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Original Research Article

Responses of Blackgram (*Vigna mungo*) to Foliar Applied Plant Growth Regulators

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A B S T R A C T

Keywords

Gibberellic acid, Salicylic acid, CGR, RGR, Black gram, and Foliar application

The studies on growth regulation in blackgram cv. Narendra Urd-1 significant changes in growth, physiology and yield due to plant growth regulators. Foliar application of GA_3 concentration 50 ppm, 100 ppm and 150 ppm and salicylic acid concentration 100 ppm, 125 ppm and 150 ppm at different growth stages influenced growth characteristics by showing increased plant height, total number of branches, CGR, RGR, days to physiological maturity, total dry biomass and yield (q/ ha). Among the treatments salicylic acid resulted in higher dry biomass, total number of branches, RGR, days to physiological maturity and yield (q/ ha). Plant height was also found improved due to GA_3 application.
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Introduction

Out of the major pulse crops in India, Black gram occupies important place. Blackgram is a perfect combination of all nutrients which include 20 to 25% proteins, 40 to 47% starch, ash fats, carbohydrates and essential vitamins. All India area, production and productivity of Black gram was 3.11 m ha, 1.90 m tones and 611 kg/ha, respectively, during 2012-13 (Anonymous, 2014).

The average productivity of pulses in India is 611 kg/ ha compares poorly with high levels of productivity in other countries. According to prospective planning, India would need around 30.3 million tonnes of pulses in 2020 AD. On the basis of food characteristic demand system the demand projection for pulses for year 2005, 2010 and 2015 are 20.0, 23.3 and 27.0 million tonnes, respectively (Chaturvedi and Ali, 2002).

Growth regulators can improve the physiological efficiency including photosynthetic ability and can enhance effective partitioning of the accumulates from source and sink in the field crops (Solaimalai, *et al* 2001). Foliar application of growth regulators and chemicals at the flowering stage may improve the physiological efficiency and may play a significant role in raising the productivity of the crop (Dashora and Jain, 1994). foliar application of either amino acids or phenolics significantly promoted the growth parameters in terms of shoot height, fresh and dry biomass, number of branches and number of umbels per plant in *Ammi visnaga* L. (Iman M. Talaat,*et al* 2014).

Plant growth regulators like salicylic acid (SA) and gibberellic acid (GA3) are recognized endogenous regulator of plant metabolism, which mainly involved in biotic and abiotic stress (Aydin and Nalbantoglu, 2011). The gibberellins are a large family of tetra cyclic diterpenoid plant growth substances. The function of GA as a hormone in regulating plant growth was known as early as the 1950s (Brian and Hemming, 1955; Vlitos and Meudt, 1957). Salicylic acid is ortho-hydroxybenzoic acid and is a secondary metabolite acting as analogous of growth regulating substances. Foliar application of salicylic acid exerted a significant effect on plant growth metabolism when applied at physiological concentration, and thus acted as one of the plant growth regulating substances (Kalarani, et al; 2002). SA increases cell metabolic rate (Amin et al 2007). Foliar application of SA and GA3 at different doses under different salinity conditions had the positive effects related to mitigation of salinity stress effect but low concentration (M. I. Hossain, et al2015).

Materials and Methods

The experiment was conducted in the Student Instructional Farm (SIF) Narendra Deva University of Agriculture & Technology, Kumarganj Faizabad (U.P.) under natural condition during *Zaid* season of 2011-12. The experimental design was randomized block design with seven treatments and three replications. Nitrogen, phosphorus, potassium and sulphur were applied in the ratio of 20:40:20:20 as basal dose through urea, single superphosphate, muriate of potash and sulfex-80-WP, respectively. Seeds were sown in field on at distance of 30 x 10 cm. Thinning was done at 14 DAS to maintain proper distance plant to plant. Irrigation was done as per requirement. The treatments consisted of foliar spray of different plant growth regulators i.e., GA_3 (50 ppm, 100 ppm and 150 ppm) and salicylic acid (100 ppm, 125 ppm and 150 ppm) with control (water spray) in blackgram cv. NDU-1. The observations were recorded on growth at different growth stages and yield at harvest stage.

