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Response of green gram to foliar application of nutrients and brassinolide

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ABSTRACT

A field experiment was carried out in the Farm of BCKV, West Bengal ($22^0$95'N, $88^0$50'E) during the summer season of 2010 and 2011 on sandy-loam alluvial soil (Inceptisol), neutral in soil reaction (pH 7.2) having 0.65% organic carbon, 0.08% total N, 27.54 kg ha^{-1} available P_2O_5 and 135.15 kg ha^{-1} available K_2O, to find out the effect of foliar application of nutrients and Brassinolide on yield of green gram crop. The crop was fertilized with a common dose of N-P_2O_5-K_2O at 20-40-40 kg ha^{-1} and grown with only one pre-sowing irrigation. The variety Bireshwar was used for this experiment, carried out in RBD with 8 treatments and 3 replications. From the results it was found that foliar application of nutrients (urea and DAP) and Brassinolide had a significant influence on growth and yield of the crop. The growth in terms of plant height, LAI and dry matter accumulation per unit area were significantly higher in the treatments where the plants got nutrients and Brassinolide. Foliar fertilization had significant effect on the main yield component, i.e., number of pods per plant; though, other yield components were statistically at par. The highest seed yield was obtained in the treatment where the crop was sprayed with Brassinolide, 0.25 ppm at 25 DAS and 45 DAS followed by the treatments where the crop was sprayed with DAP (2% solution) at 25 and 45 DAS and Urea (2% solution) at 25 and 45 DAS.Thus, it may be concluded that foliar application of nutrients and Brassinolide had a distinct effect to increase the yield of green gram crop.

Keywords : Brassinolide, DAP, foliar spray, green gram, urea

Green gram [*Vigna radiata* (L.) Wilczek] is a protein rich staple food. It contains about 25 % protein, which is almost three times that of cereals. It is consumed in the form of split pulse as well as whole pulse, and is an essential supplement of cereal based diet. Green gram improves soil physical properties and fixes atmospheric nitrogen. Green gram crop normally produces a large number of flowers but only a few retain and develop into pods. The crop suffers from excessive vegetative growth, poor harvest index and low yield mainly due to poor pod setting in spite of the fact that the flowering is profuse (Singh and Kaur, 1981). Flower as well as pod shedding is common feature in this crop which is reflected in sink realization. If these potential yield barriers could be alleviated by any means, yield enhancement and improvement in quality of green gram could be achieved (Grewal, 1985). Though, green gram is an important pulse crop of India, its average yield is low, far from satisfactory or potential level. It is advisable to grow the crop during spring or summer in medium or up land situation which are mostly kept fallow during this period. Therefore, there is a scope for augmentation of its yield through agronomic manipulation.

Brassinolide (IBR), 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 system (Yopp *et al*., 1981; Gregory and Mandava, 1982). Recently, many analogues of brassinolide have been known and they are collectively known as brassinosteroides (BRs) or brassin. Brassinosteriods is now considered as an important group of phyto-hormones. Brassinosteroides occur ubiquitously in plants and is present in extremely low concentrations. The pollen and immature seeds contains about 1-100 ng g^{-1} fresh weight, while shoots and leaves possess still lower amounts in the range of 0.01-0.1 ng g^{-1} fresh weight, which is a testimony to consider brassinosteroids as phyto-hormones (Rao *et al*., 2002). Brassinoloide induced plant growth was reported to be associated with increased metabolic processes like photosynthesis, and 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, keeping the above in view and to know possible reasons, an attempt was made to study the effect of foliar application of nutrients and Brassinolide on growth and yield of green gram crop.

MATERIALS AND METHODS

The experiment was carried out during summer season of 2010 and 2011 in the research station, BCKV, Mohanpur, Nadia, West Bengal located at $22^0$95'N latitude, $88^0$50'E longitude, with an altitude of 9.75 m above the mean sea level. The soil of the experimental field was Gangetic alluvial with sandy clay loam texture, good water holding capacity, well drained with moderate soil fertility status and soil pH of 7.2. The organic carbon, total nitrogen, available phosphorus, and potassium contents were 0.65%, 0.08%, 27.54 kg ha^{-1} and 135.15 kg ha^{-1} respectively. The crop was fertilized with a common dose of N-P_2O_5-K_2O at 20-40-40 kg ha^{-1} and raised with only one pre-sowing irrigation. The variety *Bireshwar* was used for this

