research article | International Journal of Plant Sciences, (January to June, 2010) Vol. 5 Issue 1 : 118-121

Eeffect of brassinosteroids on of greengram crop(*Vigna radiata* L.)

P. SANDHYA RANI

Accepted : September, 2009

SUMMARY

Brassinosteroids (BRs) are now widely accepted as essential regulators of plant growth as they play a key role in a variety of developmental processes,including cell elongation,vascular differentiation and fruit ripening (Clouse and Sasse 1998, Symons *et al.*, 2006).The experiment was laid out in randomized block design with three replicacations.Seven treatments were assigned to experimental units at random.in the redsoils of Pakasam district,Andhra Pradesh where the soils are poor. The HBL was serially diluted to 2.5ppm, 5.0ppm, 7.5ppm, 10.0ppm, 12.5ppm, 15.0ppm and water spray(control).Plant samples were collected at vegetative stage *i.e.*,at 15 days 30days, 45days of the crop.Final yield data was collected at at maturity with 5 plants from each plot and recorded. The HBL favoured the total drymatter production,no.of pods per plant.The lean vegetative growth of plants resulting from the foliar spray of water(control) gave poor yields may be due to limited transport of assimilatesto the sink.However,HBLs alone improved the seed yield which was highest in treatment where greengram plants were sprayed with 7.5ppm of Homobrassinolides yielding 1025 kg/ha. The treatment T_4 followed the effect where the plants were sprayed with 100ppm of HBL yielding 955 kg/ha. of seed followed by T_2 where the greengram plants were sprayed with 7.5ppm of foliarspray of HBL yielding 947 kg/ha.of seed.The seedweigh was high in T_3>T_4>T_2>T_5 *i.e.*, 4.1gm, 4.0gm, 3.8gm, 3.2gm, respectively.Along with the test weight, no, of pods per plant recorded highest *i.e.*, 38 in T_3 followed by T_4 *i.e.*, 33,followed by T_2 *i.e.*, 24.The generation of such responce in the plants by the harmone (HBL)was possible due to a cumulative expressinon 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.

Key words : Homobrassinols -HBLs, Brassinosteroids (BRs)

Brassinosteroids (BRs) have been suggested to increase the resistance of plants to a variety of stresses, including water stress.This is based on application studies, where exogenously applied bioactive BRs have been shown to improve various aspects of plant growth under water stress conditions. Brassinosteroids are now widely accepted as essential regulators of plant growth as they play a key role in a variety of developmental processes,including cell elongation,vascular differentiation and fruit ripening (Clouse and Sasse, 1998, Symons *et al.*, 2006).Numerous studies have also reported that BRs are able to increase the plants ability to cope with stress,such as water stress, salt stress and pathogen attack (Krishna, 2003), although the mechanisms by which BRs modulate plant stress responses are not yet understood.

The majority of research focusing on BR-mediated stress responses has involved simple application studies such as spraying plants with BRs.Application of BRs has resulted in reduced phytophthora infections in potato increased resistance to viral pathogens,fungi and/or disease in tobacco (Nakashita *et al.*, 2003) and tomato (Krishna,2003); a reduced inhibitory effect of salinity on seed germination in rice (Anuradha and Rao, 2001) and an increased tolerance of lethal heat treatment in *Brassica napus* and tomato seedlings (Dhaubhadel *et al.*,1999).Various studies have also reported that BR applications increase water stress tolerance. Water stress tolerance is one of the most common environmental stresses that affects plant growth and development.A deficit of water leads to various alterations in plants,including stomatal closure, leaf abscission and changes in the composition of the cell wall or plasma membrane and can result in a decline in growth as photosynthesis and turgor are decreased.A study involving cucumber (*Cucumis sativus)* showed that plants sprayed with a synthetic BR, 24-epibrassinolide (EBR), had improved resistance to dehydration,as EBR treated leaves retained more water than the controls after drought. Another study, using sugar beet (*Beeta vulgaris)* showed that BR treatment fully compensated for the reduction in taproot mass normally caused by mild drought stress (Schilling *et al.*, 1991).A BR application resulting in increases in relative water content (RWC), nitrate reductase activity,chlorophyll content and photosynthesis under water stress conditions (Sai ram,1994).