To record data on growth parameters, plant samples were collected at 25, 40, 55 DAS and maturity. Every time selected plants were uprooted carefully to minimize loss of roots. The root systems were washed with running tap water to remove adhering soil and blotted with blotting paper to remove excess water. Plant was oven dried at 80 ± 2^0C for 48 hours and the dry weight of each component was recorded. Crop growth rate (CGR) was computed using the formula-1 as

$$CGR = \frac{W_2 - W_1}{t_2 - t_1} \times \frac{1}{L} \quad g/m^2/day$$

Relative growth rate (RGR) was computed using the formula as

$$RGR = \frac{\text{Log e } W_2 - \text{Log e } W_1}{(t_2 - t_1)} \quad mg/g/day$$

Where, W_1 = total plant dry weight at time T_1, W_2 = total plant dry weight at the time T_2 and L= ground area.

The height of the plants was ascertained by measuring with a scale placed from ground level to top of the leaves. Total number of branches per plant were recorded at each harvest. The crop was harvested on 8th July 2011 and seed yield was recorded.

Results and Discussion

Plant height increased significantly due to the application of plant growth regulators. Among these, GA_3 recorded maximum plant height when applied at the rate of 150 ppm at 40 DAS, 55 DAS and at maturity followed by T_6 (GA_3 100 ppm foliar spray at 40 DAS, 55 DAS and at maturity). Similar result related to increase in plant height were also reported by Chauhan *et al* (2009) in black gram, Islam *et al* (2010) in black gram and Fawzy *et al* (2011) in Snap bean. The application of salicylic acid applied as foliar spray (100 ppm, 125 ppm and 150 ppm) at different growth stages (25, 40, 55 DAS and at maturity) decreases the plant height in comparison of GA_3 foliar application but it was higher with respect to control.

The data indicated that the effect of plant growth regulators had significant influence on total number of branches.

Among the treatments, the total number of branches increase significantly at different growth stages (40 DAS, 55 DAS and at maturity). The maximum number of branches was observed in T_4 treatment (salicylic acid foliar spray 150 ppm at 40, 55 DAS and at maturity) followed by T_3 treatment (foliar spray of salicylic acid 125 ppm at 40, 55 DAS and at maturity). The minimum number of branches was showed by treatment T_7 (GA_3 150 ppm as foliar spray at 40, 55 DAS and at maturity) over control. Similar findings related to higher number of branches were also reported by Reddy *et al* (2002), Farouk and Osman (2011) and Fawzy *et al* (2011).

Among the treatments, maximum crop growth rate was found in T_4 (SA 150 ppm foliar spray at 25 DAS) followed by T_3 (SA 125 ppm foliar spray at 25 DAS) at 25-40 DAS and at 40-55 DAS maximum CGR was found in treatment T_3 (SA 125 ppm foliar spray at 40 and 55 DAS) over control. Plant growth regulators significantly increases crop growth rate.

GA_3 increased the CGR in present investigation. Similarly, Katiyar, (1988) the CGR increased at all the treatments over control in chickpea and Sarkar *et al* (2002) were observed that CGR influenced by the application of the growth regulators.

According to the present investigation the maximum RGR was noticed in treatment T_3 (SA 125 ppm foliar spray at 25 DAS) at 40-25DAS and T_5 (GA3 50 ppm foliar spray at 40 DAS) at 55-40 DAS over the control.

Similarly, Sarkar *et al* (2002) was observed that physiological characters like CGR, RGR are influenced by plant growth regulators in soybean.

The maximum dry biomass was observed in T_7 (GA_3 150 ppm foliar spray at 25 DAS) followed by T_5 (GA_3 50 ppm foliar spray at 25 DAS) at 40 DAS, 55 DAS and at maturity maximum dry biomass showed in treatment T_4 (SA 150 ppm foliar spray at 40, 55 and at maturity). The results are in agreement with the findings of khan *et. al*., (2003) in soybean, Ngatia et. *al.*, (2004) and Pradeep Kumar Patel *et. al*., (2012) in chickpea.

Table.1 Effect of plant growth regulators on plant height, crop growth rate (CGR) and relative growth rate (RGR) of black gram at different growth stages.

