. While the highest seed yield was recorded by CCC 2000 ppm. The probable reasons for enhanced length, width and volume of pod might be due to greater accumulation of carbohydrates by photosynthetic activity which might have helped in increasing carbohydrates content of pods and responsible for pod development and seed yield. It was observed that at all concentrations of cycocel significantly increased total crude protein content of pods.

The maximum increase in the values of pod numbers and size due to the application of triacontanol and mepiquat chloride was felt to be due to more number of pods and large sized green pods as well as increased vegetative growth and balanced C/N ratio, which might have increased the synthesis of carbohydrates ultimately leading to greater growth and yield. It has been also reported that, the secretions of hormones like IAA, cytokinin, auxin and GA at higher levels of photosynthetic surface in plants, might have been another factor for increasing the yield. The above results corroborates with Brown *et al.*[2].

Seed yield per plot (kg)

The seed yield per plot (Table 3) differed significantly due to spray of growth regulators during *kharif*and *rabi*seasons. The highest seed yield per plot (*kharif*1.85 kg; *rabi*1.76 kg) was recorded by HG 365. 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). The lowest seed yield per plot was observed by the spray of MC 500 ppm (*kharif* 1.60 kg; *rabi*1.52 kg) which was on par with MC 1000 ppm (*kharif* 1.63 kg; *rabi*1.55 g). Application of TRIA 1500 ppm recorded a moderate seed yield per plot during both *kharif*(1.85 kg) and *rabi*(1.76 kg). The control recorded a seed yield per plot of 1.50 kg in *kharif*and 1.42 kg in *rabi*.Similar result found by Sharma and Lashkari[9] in cluster bean and Singh *et al.*[10], also noticed that application of 100 ppm cycocel significantly increased seed yield in mung bean.

Table 1: Number of seeds per pod as influenced by growth regulators in cluster bean varieties during *kharif* and *rabi* 2015-16

Growth regulators (ppm) (B)	Variety (A)					
	Kharif			Rabi		
	HG 365	HG 563	**Mean**	HG 365	HG 563	**Mean**
CCC 500	8.85	7.96	**8.40**	8.14	7.32	**7.73**
CCC 1000	9.58	8.62	**9.10**	8.82	7.93	**8.37**
CCC 1500	9.73	8.75	**9.24**	8.95	8.05	**8.50**
MC 500	7.74	6.96	**7.35**	7.12	6.40	**6.76**
MC 1000	7.92	7.13	**7.53**	7.29	6.56	**6.92**
MC 1500	7.96	7.16	**7.56**	7.32	6.59	**6.96**
TRIA 500	8.11	7.29	**7.70**	7.46	6.71	**7.08**
TRIA 1000	8.85	7.96	**8.40**	8.14	7.32	**7.73**
TRIA 1500	8.99	8.09	**8.54**	8.27	7.44	**7.86**
Control	7.37	6.63	**7.00**	6.78	6.10	**6.44**
Mean	**8.51**	**7.65**	**8.08**	**7.83**	**7.04**	**7.44**
Factor	**S Em±**	**CD**		**S Em±**	**CD**	
Variety (A)	0.010	0.03		0.009	0.03	
Growth regulators (B)	0.051	0.15		0.047	0.14	
Interaction (A x B)	0.058	0.17		-	NS	

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

Table 2: Hundred seed weight (g) as influenced by growth regulators in cluster bean varieties during *kharif* and *rabi* 2015-16

Growth regulators (ppm) (B)	Variety (A)					
	Kharif			Rabi		
	HG 365	HG 563	**Mean**	HG 365	HG 563	**Mean**
CCC 500	3.17	2.65	**2.91**	2.92	2.44	**2.68**
CCC 1000	3.44	2.87	**3.15**	3.16	2.64	**2.90**
CCC 1500	3.49	2.91	**3.20**	3.21	2.68	**2.94**
MC 500	2.77	2.32	**2.55**	2.55	2.13	**2.34**
MC 1000	2.84	2.37	**2.61**	2.61	2.18	**2.40**
MC 1500	2.85	2.38	**2.62**	2.63	2.19	**2.41**
TRIA 500	2.91	2.43	**2.67**	2.67	2.23	**2.45**
TRIA 1000	3.17	2.65	**2.91**	2.92	2.44	**2.68**
TRIA 1500	3.22	2.69	**2.96**	2.97	2.48	**2.72**
Control	2.64	2.14	**2.39**	2.43	1.97	**2.20**
Mean	**3.05**	**2.54**	**2.80**	**2.81**	**2.34**	**2.57**
Factor	**S Em±**	**CD**		**S Em±**	**CD**	
Variety (A)	0.004	0.01		0.003	0.01	
Growth regulators (B)	0.018	0.05		0.016	0.05	
Interaction (A x B)	0.020	0.06		-	NS	

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

Table 3: Seed yield per plot (kg) as influenced by growth regulators in cluster bean varieties during *kharif* and *rabi* 2015-16

Growth regulators (ppm) (B)	Variety (A)					
	Kharif			Rabi		
	HG 365	HG 563	**Mean**	HG 365	HG 563	**Mean**
CCC 500	1.92	1.73	**1.82**	1.82	1.64	1.73
CCC 1000	2.08	1.87	**1.98**	1.98	1.78	1.88
CCC 1500	2.11	1.90	**2.01**	2.01	1.81	1.91
MC 500	1.68	1.51	**1.60**	1.60	1.44	1.52
MC 1000	1.72	1.55	**1.63**	1.63	1.47	1.55
MC 1500	1.73	1.55	**1.64**	1.64	1.48	1.56
TRIA 500	1.76	1.58	**1.67**	1.67	1.50	1.59
TRIA 1000	1.92	1.73	**1.82**	1.82	1.64	1.73
TRIA 1500	1.95	1.76	**1.85**	1.85	1.67	1.76
Control	1.60	1.40	**1.50**	1.52	1.33	1.42
Mean	**1.85**	**1.66**	**1.75**	**1.76**	**1.57**	**1.67**
Factor	**S Em±**	**CD**		**S Em±**	**CD**	
Variety (A)	**0.00**	**0.01**		**0.00**	**0.01**	
Growth regulators (B)	**0.01**	**0.03**		**0.01**	**0.03**	
Interaction (A x B)	**0.01**	**0.04**		**0.01**	**0.04**	

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

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