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Effect of Spacing and Nutrition on Seed Characters of Guar Varieties

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ABSTRACT

The effect of planting geometry and nutrition on growth and flowering of seed guar cultivars viz., HG 365 and HG 563 was analysed under Mahanandi conditions. 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 with spacing 30 cm x 20 cm exhibited the highest quality of pod with bold size of both pod as well as seed and Among the nutritional combinations, the highest dose of NPK and S at 45N: 60P: 60K: 30S showed the best result with greatest size of pods and bold seed in huge numbers.

Key words: *Guar, Seed weight, Bold seed, Nutritional combinations.*

INTRODUCTION

Cluster bean is botanically called as *Cyamopsis tetragonoloba* (L.) Taub. It belongs to the family Leguminaceae. The term guar was evolved from its most common use in India as cattle-feed "Gowahaar (Gow means cow and Ahaar means feed)". It is also used as a green manure crop in agriculture. The guar seed has a shelf life of more than 3 years and needs the barest maintenance and handling environment. It has three parts; the seed coat or hull, endosperm and germ. The hull constitutes 14-17 per cent of the guar seed by weight, endosperm 35-42 per cent and germ 43-47 per cent. Unlike the seeds of other legumes, guar bean has a large endosperm. This spherical shaped endosperm contains significant amounts of galactomannan gum, which accounts for 28% to 33% of the whole seed. Galactomannan is also referred as guar gum. The refined splits of guar are derived from this part of the seed. The remaining two parts, hull and germ, are high in protein and fibre.

The pod quality parameters in terms of size, weight, number of seeds and test weight were found to varied due to variety, planting geometry and nutritional combinations and some of their interactions as well .Therefore, it is felt necessary to undertake a precise study in order to elucidate the effect of variety, planting geometry and nutrient dose on growth, yield and quality of seed cluster bean under local agro-climatic conditions.

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MATERIAL AND METHODS

The experiment was conducted in factorial randomized design with three factors *viz.*, varieties (2), planting geometry levels (3) and nutritional levels (3) replicated thrice. The plot was laid out at Horticultural Research Station, Mahanandi, Kurnool district of Andhra Pradesh during both *kharif* and *rabi* seasons of the years 2014-15 and 2015-16. The data obtained from both the years was pooled and presented in the tables.

RESULTS AND DISCUSSION

Number of seeds per pod

The differences observed in number of seeds per pod (Table 1) due to variety, planting geometry, nutritional combinations and some of their interactions were found significant. Among the varieties HG 365 recorded the highest number of seeds per pod both in *kharif* (7.12) and *rabi* seasons (6.34). Planting geometry of 30 cm x 20 cm (S_2) recorded significantly highest number of seeds per pod (*kharif* 6.85; *rabi* 6.10) which was on par with 40 cm x 10 cm (S_3) (*kharif* 6.70; *rabi* 5.96). The lowest number of seeds per pod was recorded by the planting geometry at 30 cm x 10 cm (S_1) (*kharif* 6.21 cm; *rabi* 5.52 cm). Application of 45N: 60P: 60K: 30S kg per ha (F_3) recorded the highest number of seeds per pod (*kharif* 7.15; *rabi* 6.37) which was on par with 30N: 40P: 40K: 20S kg per ha (F_2) (*kharif* 6.73; *rabi* 5.99). The lowest number of seeds per pod (*kharif* 5.87; *rabi* 5.22) was recorded by the application of 15N: 20P: 20K: 10S kg per ha (F_1)

Hundred seed weight (g)

Significant differences were observed in the 100-seed weight (Table 2) due to variety, planting geometry, nutritional combinations and some of their interactions. Among the varieties HG 365 recorded the highest hundred seed weight both in *kharif* (2.70 g) and *rabi* seasons (2.40 g). Planting geometry of 40 cm x10 cm (S_3) recorded significantly the highest hundred seed weight (*kharif*: 2.83 g; *rabi*: 2.52 g) followed by 30 cm x 10 cm (S_1) (*kharif*: 2.48 g; *rabi*: 2.21 g). The lowest hundred seed weight was recorded by the planting geometry at 30 cm x 20 cm (S_2) (*kharif* 2.39 g; *rabi* 2.13 g). Application of 45N: 60P: 60K: 30S kg per ha (F_3) recorded the highest hundred seed weight (*kharif* 2.71 g; *rabi*2.41 g) which was on par with 30N: 40P: 40K: 20S kg per ha (F_2) (*kharif*2.66 g; *rabi*2.36 g). The lowest hundred seed weight (*kharif* 2.34 g; *rabi* 2.08 g) was recorded by the application of 15N: 20P: 20K: 10S kg per ha (F_1).

