IJPS INTERNATIONAL JOURNAL OF PLANT SCIENCES
Volume **8** | Issue 2 | July, 2013 | 276-279

RESEARCH ARTICLE

Physiological basis for increasing the yield of blackgram on yield parameters under the influence of brassinosteroids

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SUMMARY

The present investigation entitled physiological basis for increasing the yield of blackgram (*Vigna mungo* L.) on yield parameters under the influence of brassinosteroids was undertaken at the Agricultural College Farm, Bapatla during *Kharif* 2011-12. The treatments comprised of foliar spray of brassinosteroids @ 0.025 mg L^{-1}, 0.05 mg L^{-1}, 0.075 mg L^{-1}, 0.1 mg L^{-1} at vegetative, pod development and vegetative + pod development stages. Besides these, water spray is maintained in RBD with three replications. Application of brassinosteroids @ 0.1 mg L^{-1} at vegetative + pod development stage resulted maximum increase in plant height (35.3 per cent) than control. Spraying of brassinosteroids @ 0.1 mg L^{-1} at vegetative + pod development stage resulted in highest increase of leaf area, dry weight at the rate of 56.2 and 97 per cent, respectively, indicating its positive impact in accumulating dry matter. Foliar spray of brassinosteroids significantly increased the yield and yield attributes especially in the sprays at both stages. The grain yield per plant, 100 seed weight, harvest index recorded higher with the two sprays compared to alone sprays at vegetative or pod development stage. However, spray of brassinosteroids @ 0.1 mg L^{-1} at vegetative + pod development stage recorded highest net returns of Rs. 38,235.17 and C-B ratio (1:2.68) and proved superior to the rest of the treatments.

Key Words : Brassinosteroids (BR), Homobrassinolide (HBR),Growth, Total dry matter, Yield, Blackgram

How to cite this article : Rao, M. Jaganmohan and Rani, P. Sandhya (2013). Physiological basis for increasing the yield of blackgram on yield parameters under the influence of brassinosteroids. *Internat. J. Plant Sci.,* **8** (2) : 276-279.

Article chronicle : Received : 26.10.2012; **Revised :** 16.02.2013; **Accepted :** 20.04.2013

Blackgram [*Vigna mungo* (L.) Hepper] is the fourth important pulse crop in India and second most important in Andhra Pradesh in terms of extent of cultivation. Blackgram is commonly known as urdbean or mash is cultivated throughout the country occupying about 3.6 M.ha area and producing about 1.46M.t(Survey of Indian Agriculture, 2010).

Blackgram is cultivated mainly in Andhra Pradesh, Uttar Pradesh, Bihar, Madhya Pradesh and West Bengal in both *Kharif* and *Rabi* seasons. The production of blackgram in Andhra Pradesh is 2.5 lakh tonnes from an area of 3.56 lakh hectares during 2010-11(India stat, 2011). Blackgram is grown during *Rabi* season in Krishna, Prakasam, Nellore, Guntur, Khammam, East and West Godavari on receding soil moisture conditions in Andhra Pradesh.

To raise the yield potential under such a situation, in addition to the development or identification of cultivars, there is a need to work out a technological/management strategy including the application of bio-regulators. Applying growth regulators may modify morphological characteristics of plant and may also induce better adaptation of plant to environment which improve the growth and yield.

Brassinosteroids (BRs) are considered as sixth group of phytohormones with significant growth promoting activity as they influence varied developmental processes like growth, germination of seeds, rhizogenesis, flowering and senescence. Brassinosteroids also confer resistance to plants against various abiotic stresses. Brassinosteroids are now receiving a great deal of international attention towards improving crop production. Foliar spraying of brassinolide, 28-homobrassinolide and 24 - epibrassinolide increased the yields in many crops like rice, wheat, corn, legumes, groundnut, radish, lettuce, mustard,

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watermelon, cucumber, tobacco and grapes etc. Many reports are available on the foliar application of brassinosteroids significantly improved the growth, dry matter production and yield under moisture deficit conditions and ameliorates the adverse effects of abiotic stresses (Bajguz and Hayat, 2009).

