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Effect of Brassinolide on growth and yield of summer green gram crop

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ABSTRACT

A field experiment was conducted in two consecutive years at University Farm (New Alluvial zone) of Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal during the summer season of 2007 and 2008 at upland situation on sandy-loam soil, almost neutral in soil reaction (pH 6.90) having 0.68% organic carbon, 28.45 kg/ha available P_2O_5 and 135.51 kg/ha available K_2O to study the effect of brassinolide on growth and yield of summer green gram crop. The crop was fertilized with recommended dose of N-P_2O_5-K_2O at 20-40-40 kg/ha and received only one light pre-sowing irrigation. The experiment was carried out in RBD with 8 treatments and 3 during the summer season under limited soil moisture condition. The result revealed that brassinolide (plant growth regulator) had a significant influence on growth and seed yield of the crop. The crop sprayed with 0.25 ppm brassinolide yielded better than other concentrations of brassinolide and the highest seed yield was obtained with the treatment where it was sprayed twice. The growth parameters like plant height, LAI and dry matter accumulation per unit area were significantly higher in the treatments where brassinolide were sprayed. Yield differences due to different treatments were mainly due to significant effect of the plant growth regulator (brassinolide) on LAI and dry matter accumulation in aerial plant parts and the number of pods per unit area. The experimental results revealed that application of plant growth regulator (brassinolide) is an effective management practice to increase the yield of green gram crop grown under limited moisture condition.

Key words: Brassinolide, growth attributes, , seed yield, yield components.

Green gram (*Vigna radiata* L.), commonly known as 'Mung bean' or 'Moong' normally produces a large number of flowers but only a few are retained and developed into pods. The crop suffers from excessive vegetative growth, poor harvest index and low yield mainly due to poor pod setting in spite of profuse flowering (Singh and Kaur, 1981). Flower as well as pod shedding is common feature in this legume crop which is reflected in sink realization. If these potential yield barriers could be alleviated by any means, then yield enhancement and improvement in quality of green gram could be achieved (Grewal, 1985). Yield is the consequence of various physiological processes. It has long been recognized that pollen is rich in hormones and other growth substances, thus, hormones play an important role in reproduction of plants. A number of plant growth regulators have been known to maximize the yield in many crops. Brassinolide, a novel plant growth promoting steroidal lactone, was first isolated from rape (*Brassica napus* L.) pollen and was found to exhibit unique plant growth responses in several test systems (Yopp *et al.*, 1981; Gregory and Mandava, 1982). Recently, many analogues of brassinolide have been known and they collectively known as brassinosteroids (BRs) or brassin. Brassinosteroids is now considered as an important group of phyto-hormones. Brassinosteroids occur ubiquitously in plants and present in extremely low concentrations. The pollen and immature seeds contain about 1-100 ng per g fresh weight, while shoots and leaves possess still lower amounts in the range of 0.01-0.1 ng per g fresh weight, which is a testimony to consider brassinosteroids as phyto-hormones (Rao *et al.*, 2002). Brassinolide induced plant growth was reported to be associated with increased metabolic processes like photosynthesis (Sairam, 1994), nucleic acid and protein synthesis (Kalinich *et al.*, 1985). In an early study, brassinosteroids induced growth promotion was found to be associated with enhanced levels of nucleic acids, soluble proteins and carbohydrates (Vardhini and Rao, 1998). Therefore, improvement in yield and quality parameters in food legumes may be achieved through suitable application of growth regulators as well as appropriate agronomical practices. An attempt was thus made with following objectives:

(1) to evaluate the effect of brassinolide on growth and yield of green gram crop when grown in the summer season under limited soil moisture condition; (2) to identify its most active concentrations (i.e., to find out the suitable dose of application of brassinolide) for obtaining a higher yield of summer green gram crop; (3) to get an idea about the appropriate number and stage of the crop with regard to the application of brassinolide for obtaining a better yield.

MATERIALS AND METHODS

The experiment was undertaken at UniversityFarm (New Alluvial zone) of Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal (The farm is situated at 22°56' N latitude, 88°32' E longitude and at an altitude of 9.75 m above mean sea level) during two consecutive summer seasons (2007 and 2008) to study the effect of Brassinolide on growth and yield of summer green gram (*Vigna radiata* L.) crop using the variety PDM-54 (***Vijoy***). The experiment was laid out in randomized complete

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block design with 8 treatments and 3 replications. The treatment were: (1) Control (no plant growth regulator was applied), (2) Spraying of Brassinolide (0.10 ppm) at 25 DAS, (3) Spraying of Brassinolide (0.25 ppm) at 25 DAS, (4) Spraying of Brassinolide (0.50 ppm) at 25 DAS, (5) Spraying of Brassinolide (0.10 ppm) at 25 and 40 DAS, (6) Spraying of Brassinolide (0.25 ppm) at 25 and 40 DAS, (7) Spraying of Brassinolide (0.50 ppm) at 25 and 40 DAS, and (8) Spraying of liquid soap solution at 25 and 40 DAS. The physico-chemical properties of surface soil were: textural class - sandy loam, soil pH 6.90, organic carbon 0.68 percent, total nitrogen 0.07 percent, with available P_2O_5 28.45 kg/ha and available K_2O 135.51 kg/ha. The crop was fertilized with recommended dose of N-P_2O_5-K_2O at 20-40-40 kg/ha and one light pre-sowing irrigation was given for uniform germination. Spray operation was always carried out from lower to higher concentration of Brassinolide. Spraying with soap solution in the control plot was done before initiation of chemical spray using a separate sprayer which had never been used to spray any chemical as a safe guard of contamination. The crop was sprayed thoroughly, in such a way so that all portion of the leaves (adaxial and abasial surfaces) and plant parts moistened with respective solution. Spraying was done at morning hours of bright sunny days. Observations on the growth characters and yield components and yield were taken and analyses were done.