Treatments	Plant height (cm)				CGR (mg cm^{-2} day^{-1})		RGR (mg g^{-1} day^{-1})	
	25 DAS*	40 DAS	55 DAS	At maturity	40-25 days	55-40 days	40-25 days	55-40 days
T_1	10.68	15.82	22.38	39.53	0.0680	0.0773	0.0437	0.1344
T_2	11.13	17.13	28.82	48.97	0.0681	0.0880	0.0477	0.1432
T_3	10.67	17.69	29.54	51.62	0.0689	0.0929	0.0493	0.1463
T_4	11.25	18.74	31.65	54.87	0.0750	0.0909	0.0464	0.1513
T_5	10.54	20.95	35.78	57.65	0.0677	0.0824	0.0454	0.1576
T_6	10.37	22.85	37.85	59.47	0.0697	0.0786	0.0441	0.1542
T_7	11.21	24.47	39.36	64.53	0.0435	0.0582	0.0455	0.1425
SEm±	_	1.131	1.183	1.891	**0.0009**	**0.0049**	**0.0009**	**0.0027**
CD at 5%	–	3.432	3.589	5.737	**0.0029**	**0.0149**	**0.0026**	**0.0083**

Note-Data at the time of first spraying (25 DAS*)

Table.2 Effect of plant growth regulators on total number of branches, days to physiological maturity, seed yield and dry biomass of black gram.

Treatments	Total number of branches			Days to physiological maturity	Seed yield (q ha^{-1})	Total dry biomass (g) plant^{-1}			
	40 DAS	55 DAS	At maturity			25 DAS*	40 DAS	55 DAS	Maturity
T_1	3.20	8.70	14.80	68.50	10.28	0.827	4.500	8.670	20.540
T_2	4.30	10.80	17.60	71.60	11.87	0.852	4.532	9.284	21.944
T_3	4.30	11.30	18.90	72.30	12.38	0.827	4.548	9.563	23.834
T_4	4.50	11.70	19.70	73.70	12.533	0.783	4.831	9.738	24.763
T_5	4.00	10.80	17.30	69.50	11.54	0.861	4.517	8.967	21.730
T_6	3.50	10.30	16.70	69.70	11.13	0.749	4.513	8.756	21.630
T_7	2.50	7.90	12.50	67.50	9.46	0.865	3.214	6.358	18.840
SEm±	0.235	0.639	0.768	0.775	0.293	-	0.207	0.519	0.577
CD at 5%	0.712	1.938	2.329	2.350	**0.888**	-	0.628	1.575	1.749

The maturity duration were markedly and significantly increased by different treatments with respect to control. Maximum days to physiological maturity was recorded with treatment T_4 (SA 150 ppm foliar spray at 25, 40 and 55 DAS), whereas the minimum days to physiological maturity among the treatments was recorded in treatment T_7 (GA_3 150 ppm foliar spray at 25, 40 and 55 DAS) with respect to control. Similar findings was reported by Khan *et al* (2008) data regarding days to crop maturity, treatments significantly affected the days to crop maturity in mungbean genotypes, similar result reported by Patel *et. al*., (2012) on chickpea, SA has a significant response in 50% flowering and 50% podding.

Maximum seed yield (q) per hectare was recorded in T_4 (SA 150 ppm). While, minimum seed yield (q) per hectare was recorded with treatment T_7 (GA_3 150 ppm) over the control. These results were strongly supported by Reddy *et al* (2002) noted that the effect of salicylic acid in mung bean recorded higher seed yield. Mandavia *et al* (2006) reported the effect of salicylic acid on chickpea increased the seed yield. Ghulam murtaza et al (2007) reported that all the yield and yield components was increase in pea plant treated with salicylic acid. Pradeep kumar patel *et al* (2012) noted that the yield was increased by the application of salicylic acid on chickpea.

Thus, it can be concluded from the present study that application of salicylic acid and GA_3 as foliar spray at 25, 40 and 55 DAS improve the physiological efficiency of crop and result in better growth and yield of black gram cv. NDU-1. The present findings indicate possibility of use of PGRs in enhancing productivity of urd bean by improving parameters responsible for yield.

References

All India Coordinated Research Project on MuLLaRP crops. *Annual Group* Meet, *Zaid*, 2014.

Amin A.A., Rashad M., El-Abagy H.M.H. Physiological effect of indole-3-butyricacid and salicylic acid on growth, yield and chemical constituents of onion plants. J. Appl. Sci. Res. 2007;3: 1554–1563.

Aydin, B. and B. Nalbantoglu. 2011. Effects of cold and salicylic acid treatments on nitrate reductase activity in spinach leaves. Turk. J. Biol. 35: 443-448.

