Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(3): 1754-1756
Received: 12-03-2020
Accepted: 16-04-2020

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Effect of foliar nutrition and plant growth regulators on growth of Blackgram (*Vigna mungo* L.)

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Abstract
A field experiment was conducted during *kharif* season of 2018 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj to study the growth of Blackgram (*Vigna mungo* L.) as influenced by foliar application of nutrients and plant growth regulators. The experiment comprised of Randomized Block Design with three replications and nine treatments. It consisted of foliar applied Urea at 2% and Micronutrient mixture (Zn, Fe, B and Mo) at 0.5% and Plant growth regulators such as NAA at 40 ppm, Brassinolide at 0.25 ppm, Salicylic acid at 50 ppm and Gibberellic acid at 50 ppm spraying at 25DAS and 45DAS. It was observed that the combination of Recommended Dose of Fertilizers (25-50-25kg N-P-K/ha), Urea at 2% and NAA at 40 ppm (T_1) was proved to be the best treatment for obtaining higher growth attributes such as Plant height (63.63 cm), No. of Branches (31.13), Root nodules (23.73), Plant dry weight (51.71 g), and higher Protein content (31.50%) was obtained in Blackgram variety ‘T-9 (improved)’ as compared to other treatments.

Keywords: Blackgram, foliar application, Urea, NAA

Introduction
Blackgram (*Vigna mungo* L.) is a widely grown grain legume and belongs to the family fabaceae. It is an N-fixing legume that improves soil fertility and soil physical properties (Parashar, 2006). *Vigna mungo* is responsive to P (40 kg/ha) and K (30 kg/ha) and only needs rough tillage and one or two weeding (Baligar *et al*. 2007). Many *Vigna mungo* cultivars exist, each one adapted to specific environmental conditions. The main producer of blackgram is India, which produces about 1.5 million tones of seeds annually (Sharma *et al*. 2011). India consumes its entire production. The other main producers (Myanmar and Thailand) are the major exporters.

Globally blackgram accounts for more than 40% of total legume seeds traded (CRN India, 2011). *Vigna mungo* seeds are mainly a staple food and the dehulled and split seeds (*dhal* in Hindi) are a common dish in South Asia. They can be ground into flour and used for making *papadum*, typical Indian flat bread. The seeds are normally too expensive to be used as a feed, even in areas of primary production (Rajaguru *et al*. 1985). Hence, there is a need for enhancement of the productivity of blackgram by proper agronomic practices. Several strategies have been initiated to boost the productivity of blackgram. Nutrients play a vital role in increasing the growth in pulses. Apart from the genetic makeup, the physiological factor *viz.*, insufficient portioning of assimilates, poor pod setting due to the flower abscission and lack of nutrient during critical stages of crop growth play a major role in declined blackgram production was coupled with a number of diseases and pests (Mahala *et al.* 2001). Foliar application is credited with the advantage of quick and efficient utilization of nutrients, elimination of losses through leaching, fixation and regulating the uptake of nutrients by plant (Manonmani and Srimathi, 2009) since foliar nutrients penetrate the leaf cuticle or stomata and enters the cells facilitating easy and rapid utilization of nutrients. Foliar application of nutrient and growth regulator at pre flowering and flowering stage was seen on reduction in flowering drop percentage in blackgram. Growth regulators can improve the physiological efficiency including photosynthetic ability and can enhance effective partitioning of accumulates from source and sink in the field crops (Solaimalai, *et al.* 2001) and also it improves the physiological efficiency and may play a significant role in raising the productivity of the crop (Dashora and Jain, 1994). Keeping the aspects in view, the present investigation entitled “Effect of Foliar Nutrition and Plant Growth Regulators on growth of Blackgram (*Vigna mungo* L.)” was carried out.

Materials and Methods

The field experiment was conducted to study the "Effect of Foliar nutrition and Plant growth regulators on growth and yield of Blackgram (*Vigna mungo* L.)" during *kharif* season of 2018, at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P) which is located at 25° 24' 42" N latitude, 81° 50' 56" E longitude and 98m altitude above mean sea level. This area is situated on the right side of the river Yamuna by the side of Prayagraj Rewa Road, about 5 km away from Prayagraj city. The experiment was conducted in Randomized Block Design (RBD) consisting of 13 treatments in combination with 3 replications and was laid out with a different treatment allocated randomly in each replication. Factor one consisted of Different use of foliar nutrient spray at 25 DAS and 45 DAS and factor two *i.e.*, Different use of Growth Regulators at 25 DAS and 45 DAS. The details of treatments were T_1: Urea + NAA at 40 ppm, T_2: Urea + Brassinolide at 0.25 ppm, T_3: Urea + Salicylic acid at 50 ppm, T_4: Urea + Gibberellic acid at 50 ppm, T_5: Micronutrient mixture + NAA at 40 ppm, T_6: Micronutrient mixture + Brassinolide at 0.25 ppm, T_7: Micronutrient mixture + Salicyclic acid at 50 ppm, T_8: Micronutrient mixture + Gibberellic acid at 50 ppm and T_9: Control. Recommended dose of fertilizers (25-50-25 kg N-P-K/ha) was applied to all the treatments. Irrigation was applied immediate after sowing and 3-5days after sowing. Data regarding growth and growth attributes *viz.*, Plant height (cm), number of branches/plant, number of Nodules/plant, leaf area index (LAI), Leaf area duration (days), plant dry weight (g/plant), Crop growth rate (CGR) (g/m^2/day) and Relative growth rate (RGR) (g/g/day) were taken at 15 DAS, 30 DAS, 45 DAS and 60 DAS. The data was statistically analyzed.