Seed yield per plant (g)

Significant differences were observed in the seed yield per plant (Table 3) due to variety, planting geometry, nutritional combinations and some of their interactions. Among the varieties HG 365 recorded the highest seed yield per plant both in *kharif* (19.41 g) and *rabi* seasons (17.27 g). Planting geometry of 30 cm x 20 cm (S_2) recorded significantly the highest seed yield per plant (*kharif* 19.21g; *rabi* 17.10g) which was on par with 40 cm x 10 cm (S_3) (*kharif* 18.43g; *rabi* 16.41g). The lowest seed yield per plant was recorded by the planting geometry at 30 cm x 10 cm (S_1) (*kharif* 16.21 g; *rabi*14.42g). Application of 45N: 60P: 60K: 30S kg per ha (F_3) recorded the highest seed yield per plant (*kharif* 19.50 g; *rabi*17.35 g) which was on par with 30N: 40P: 40K: 20S kg per ha (F_2) (*kharif* 18.36 g; *rabi*16.34 g). The lowest seed yield per plant (*kharif* 16.00 g; *rabi*14.24 g) was recorded by the application of 15N: 20P: 20K: 10S kg per ha (F_1).

Seed yield per plot (kg)

Significant differences were observed in the seed yield per plot (Table 4) due to variety, planting geometry, nutritional combinations and their interactions. Among the varieties HG 365 recorded the highest seed yield per plot both in *kharif* (2.39 kg) and *rabi* seasons (2.12 kg). Planting geometry of 30 cm x 10 cm (S_1) recorded significantly the highest seed yield per plot (*kharif*: 2.77 kg; *rabi*: 2.46 kg) followed by 40 cm x 10 cm (S_3) (*kharif*: 2.36

kg; *rabi*: 2.10 kg) (Fig. 7). The lowest seed yield per plot was recorded by the planting geometry at 30 cm x 20 cm (S_2) (*kharif* 1.64 kg; *rabi* 1.46 kg). Application of 45N: 60P: 60K: 30S kg per ha (F_3) recorded the highest seed yield per plot (*kharif* 2.45 kg; *rabi* 2.18 kg) which was on par with 30N: 40P: 40K: 20S kg per ha (F_2) (*kharif* 2.30 kg; *rabi* 2.05 kg). The lowest seed yield per plot (*kharif* 2.01 kg; *rabi* 1.79 kg) was recorded by the application of 15N: 20P: 20K: 10S kg per ha (F_1). The interaction effect between planting geometry and nutritional level was found significant during both *kharif* and *rabi* with respect to seed yield per plot. The highest seed yield per plot was recorded by the closest planting pattern of 30 cm x 10 cm and applied with 45N: 60P: 60K: 30S kg per ha (*kharif* 3.04; *rabi* 2.71) which was on par with the same planting geometry + application of 30N: 40P: 40K: 20S kg per ha (*kharif* 2.81; *rabi* 2.50) and followed by the planting geometry of 40 cm x 10 cm + application of 45N: 60P: 60K: 30S kg per ha (*kharif* 2.56; *rabi* 2.28).

The pod quality parameters in terms of size, weight, number of seeds and test weight were found to vary significantly due to variety, planting geometry and nutritional combinations and some of their interactions as well. 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 population densities, the lowest density at the spacing 30 cm x 20 cm exhibited the highest quality of pod with bold size of both pod as well as seed. Plants spaced widely were late to initiate flowering and took a lot of time for completing flowering phase and also vested with greater amount of time 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. Among the nutritional combinations, the highest dose of NPK and S at 45N: 60P: 60K: 30S showed the best result with greatest size of pods and bold seed in huge numbers compared to the lowest dose *i.e.* 15N: 20P: 20K: 10S but which was on par with next highest level *i.e.* 30N: 40P: 40K: 20S. The reasons quoted earlier also hold good in the case of nutrient dose since, the greatest nutrient dose influenced the plants to extend their flowering period and enlarged the duration of pod maturity significantly over the smallest nutrient dose, however, remained at parity with the moderate nutrient dose of 30N: 40P: 40K: 20S. Non-significant increase in pod size with additional nutrient dose might be due to the corresponding non- significant increase in majority of growth parameters and the duration of reproductive phase.