Brian, P.W. and Hemming, H.G. (1955). The effect of gibberellic acid on shoot growth and development. *Physio plant*, 8: 669-681.

Chaturvedi, S.K. and Ali, M. (2002). Area and Production of pulses in India. Survey of Indian Agric. *The Hindu India*, pp. 62-69.

Dashora, L.D. and Jain, P.M. (1994). Effect of growth regulators and phosphorus levels on growth and yield of soybean. *Madras Agric. J.*, 81: 235-237.

Farouk, S. and Osman, M.A. (2011). Effect of plant defense elicitors on common bean (*Phaseolus Vulgaris* L.) growth and yield in absence or presence of spidermite infestation. *Journal of stress physiology and Biochemistry*, Vol. 7 No. 3 2011, pp. 05-22 ISSN 1997-0838.

Fawzy, Z.F.; El-Bassinoy, A.M.; El-Nemr, M.A. and El-Desuki, M. (2011). Improvement growth, yield and quality of two snap bean (*Phaseolus vulgaris* L.) varieties using some growth regulators. *Journal of Applied Sciences Research*, 7(12): 2047-2055.

Ghulam, M.; Rehana, A.; Shahbaz, A. and Syed, M.A. (2007). The yield and yield components of pea (*Pisum sativum* L.) as influenced by salicylic acid. *Pak.J. Bot*., 39(2): 551-559.

Iman M. Talaat,[a]Hemmat I. Khattab,[b] and Aisha M. Ahmed[a] (2014). Changes in growth, hormones levels and essential oil content of *Ammi visnaga* L. plants treated with some bioregulatorsSaudi J Biol Sci. Sep; 21(4): 355–365.

Islam, M.R.; Prodhan, A.K.M.A.; Islam, M.O. and Uddin, M.K. (2010). Effect of plant growth regulators (GABA) on Morphological Characters and yield of Blackgram (*Vigna mungo* L.). *J. Agric. Res*., 48(1): 97-101.

Kalarani, M.K.; Thangaraj, M.; Sivakumar, R.; Anbumani, B.; Suresh, T. and Arumugan, K. (2001). Role of plant growth regulators in rice production: A review. *Agric. Rev.*,22:33-40.

Katiyar, R.P. (1980). Development changes in leaf area index and other growth parameters in chickpea. *Indian J. Agric. Sci.*,50: 684-691.

Khan, W.; Balakrishnan, P. and Smith, L.D. (2003). Photosynthetic responses of corn and soybean to foliar application of salicylates. *Journal of Plant* physiology, 160: 485-492.

M. I. Hossain, M. A. Mannan and M. A. Karim (2015). Salicylic acid and gibberelic acid ameliorates the adverse effects of salinity on chickpea. Bangladesh agron. J., 18(1): 81-88

Mandavia, M. K.; Karkar, C.; Mandavia, C. and Khasiya, V. (2006). Effect of Salicylic acid and brassinolide on yield and quality traits of chickpea seeds. *Indian Journal of Agricultural Biochemistry*,19 (1): 29-31.

Ngatia, T.M.; Shibairo, S.I.; Emonger, V.E. and Obukosia, S.D. (2004). Effect of levels and timing of application of gibberellic acid on growth and yield components of common bean. *African Crop Science Journal*,12(2): 123-131.

Patel, P.K. and Hemantaranjan, A. (2012). Salicylic Acid Induced Alteration in Dry Matter Partitioning, Antioxidant Defence System and Yield in Chickpea (*Cicer arietinum* L.) under Drought Stress. *Asian Journal of Crop Science*, 4: 86-102.

Pulak, S.K.; Haque Shahidul, Md. and Karim Abdul, M. (2002). Effects of GA_3 and IAA and their frequency of application on morphology, yield contributing characters and yield of soybean. *Pakistan Journal of Agronomy*,1(4): 119-122.

Reddy, P.J.; Rao, K.L.M.; Rao, C.L.M. and Mahalakshmi, B.K. (2003). Effect of different chemicals on growth, yield and yield attribute of pigeonpea in vertisols. *Ann. Plant Physiol.*,17(2): 120-124.

Vlitos, A.J. and Meudt, W. (1957). Relationship between shoot apex and effect of gibberellic acid on elongation of pea stem. *Nature*,18