MATERIAL AND METHODS

Blackgram seed (LBG-20) was sown in black clay loam soil on August 2011 at Agricultural College Farm, Bapatla. The average temperature during the crop period varied from 31.4^{0}C to 37.0^{0}C during 2011-2012. The total amount of rainfall received during the crop duration was 399.9 mm. The plot area was 16 m^2 (4×4 m), 30 cm apart in rows and 10 cm apart between plants along the row. The plants were sprayed at 20 DAS and 50 DAS with the 28-homobrassinolide @ 0.025 mg l^{-1}, 0.05 mg l^{-1}, 0.075 mg l^{-1}, 0.1 mg l^{-1} at different stages of the crop period. Control treatment was sprayed with water at the same period. The experiment was arranged as Randomized Block Design with three replications and thirteen treatments *viz*., brassinosteroid @ 0.025 mg l^{-1} at vegetative stage (T_1), brassinosteroid @ 0.05 mg l^{-1} at vegetative stage (T_2), brassinosteroid @ 0.075 mg l^{-1} at vegetative stage (T_3), brassinosteroid @ 0.1 mg l^{-1} at vegetative stage (T_4), brassinosteroid @ 0.025 mg l^{-1} at pod development stage (T_5), brassinosteroid @ 0.05 mg l^{-1} at pod development stage (T_6), brassinosteroid @ 0.075 mg l^{-1} at pod development stage (T_7), brassinosteroid @0.1 mg l^{-1} at pod development stage (T_8), brassinosteroid @ 0.025 mg l^{-1} at vegetative stage+ pod development stage (T_9), brassinosteroid @ 0.05 mg l^{-1} at vegetative stage+ pod development stage (T_{10}), brassinosteroid @ 0.075 mg l^{-1} at vegetative stage+ pod development stage (T_{11}), brassinosteroid @ 0.1 mg l^{-1} at vegetative stage+ pod development stage (T_{12}), water spray (control) (T_{13}) in three replications. Nitrogen and phosphorus were applied as per the recommendation (20 kg N and 50 kg P_2O_5 ha^{-1}) to the experimental plots before sowing of crop. The data were collected at regular intervals and analyzed, the tabled data at harvesting are represented in Table 1and 2. The following growth characteristics were measured. Plant height, leaf area and total dry matter production. Yield and its components and harvest index (HI) were determined at harvesting stage. Cost Benefit ratio was also calculated. The data were analyzed statistically following analysis of variance (ANOVA) technique suggested by Panse and Sukhathme, (1967) for Randomized Block Design.

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Growth characteristics :

Data presented in the Table 1 show that vegetative growth characters of blackgram like plant height, leaf area plant^{-1}, total dry matter were significantly increased as a result of foliar application of brassinosteroids. Plant height increased significantly with the spray of brassinosteroids at vegetative stage, pod development stage and vegetative + pod development stage. This effect of increment in the growth characters could be attributed to brassinosteroid effect on physiological processes in plants such as ion uptake, cell elongation, cell division, sink/source regulation, enzymatic activities, protein synthesis and photosynthetic activity. The

Table 1: Effect of brassinosteroids on morpho-physiological characters of blackgram at harvesting stage (7 days)

Treatments	Plant height (cm)	La/plant (cm^2)	Total leaf dry weight (g)	Total stem dry weight (g)	Total pod dry weight (g)	Total dry matter (g)
T_1	33.20	320.97	4.65	5.23	5.11	14.14
T_2	34.17	337.67	4.88	5.37	5.14	15.86
T_3	34.30	340.93	5.10	5.56	5.28	17.59
T_4	36.47	359.43	5.51	5.77	5.41	18.73
T_5	36.43	335.97	4.72	5.42	5.14	16.29
T_6	37.37	344.40	4.91	5.58	5.19	16.68
T_7	37.93	353.90	5.18	5.76	5.27	17.43
T_8	39.83	372.40	5.77	5.98	5.55	18.02
T_9	36.23	383.67	5.26	7.06	5.29	17.32
T_{10}	38.87	417.07	5.77	7.25	5.35	18.96
T_{11}	39.80	424.50	6.14	7.54	5.47	21.21
T_{12}	43.07	436.13	6.93	7.72	5.66	24.66
T_{13}	29.83	280.00	3.90	4.35	4.88	12.48
S.E.$\pm$	0.302	1.302	0.134	0.103	0.094	0.173
C.D.	0.88	3.80	0.39	0.30	0.28	0.50
C.V. (%)	8.62	11.85	10.08	7.24	7.10	7.12

Table 2: Effect of brassinosteroids on yield and yield components of blackgram

Treatments	No. of pods plant $^{-1}$	No. of seeds pod $^{-1}$	100 seed weight (g)	Seed yield (kg ha $^{-1}$)	Harvesting index (%)	Cost benefit ratio
T_1	18.90	5.07	4.06	1288.97	26.00	2.21
T_2	19.33	5.13	4.11	1344.93	26.23	2.27
T_3	19.67	5.33	4.17	1459.73	27.60	2.43
T_4	20.33	5.53	4.24	1583.10	28.67	2.60
T_5	19.53	5.30	4.04	1384.47	26.10	2.37
T_6	19.93	5.53	4.09	1493.07	27.37	2.52
T_7	20.33	5.67	4.13	1575.87	28.33	2.58
T_8	20.93	5.80	4.22	1625.27	28.97	2.64
T_9	20.60	5.60	4.17	1603.20	28.03	2.60
T_{10}	21.20	5.87	4.23	1676.47	28.73	2.65
T_{11}	21.40	5.93	4.36	1713.70	29.43	2.66
T_{12}	21.93	6.00	4.44	1752.43	30.60	2.68
T_{13}	18.07	4.80	3.82	1091.20	25.03	1.95
S.E.±	0.231	0.135	0.099	1.648	0.282	-
C.D.	0.67	0.40	0.29	4.81	0.82	-
C.V. (%)	8.90	9.99	8.41	7.35	9.28	-

present results are in harmony with Kalinch *et al*.(1985) in *Phasiolus aureus* and *Phasiolous vulgaris* , (Prakash *et al*., 2008) in sesame, Talaat and Abdallah (2010) in faba bean. The leaf area plant $^{-1}$ was increased significantly increased by brassinosteroid application (Ali *et al*., 2008). The above results are in support with the findings of Fariduddin *et al*. (2003) in greengram and Prakash *et al*.(2008) in sesame. The higher dry matter production was due to increased photosynthesis favored by both photosynthetic efficiency and photosynthetic transport, (Sengupta *et al*., 2009; Sandhya Rani, 2010 in greengram crop).