Recently it has been shown that EBR –treated *Arabidopsis* and *B.napus* seedlings had a higher survival rate when subjected to drought (Kagale *et al.*, 2007) and that BR-treated sorghum (*Sorghum vulgare*) showed

Correspondence to:
P. SANDHYA RANI, Agricultural Research Station, Darsi, PRAKASAM (A.P.) INDIA

increased germination and seedling growth under osmotic stress.In legumes,exogenous BRs have also been reported to increase drought tolerance in *Phaseolus vulgaris* and can control stomatal aperture in Vicia faba (Haubrick *et al.*, 2006).It has therefore been suggested (Catala *et al.*, 2007) that normal responses to drought may involve an increase in BRs levels and these authors suggested that this should be examined.

MATERIALS AND METHODS

The experiment was laid out in randomized block design with three replicacations.Seven treatments were assigned to experimental units at random.in the redsoils of Pakasam district,Andhra Pradesh.The HBL was serially diluted to 2.5ppm, 5.0ppm, 7.5ppm, 10.0ppm, 12.5ppm, 15.0 ppm and water spray (control).Plant samples were collected at vegetative stage *i.e.*, at 15 days 30 days, 45 days of the crop.Final yield data was collected at maturity with 5 plants from each plot and recorded.

Biometric observations:

The biometric observations were recorded on five plants selected randomly in plots. Plant height (cms), root length (cms) drymatter production (kg/ha), no.of branches/plant, no.of seeds/pod, no.of filled seed/pod,100 seed weight (g) and final yield per hectare was recorded. The data obtained from the present investigations were subjected to statistical analysis following the methods of Panse and Sukhatme (1967).

Treatments:

T_1-Foliar application of brassinosteriods spray @ 2.5ppm and RDF of NP, T_2-Foliar application of Brassinosteriods spray @ 5.0ppm and RDF of NP, T_3-Foliar application of brassinosteriods spray @ 7.5ppm and RDF of NP, T_4-Foliar application of brassinosteriods spray @ 10.0ppm and RDF of NP, T_5-Foliar application of Brassinosteriods spray @ 12.5ppm and RDF of NP, T_6-Foliar application of brassinosteriods spray @ 15.0ppm and RDF of NP and T_7-control (water spray).

RESULTS AND DISCUSSION

The results obtained from the present investigation are presented in Table 1, 2, 3 and 4.

The experiments conducted with Brassinosteroids (BRs) applied in the form of homobrassinols(HBLs) at 2.5ppm, 5.0ppm, 7.5ppm, 10.0ppm, 15.0 ppm, control (water spray).The harmone proved to be most effective at 7.5ppm,10.0ppm and 12.5ppm.The HBL favoured the total drymatter production, no.of pods per plant.The lean vegetative growth of plants resulting from the foliar spray of water (control) gave poor yields which may be due to limited transport of assimilates to the sink.However, HBL alone improved the seed yield which was highest in treatment where greengram plants were sprayed with 7.5 ppm of Homobrassinolides yielding 1025 kg/ha in red soils of prakasam district of Andhra Pradesh.

The treatment T_4 followed the effect where the plants were sprayed with 10.0ppm of HBL yielding 955 kg/ha. of seed followed by T_2 where the greengram plants were sprayed with 7.5ppm of foliarspray of HBL yielding 947 kg/ha.of seed. The seedweight was high in $T_3>T_4>T_2>T_5$ *i.e.*, 4.1g, 4.0g, 3.8m, 3.2m, respectively. Along with the test weight, no, of pods per plant recorded highest *i.e.*, 38 in T_3 followed by T_4 *i.e.*, 33, followed by T_2 *i.e.*, 24.