Results and Discussion

Growth attributing parameters

Plant height (cm)

Plant height of mungbean differed significantly due to plant growth regulator (Table 1).

At 60DAS, T_1 (Urea+ NAA at 40 ppm) recorded significantly higher plant height (63.63 cm) over rest of the treatments. However, T_3 (Urea + Salicylic acid at 50 ppm) recorded lower plant height (39.70 cm) respectively. Thus, the application of promotive substances increased the plant height.

Number of branches/plant

The data revealed that the effect of foliar application of nutrients increased the No. of branches. The application of Urea+ NAA at 40 ppm (T_1) at 60DAS recorded maximum number of branches/plant (31.13), which was significantly highest than rest of the treatments and The minimum number of branches/ plant (19.1) was recorded in T_8 (Micronutrient mixture + Gibberellic acid at 40 ppm) respectively.

Number of nodules/plant

At 60 DAS, T_1 (Urea + NAA at 40 ppm) recorded significantly highest number of root nodules per plant (23.73).However lower number of root nodules per plant were recorded in T_8 (Micronutrient mixture + Gibberellic acid at 40 ppm) of 16.67.

The root nodules of the plant were significantly increased with foliar application can be attributed to the fact that nutrients enhance plant vigour and strengthen the stalk. During this study we examined that these results also resemble the findings of Barik *et al*. (1994) who reported increase in number of nodules with foliar application of nutrients.

Plant dry weight (g/plant)

At 60 DAS, significant highest plant dry weight (51.71 g) was perceived in T_1 (Urea+ NAA at 40 ppm). However, T_4 (Urea + Gibberellic acid at 50 ppm) recorded the lowest dry weight (42.10 g) respectively. The growth regulator NAA is capable of redistribution of dry matter in the plant and there by bringing about an improvement in the yield potential. Kelaiya *et al.* also stated that NAA help to increase the plant dry weight.

Crop growth rate (g/m^2/day)

At 45-60 DAS, significant highest crop growth rate (2.60 g/m^2/day) was observed in T_2 (Urea+ Brassinolide at 0.25 ppm) and the lowest was recorded in T_9 (Control) 1.82 g/m^2/day respectively.

Relative Growth Rate (g/g/day)

At 45-60 DAS, significant highest relative growth rate (0.091 g/g/day) was observed in T_3 (Urea + Salicylic acid at 50 ppm) respectively.

Table 1: Effect of Foliar Nutrition and Plant Growth Regulators on growth of Blackgram at 60 DAS (Maximum vegetative growth)

Treatment	Plant height (cm)	No. of branches plant^{-1}	Number of nodules plant^{-1}	Dry weight (g/plant)	CGR (g/m^2/day)	RGR (g/g/day)
1	63.63	31.1	23.73	51.71	2.11	0.063
2	47.80	22.5	17.53	47.17	2.60	0.117
3	39.70	23.3	17.43	45.54	2.25	0.091
4	58.07	25.8	18.87	42.10	1.89	0.075
5	45.13	22.5	15.63	44.83	1.95	0.070
6	46.33	24.3	16.67	47.70	2.18	0.085
7	58.63	23.8	18.47	42.58	1.88	0.073
8	45.63	19.1	16.67	36.76	1.59	0.070
9	51.13	26.1	17.47	40.70	1.82	0.063
SEm.±	4.39	1.88	1.44	2.73	0.15	0.01
CD (P = 0.05)	13.15	5.63	4.31	8.17	0.44	0.02

Conclusion

The present investigation indicated that NAA and urea has a positive effect on blackgram growth. The highest plant height (63.63 cm), no. of branches (31.13), root nodules (23.73) and plant dry weight (51.71 g) were recorded in the treatment T_1 (Urea+ NAA at 40 ppm). Therefore, it can be concluded that the application of NAA increased the growth of Blackgram.

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