Yield and its components :

Data in Table 2 show that yield and its components such as number of pods plant $^{-1}$, number of seeds pod $^{-1}$, 100–grain weight, seed yield (kg ha $^{-1}$) and harvest index (HI) were determined at harvesting stage significantly enhanced with foliar application of brassinosteroids, compared to control. It is appearent from the results that spray of brassinosteroids @ 0.1 mg l $^{-1}$ at vegetative + pod development stage showed higher yields compared to other treatments and control. Maximum number of pods plant $^{-1}$ (21.93), seeds pod $^{-1}$ (6.00 seeds pod $^{-1}$), 100 seed weight (4.44 g)was observed in the spray of brassinosteroids @ 0.1 mg l $^{-1}$ at vegetative + pod development stage. 100 grain weight was significantly high in all treatments than control. Highest grain yield (1752.43 kg ha $^{-1}$) was recorded with the spray of BR @ 0.1 mg l $^{-1}$ at vegetative + pod development stage which was about 60.5 per cent higher to control plants followed by BR @ 0.075 mg l $^{-1}$ at vegetative + pod development stage (1713.70 kg ha $^{-1}$). The generation of such responses in the plants by hormone (HBL) was possible due to a cumulative expression of accelerated rate of nitrate assimilation, protein synthesis, preferential translocation of photosynthates to the sink and delayed leaf senescence. The healthy growth obviously had an input on the productivity (Sandhya Rani, 2010). The above results are in harmony with findings of Kamal *et al*. (1995) where the BR application increased the seed and pod numbers in soybean. Foliar application of brassinolide at 0.1 ppm significantly increased the yield and yield attributing characters like number of pods, pod weight, yield and harvest index. The increase in yield was 62 per cent over the control. The increased yield might be due to increase in translocation of photosynthate by BL treatment. Significant increase in DNA, RNA and protein in BR treated mungbean and beans resulted in transcription and replication leading to increase in enzyme activities during tissue growth (Kalinich *et al.*, 1985).

REFERENCES

Ali, B., Hasan, S. A., Hayat, S., Hayat, Q., Yadav, S., Fariduddin, Q. and Ahmad, A. (2008). A role for brassinosteroids in the amelioration of aluminium stress through antioxidant system in mung bean [*Vigna radiata* (L.) Wilczek]. *Environ. & Exp. Bot.*, **62** : 153–159.

Bajguz, A. and Hayat, S. (2009). Effects of brassinosteroids on the plant responses to environmental stresses. *Plant Physiol. & Biochem.*, **47**: 1-8.

Fariduddin, Q., Ahmad, A. and Hayat, S. (2003). Photosynthetic response of *Vigna radiata* to pre-sowing seed treatment with 28-homobrassinolide. *Photosynthetica*, **41** (2): 307-310.

Kalinich, J.E.,Mandava,N.B.and Todhunter,J.E. (1985). Relationship of nucleic acid metabolism to brassinolide-induced responses in bean. *J. Plant Physiol.*,**125**: 345-354.

Kamal, M.R., Garmabi, H., Hozhabr, S. and Arghyris, L. (1995). The development of laminar morphology during extrusion of polymer blends, *Polym. Eng. Sci*., **35**: 41-51.

Panse, V.G. and Sukhatme, P.V. (1978). *Statistical methods for agriculture workers*. Indian Council of Agriculture Research Publications .

Prakash, M., Suganthi, S., Gokulakrishnan, J. and Sabesan, T. (2008). Effect of homobrassinolide on growth, physiology and biochemical aspects of sesame. *Karnataka J. Agric. Sci*., **20** (1): 110-112.

Sandhya Rani, P. (2010). Effect of brassinosteroids on of greengram crop (*Vigna radiata* L.). *Internat. J.Plant Sci.*, **5**(1): 118-121.

Sengupta, K., Mitra, S. and Ray, M. (2009). Effect of brassinolide on growth and yield of summer greengram crop. *Indian Agric.*, **53** (3 & 4): 155-157.

Talaat,N.B.and Abdallah, A.M. (2010). Effect of 28-homobrassinolide and 24-epibrassinolide on the growth, productivity and nutritional value of two faba bean (*Vicia faba* L.) cultivars. *Archives Agron.& Soil Sci.*, **56**(6): 649-669.

■ Webliography

India stat (2010). *http://www.indiastat.com*/agriculture/2/stats.aspx.