Similar view was also expressed by Abid *et al.*[1] who observed that wider spacing favoured better development of grains, which was ascribed to be due to enhanced photosynthetic activity in the widely spaced plants. Baviskar *et al.*[2] reported that the plants receiving sulphur @ 50 kg ha^{-1} produced significantly the highest green pod and straw yield over control. The bioactivities of sulphur might have played important role in improving yield attributes like pods per plant, length of pod and thereby pod yield per plant ultimately increasing pod and straw yield. These findings are in line with those of Singh *et al.*[4] and Singh and Mann[5].

Rathore *et al.*[3] found significant variation in 1000-seed weight under various nutrient doses. Better growth associated with increased availability of plant nutrients might have resulted in better development of yield attributes under certain treatments compared to other ones.

Table 1: Number of seeds per pod as influenced by variety, planting geometry and nutritional combination during *kharif&rabi* (pooled data of 2014-15 & 2015-16)

Planting Geometry (B)	Nutritional Combination (C)	Variety (A)					
		Kharif			*Rabi*		
		HG 365	HG 563	**Mean**	HG 365	HG 563	**Mean**
S_1 (30 cm x 10 cm) (33.3 plants per m^2)	F_1 (15N:20P:20K:10S)	5.95	5.05	**5.50**	5.29	4.50	**4.90**
	F_2 (30N:40P:40K:20S)	6.81	5.79	**6.30**	6.06	5.15	**5.60**
	F_3 (45N:60P:60K:30S)	7.37	6.27	**6.82**	6.56	5.58	**6.07**
	Mean	**6.71**	**5.70**	**6.21**	**5.97**	**5.08**	**5.52**
S_2 (30 cm x 20 cm) (16.7 plants per m^2)	F_1 (15N:20P:20K:10S)	6.61	5.62	**6.11**	5.88	5.00	**5.44**
	F_2 (30N:40P:40K:20S)	7.64	6.49	**7.06**	6.80	5.78	**6.29**
	F_3 (45N:60P:60K:30S)	7.97	6.77	**7.37**	7.09	6.03	**6.56**
	Mean	**7.40**	**6.29**	**6.85**	**6.59**	**5.60**	**6.10**
S_3 (40 cm x 10 cm) (25 plants per m^2)	F_1 (15N:20P:20K:10S)	6.47	5.50	**5.99**	5.76	4.90	**5.33**
	F_2 (30N:40P:40K:20S)	7.40	6.29	**6.84**	6.58	5.60	**6.09**
	F_3 (45N:60P:60K:30S)	7.86	6.68	**7.27**	6.99	5.95	**6.47**
	Mean	**7.24**	**6.16**	**6.70**	**6.45**	**5.48**	**5.96**
For Comparing varieties (A) and Nutritional combinations (C)							
F_1 (15N:20P:20K:10S)		6.34	5.39	**5.87**	5.65	4.80	**5.22**
F_2 (30N:40P:40K:20S)		7.28	6.19	**6.73**	6.48	5.51	**5.99**
F_3 (45N:60P:60K:30S)		7.73	6.57	**7.15**	6.88	5.85	**6.37**
Mean		**7.12**	**6.05**	**6.58**	**6.34**	**5.39**	**5.86**

Factor	**S Em±**	**CD**	**S Em±**	**CD**
Variety (A)	**0.15**	**0.44**	**0.13**	**0.39**
Ptg. Geom. (B)	**0.07**	**0.20**	**0.06**	**0.17**
Nutril. Combn.(C)	**0.16**	**0.48**	**0.15**	**0.42**
A x B	**-**	**NS**	**-**	**NS**
B x C	**0.22**	**0.64**	**0.20**	**0.57**
A x C	**0.30**	**0.87**	**-**	**NS**
A x B x C	**-**	**NS**	**-**	**NS**

CD: CD at 5% level of significance

Table 2: Hundred seed weight (g) as influenced by variety, planting geometry and nutritional combination during *kharif&rabi* (pooled data of 2014-15 & 2015-16)