RESULTS AND DISCUSSION

Table 1 revealed that the effect of plant growth regulator was not conspicuous at initial growth stage; however, most of the treatments receiving brassinolide produced significantly taller plants than control treatment. At 45 and 60 DAS highest plant height recorded in the treatment T-6. Kothule *et al.*, 2003 and Singh, 2001 also reported similar results of growth regulators. It is assumed that brassinolide induced synthesis of both IAA and GA in plant body and increase in plant height was probably due to their cumulative action. In case of LAI, the highest value of LAI at 30 DAS (3.35) was obtained in T-3 followed by T-7 treatment (3.31), where the crop received plant growth regulator at 0.25 and 0.50 ppm, respectively; however, the said treatments were at par with the control treatment T-1, where the crop received no plant growth regulator. At 45 DAS significant variation in LAI values due to different treatments was observed and the highest value of LAI (4.94) was recorded in T-6; the trend was more or less similar. At later stage of crop growth application of brassinolide significantly increased LAI of green gram crop compared with the control (T-1) and liquid soap spray treatment (T-8). The bio-mass of the crop increased with the age of the crop and applied growth regulator has distinct and significant effect on dry matter accumulation. Application of brassinolide increased dry matter accumulation significantly at 45 and 60 DAS when compared with the control and liquid soap spray treatments (T-1 and T-8, respectively). The results lend support to the views expressed by earlier researchers (Bera *et al.*, 2006; Sharma and Walia, 1996).

Table 1 : Effect of Brassinolide on plant height (cm), leaf area index and dry matter accumulation (gm^{-2}) of summer green gram crop

(Pooled data)

Treatments	Plant height (cm)			Leaf area index			Dry matter accumulation ($g\ m^{-2}$)		
	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS
T- 1	15.88	37.82	52.68	2.91	3.52	3.22	40.76	106.92	224.55
T- 2	19.53	48.82	62.42	3.12	4.76	4.36	43.19	137.79	306.45
T- 3	19.92	52.98	65.19	3.35	4.86	4.77	45.67	152.88	348.11
T- 4	20.57	53.25	63.63	3.26	4.68	4.54	44.34	139.58	347.07
T- 5	20.40	51.58	65.83	3.15	4.74	4.76	43.64	141.50	341.19
T- 6	20.92	55.55	67.57	3.29	4.94	4.81	48.37	152.46	377.35
T- 7	21.03	53.47	65.91	3.31	4.85	4.66	45.19	152.55	358.86
T- 8	15.85	40.52	52.49	2.97	3.70	3.25	42.14	110.04	230.18
SE m (±)	**0.84**	**2.37**	**2.04**	**0.23**	**0.24**	**0.20**	**4.80**	**6.18**	**13.32**
LSD(0.05)	**2.51**	**7.11**	**6.12**	**NS**	**0.72**	**0.59**	**NS**	**18.53**	**39.90**

Table 2 revealed that seed yield of the crop was distinctly influenced by the application of brassinolide. The average seed yield was comparatively more in case of foliar application of 0.25 ppm brassinolide than higher or lower concentration of the growth regulator. The maximum seed yield (724.50 kg/ha) was obtained in T-6 and that was statistically superior over treatments T-1 and T-8, and the treatment T-6 caused about 38.71% increase in seed yield over the control treatments. The second highest yield was obtained in T-7, where 0.50 ppm brassinolide was applied twice as foliar spray. Similar

observations were also made earlier by Singh, 2001 and Reddy *et al.*, 2002).

Seed yield of green gram crop is influenced by a number of yield attributing characters, like number of pods/m^2, number of seeds per pod and test weight of seeds. However, in this experiment statistical significance was observed only in case of number of pods per m^2. It may be worth mentioned here that number of plants per unit area was not varied significantly in this experiment, and thus the number of pods/m^2 gave a more reliable or accurate picture and contributed most in determining the seed yield. The number of pods/m^2 ranged from 291.06 in T-1 (control treatment) to 428.69 in T-6 (where brassinolide was applied twice at 0.25 ppm as foliar spray). In T-6 maximum number of pods/m^2 was obtained and it was followed by T-7 and T-3; these three treatments were, however, statistically at par with each other. The differences in pod number may be due to better utilization of resources in the plots received plant growth regulator. The results revealed that brassinolide had a significant influence on growth and seed yield of the crop. Hence, the importance of plant growth regulator may be realized for efficient utilization of natural resources in a sustainable manner. Application of plant growth regulator may be a better option, particularly in case of a short duration legume crop like green gram.

Table 2 : Effect of Brassinolide on yield components and seed yield (kgha^{-1}) of summer green gram crop

(Pooled data)

Treatments	No. of pod m^{-2}	No. of seed pod^{-1}	Test weight (g) of seed	Seed yield (kgha^{-1})
T- 1	291.06	10.47	22.79	508.42
T- 2	361.23	11.04	22.98	632.45
T- 3	412.05	11.49	23.58	678.10
T- 4	388.24	11.21	23.16	659.15
T- 5	392.04	10.73	23.32	660.35
T- 6	428.69	11.29	23.24	724.50
T- 7	413.75	11.14	23.08	687.55
T- 8	306.47	10.82	23.17	536.23
SE m (±)	**10.78**	**0.37**	**0.53**	**39.42**
LSD(0.05)	**32.32**	**NS**	**NS**	**118.25**

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