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experiment which was carried out in RBD with 8 treatments and 3 replications. The treatment details : T_1: Control -I (No external input); T_2: Control-II (Received only basal fertilizers at 20-40-40 kg ha^{-1} and distilled water as foliar spray at 25 DAS and 45 DAS); T_3: Spraying of DAP (2% solution) at 25 DAS; T_4: Spraying of DAP (2% solution) at 25 DAS and 45 DAS; T_5: Spraying of urea (2% solution) at 25 DAS; T_6 : Spraying of urea (2% solution) at 25 DAS and 45 DAS; T_7: Spraying of brassinolide (0.25 ppm) at 25 DAS; T_8: Spraying of brassinolide (0.25 ppm) at 25 DAS and 45 DAS.

The variety Bireshwar matures in 60-70 days. The colour of the seed was shining pale green and the seeds are bold in size. Yield potential of the variety is 700-800 kg ha^{-1}. Test weight *i.e.,* 1000 seed weight of seed is 28 g. (approx.)

RESULTS AND DISCUSSIONS:

Plant height

Height of the crop plants was recorded at 15 days interval starting from 30 DAS. The height of the plants increased steadily up to 60 DAS and it was significantly influenced by the foliar application of DAP (2 %), urea (2 % solution) and brassinolide (0.25 ppm). At 30 DAS minimum plant height was recorded in treatment T_1 (Control - I) and maximum plant height was recorded in treatment T_8 (Spraying of brassinolide (0.25 ppm) at 25 DAS and 45 DAS). All the treatments receiving foliar application of inputs produced taller plant over the control plot. T_2, T_3, T_4, T_5 and T_7 treatments were statistically *at par*. At 45 DAS the plant height varied from 26.94 cm in treatment T_1 (Control -I) to 54.37 cm in treatment T_8 (Spraying of brassinolide (0.25 ppm) at 25 DAS and 45 DAS). All the treatments significantly differed from the control-I.

Treatments T_4, T_5, T_7 and T_8 were higher than T_2 (Control - II) and they were statistically *at par*. Treatments T_2, T_3 and T_6 were also significantly higher from T_8. Similar trend was followed at 60 DAS also (Table 1). This result is in conformity with the findings reported by Sengupta *et al.* (2011).

Leaf area index (LAI)

LAI of the crop was determined at 30, 45 and 60 DAS and presented in table 1. At 30 DAS the highest value LAI (3.64) was obtained in T_7 treatment. The lowest value of LAI (2.17) was obtained in T_1, where the crop received no plant nutrient or input. All the treatments were significantly superior over T_1. The treatments T_3 and T_4 differ significantly. The treatments T_5 and T_6 were statistically *at par*, T_7 and T_8 were statistically *at par*. At 45 DAS there were significant variations in LAI values due to different treatments. The maximum LAI value (5.02) was obtained in T_8 treatment. All treatments were significantly superior over T_1. The treatments T_2, T_3, T_4, T_7 and T_8 were statistically *at par*. The treatments T_3 and T_4, T_5 and T_6, T_7 and T_8 were statistically *at par*. On an average the LAI value was decreased slightly at 60 DAS. At this stage also highest LAI value (4.39) was obtained in treatment T_8 and the lowest value (2.17) was recorded in T_1 treatment. All treatments were significantly superior over T_1. The treatments T_2, T_3, T_4, T_5, T_6 and T_7 and T_8 were at par, and the best treatment was T_8.

Dry matter accumulation

The minimum dry matter accumulation was recorded in treatment T_1 and maximum in treatment T_8 at 30, 45 and 60 DAS (Table 1). At 30 DAS the dry matter accumulation ranged from 22.11 (g m^{-2}) to 29. 19 (g m^{-2}). All treatments except T_6 were superior over Control- I. The treatment T_1 and T_6 were statistically *at par*. The

Table 1: Effect of foliar application of DAP, urea and brassinolide on growth and yield parameter of green gram crop (Pooled)