Planting Geometry (B)	Nutritional Combination (C)	Variety (A)					
		Kharif			*Rabi*		
		HG 365	HG 563	**Mean**	HG 365	HG 563	**Mean**
S_1 (30 cm x 10 cm) (33.3 plants per m^2)	F_1 (15N:20P:20K:10S)	2.46	2.27	**2.36**	2.19	2.02	**2.10**
	F_2 (30N:40P:40K:20S)	2.68	2.39	**2.53**	2.38	2.13	**2.25**
	F_3 (45N:60P:60K:30S)	2.71	2.40	**2.55**	2.41	2.13	**2.27**
	Mean	**2.61**	**2.35**	**2.48**	**2.33**	**2.09**	**2.21**
S_2 (30 cm x 20 cm) (16.7 plants per m^2)	F_1 (15N:20P:20K:10S)	2.29	2.11	**2.20**	2.04	1.88	**1.96**
	F_2 (30N:40P:40K:20S)	2.63	2.35	**2.49**	2.34	2.09	**2.21**
	F_3 (45N:60P:60K:30S)	2.63	2.35	**2.49**	2.34	2.09	**2.22**
	Mean	**2.52**	**2.27**	**2.39**	**2.24**	**2.02**	**2.13**
S_3 (40 cm x 10 cm) (25 plants per m^2)	F_1 (15N:20P:20K:10S)	2.56	2.36	**2.46**	2.27	2.10	**2.19**
	F_2 (30N:40P:40K:20S)	3.11	2.78	**2.95**	2.77	2.47	**2.62**
	F_3 (45N:60P:60K:30S)	3.26	2.91	**3.09**	2.90	2.59	**2.75**
	Mean	**2.98**	**2.68**	**2.83**	**2.65**	**2.39**	**2.52**
For Comparing varieties (A) and Nutritional combinations (C)							
F_1 (15N:20P:20K:10S)		2.43	2.25	**2.34**	2.17	2.00	**2.08**
F_2 (30N:40P:40K:20S)		2.81	2.50	**2.66**	2.50	2.23	**2.36**
F_3 (45N:60P:60K:30S)		2.87	2.55	**2.71**	2.55	2.27	**2.41**
Mean		**2.70**	**2.43**	**2.57**	**2.40**	**2.17**	**2.29**

Variety (A)	**0.04**	**0.11**	**0.03**	**0.10**
Ptg. Geom. (B)	**-**	**NS**	**-**	**NS**
Nutril. Combn.(C)	**0.04**	**0.12**	**0.04**	**0.10**
A x B	**-**	**NS**	**-**	**NS**
B x C	**0.08**	**0.24**	**0.07**	**0.21**
A x C	**-**	**NS**	**-**	**NS**
A x B x C	**-**	**NS**	**-**	**NS**

CD: CD at 5% level of significance

Table 3: Seed yield per plant (g) as influenced by variety, planting geometry and nutritional combination during *kharif&rabi* (pooled data of 2014-15 & 2015-16)

Planting Geometry (B)	Nutritional Combination (C)	Variety (A)					
		Kharif			*Rabi*		
		HG 365	HG 563	**Mean**	HG 365	HG 563	**Mean**
S_1 (30 cm x 10 cm) (33.3 plants per m^2)	F_1 (15N:20P:20K:10S)	15.53	13.20	**14.36**	13.82	11.75	**12.78**
	F_2 (30N:40P:40K:20S)	17.77	15.11	**16.44**	15.82	13.45	**14.63**
	F_3 (45N:60P:60K:30S)	19.26	16.37	**17.81**	17.14	14.57	**15.85**
	Mean	**17.52**	**14.89**	**16.21**	**15.59**	**13.25**	**14.42**
S_2 (30 cm x 20 cm) (16.7 plants per m^2)	F_1 (15N:20P:20K:10S)	18.54	15.76	**17.15**	16.50	14.03	**15.27**
	F_2 (30N:40P:40K:20S)	21.42	18.21	**19.82**	19.07	16.21	**17.64**
	F_3 (45N:60P:60K:30S)	22.35	18.99	**20.67**	19.89	16.90	**18.40**
	Mean	**20.77**	**17.66**	**19.21**	**18.49**	**15.71**	**17.10**
S_3 (40 cm x 10 cm) (25 plants per m^2)	F_1 (15N:20P:20K:10S)	17.81	15.14	**16.47**	15.85	13.47	**14.66**
	F_2 (30N:40P:40K:20S)	20.35	17.30	**18.83**	18.11	15.40	**16.76**
	F_3 (45N:60P:60K:30S)	21.63	18.38	**20.00**	19.25	16.36	**17.80**
	Mean	**19.93**	**16.94**	**18.43**	**17.74**	**15.08**	**16.41**
For Comparing varieties (A) and Nutritional combinations (C)							
F_1 (15N:20P:20K:10S)		17.29	14.70	**16.00**	15.39	13.08	**14.24**
F_2 (30N:40P:40K:20S)		19.85	16.87	**18.36**	17.67	15.02	**16.34**
F_3 (45N:60P:60K:30S)		21.08	17.91	**19.50**	18.76	15.94	**17.35**
Mean		**19.41**	**16.50**	**17.95**	**17.27**	**14.68**	**15.98**

Factor	**S Em±**	**CD**	**S Em±**	**CD**
Variety (A)	**0.41**	**1.19**	**0.37**	**1.06**
Ptg. Geom. (B)	**0.31**	**0.90**	**0.28**	**0.80**
Nutril. Combn.(C)	**0.45**	**1.29**	**0.40**	**1.15**
A x B	**0.69**	**1.99**	**-**	**NS**
B x C	**0.72**	**2.09**	**0.64**	**1.86**
A x C	**-**	**NS**	**-**	**NS**
A x B x C	**-**	**NS**	**0.99**	**2.87**

CD: CD at 5% level of significance

Table 4: Seed yield per plot (kg) as influenced by variety, planting geometry and nutritional combination during *kharif&rabi* (pooled data of 2014-15 & 2015-16)

Planting Geometry (B)	Nutritional Combination (C)	Variety (A)					
		Kharif			*Rabi*		
		HG 365	HG 563	**Mean**	HG 365	HG 563	**Mean**
S_1 (30 cm x 10 cm) (33.3 plants per m^2)	F_1 (15N:20P:20K:10S)	2.59	2.31	**2.45**	2.31	2.05	**2.18**
	F_2 (30N:40P:40K:20S)	2.97	2.64	**2.81**	2.64	2.35	**2.50**
	F_3 (45N:60P:60K:30S)	3.22	2.86	**3.04**	2.86	2.55	**2.71**
	Mean	**2.93**	**2.60**	**2.77**	**2.60**	**2.32**	**2.46**
S_2 (30 cm x 20 cm) (16.7 plants per m^2)	F_1 (15N:20P:20K:10S)	1.55	1.38	**1.46**	1.38	1.23	**1.30**
	F_2 (30N:40P:40K:20S)	1.79	1.59	**1.69**	1.59	1.42	**1.50**
	F_3 (45N:60P:60K:30S)	1.87	1.66	**1.76**	1.66	1.48	**1.57**
	Mean	**1.73**	**1.54**	**1.64**	**1.54**	**1.37**	**1.46**
S_3 (40 cm x 10 cm) (25 plants per m^2)	F_1 (15N:20P:20K:10S)	2.23	1.99	**2.11**	1.99	1.77	**1.88**
	F_2 (30N:40P:40K:20S)	2.55	2.27	**2.41**	2.27	2.02	**2.14**
	F_3 (45N:60P:60K:30S)	2.71	2.41	**2.56**	2.41	2.15	**2.28**
	Mean	**2.50**	**2.22**	**2.36**	**2.22**	**1.98**	**2.10**
For Comparing varieties (A) and Nutritional combinations (C)							
F_1 (15N:20P:20K:10S)		2.12	1.89	**2.01**	1.89	1.68	**1.79**
F_2 (30N:40P:40K:20S)		2.44	2.17	**2.30**	2.17	1.93	**2.05**
F_3 (45N:60P:60K:30S)		2.60	2.31	**2.45**	2.31	2.06	**2.18**
Mean		**2.39**	**2.12**	**2.25**	**2.12**	**1.89**	**2.01**

Factor	**S Em±**	**CD**	**S Em±**	**CD**
Variety (A)	**0.04**	**0.11**	**0.03**	**0.10**
Ptg. Geom. (B)	**0.11**	**0.33**	**0.10**	**0.29**
Nutril. Combn.(C)	**0.06**	**0.16**	**0.05**	**0.15**
A x B	**-**	**NS**	**-**	**NS**
B x C	**0.16**	**0.47**	**0.14**	**0.42**
A x C	**-**	**NS**	**-**	**NS**
A x B x C	**0.20**	**0.57**	**0.18**	**0.51**

CD: CD at 5% level of significance

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