Treatment	Plant height (cm)			Leaf area index (LAI)			Dry matter accumulation (g m^2)			No. of pods per m^2	Seed yield (kg ha^{-1})
	30 D	45 D	60 D	30 D	45 D	60 D	30 D	45 D	60 D		
T_1	7.02	26.94	34.41	2.17	3.13	2.17	22.11	82.35	232.61	198.31	398.56
T_2	9.41	39.76	49.25	3.14	4.27	3.26	28.24	126.48	300.44	308.40	634.16
T_3	10.03	46.11	55.19	3.23	4.54	3.88	28.96	143.55	337.75	336.50	712.41
T_4	9.77	49.11	59.30	3.18	4.55	3.73	28.19	144.34	351.90	352.03	750.44
T_5	10.19	47.68	58.22	3.32	4.30	3.94	29.02	144.50	336.53	340.35	722.80
T_6	9.66	50.72	61.43	3.34	4.63	4.02	28.92	145.65	339.95	350.09	745.89
T_7	10.10	52.44	61.98	3.64	4.58	4.26	28.39	146.13	345.18	342.63	738.11
T_8	10.35	54.37	65.54	3.61	5.02	4.39	29.19	147.39	361.79	373.86	768.12
Sem (±)	**0.41**	**1.84**	**1.92**	**0.08**	**0.21**	**0.19**	**0.68**	**3.28**	**5.14**	**11.24**	**19.89**
LSD (0.05)	**1.24**	**5.56**	**5.80**	**0.24**	**0.64**	**0.58**	**2.05**	**9.90**	**15.56**	**33.54**	**59.35**

treatments T_2, T_3, T_4, T_5, T_6, T_7 and T_8 were statistically *at par* and there was no significant difference.

At 45 DAS the trend of variations among the treatments was more or less similar. The variation in dry matter accumulation due to foliar application of plant nutrients and growth regulator ranged between 82.35 (g m^{-2}) to 146.13 (g m^{-2}) and the difference was statistically significant at 5% level. All the treatments were significantly superior over T_1. The treatments T_2, T_3, T_4, T_5, T_6 and T_7 were statistically *at par*. At 60 DAS treatment T_8 recorded 361.79 (g m^{-2}) maximum dry matter accumulation and treatment T_1 recorded 232.61 (g m^{-2}) minimum. All treatments were significantly superior over T_1. The Treatment T_2, T_3, T_5 and T_7 were statistically *at par*. Treatment T_3 and T_4 are statistically *at par*. Treatment T_5 and T_6 differed significantly and T_6 was superior over T_5. Treatment T_7 and T_8 differed significantly and T_6 was superior over T_7.

Number of pods m^{-2}

In pulse crops number of pods m^{-2} is the most important determinant of grain or seed yield. The number of pods m^{-2} ranged from 198.31 in T_1 to 373.86 in T_8. In treatment T_8 recorded maximum number of pods m^{-2} was obtained and it was followed by T_4 and T_6; these treatments were, however statistically *at par*. Treatments T_5 and T_6 were statistically *at par*. Treatment T_8 was significantly better than T_7. The differences in pod number may be due to better utilization of resources in the plots receiving plant nutrients (Table 1). This result is in conformity with the findings reported by Dixit and Elamathi (2007).

Seed yield

Seed yield of the crop was distinctly influenced by the foliar application of nutrients and Brassinolide. The maximum seed yield 768.12 (kg ha^{-1}) was obtained in T_8 followed by 750.44 (kg ha^{-1}) in T_4 and 745.89 (kg ha^{-1}) in T_6. The minimum seed yield 398.56 (kg ha^{-1}) was obtained in T_1. The reduction in yield under the control treatments (*i.e.* in T_1 and T_2) may be attributed to reduced growth and number of pods per unit area. The average seed yield increased with increased number of application of nutrients and brassinolide. Crop performance was not good in the control treatment thus, the yields per hectare was significantly lower than that obtained in other treatments. This result in conformity with the findings reported by Fariduddin, 2004 (Table 1).

Foliar application of nutrients and Brassinolide has a distinct advantage over the control treatment. Application of DAP, urea and brassinolide on the foliage of summer green gram crop is a good management practice to obtain a higher crop yield. Spraying of nutrients is effective, more efficient, and requires less amount of fertilizer in comparison with surface application and thus it is certainly beneficial from practical point of view.

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