The generation of such responc in the plants by the harmone (HBL)was possible a cumulative expressinon of accelerated rate of nitrate assimilation (Mai *et al.*, 1989), Protein synthesis (Hayat *et al.*,2001); preferential translocation of photosynthates to the sink (Fuji and Saka, 2001) and delayed leaf senescence (Iwahori *et al.*, 1990).

Table 1 : Effect of brassinosteroids foliar spray on yield and yield attribnutes of greengram during *Kharif*, 2008-2009

Sr. No.	Treatment details	No. of branches / plant	No. of pods/ plant	No. of seeds/pod	No. of filled seed/pod	Filled Seed %	100 seed weight (g)	Yield kg/ha	DMP kg/ha
1.	T_1-FABS @ 2.5ppm+RDF of NP	4.5	19	9	7	77	3.2	724	1737
2.	T_2 FABS @ 5.0ppm+RDF of NP	5.1	24	10	8	80	3.8	947	2367
3.	T_3-FABS @ 7.5ppm+RDF of NP	5.4	38	10	9	90	4.1	1025	2152
4.	T_4-FABS @ 10.0ppm+RDF of NP	5.5	33	10	7	70	4.0	955	2578
5.	T_5-FABS @ 12.5ppm+RDF of NP	5.2	29	9	6	66	3.2	841	2607
6.	T_6- FABS @ 15.0ppm+RDF of NP	4.3	24	9	6	66	3.0	644	1803
7.	T_7-Control(water spray).	4.0	17	8	6	75	3.0	532	1330
	S.E.$\pm$	0.06	1.5	0.4	0.3	2.8	0.06.	62	101.2
	C.D. (P=0.05)	NS	3.4	0.5	0.4	3.5	0.08.	105	200.3

N.S.-Non significant

Table 2 : Effect of brassinosteroids foliar spray on yield and yield attribnutes of greengram during *Rabi*, 2008-2009

Sr. No.	Treatment details	No. of branches / plant	No. of pods/ plant	No. of seeds/pod	No. of filled seed/pod	Filled seed %	100 seed weight (g)	Yield kg/ha	DMP kg/ha
1.	T_1-FABS @ 2.5ppm+RDF of NP	4.5	17	8	6	75	3.2	724	1755
2.	T_2 FABS @ 5.0ppm+RDF of NP	5.3	35	10	8	80	4.1	988	2677
3.	T_3-FABS @ 7.5ppm+RDF of NP	5.4	42	10	9	90	4.4	1100	2250
4.	T_4-FABS @ 10.0ppm+RDF of NP	5.3	37	10	9	90	4.2	995	2422
5.	T_5-FABS @ 12.5ppm+RDF of NP	5.1	32	9	8	88	4.0	920	2705
6.	T_6- FABS @ 15.0ppm+RDF of NP	4.4	27	7	6	85	3.3	644	1846
7.	T_7-Control(water spray).	4.4	25	8	6	75	3.2	532	1480
	S.E.$\pm$	0.05	1.7	0.5	0.2	2.9	0.07	77	112.3
	C.D. (P=0.05)	NS	3.6	0.6	0.4	4.2	0.09	119	217.1

N.S.-Non significant

Table 3 : Effect of brassinosteroids foliar spray on growth attributes of greengram during *Kharif*,2008-2009

Treatment particulars	Plant height (cm)			Root length (cm)			DMP kg/ha			H.I.
	Before spray	After 1 spray 30 days	After 11 spray 45 days	Before spray	After 1 spray 30 days	After 11 spray 45 days	Before spray	After 1 spray 30 days	After 11 spray 45 days	
T_1-FABS @ 2.5ppm+RDF of NP	18.2	26.4	32.2	3.7	6.3	10.1	749	1028	1521	0.41
T_2 FABS @ 5.0ppm+RDF of NP	19.5	32.3	44.0	4.2	7.4	13.0	790	1277	2175	0.40
T_3-FABS @ 7.5ppm+RDF of NP	20.1	37.5	47.7	4.5	8.3	12.3	870	1243	1963	0.47
T_4-FABS @ 10.0ppm+RDF of NP	19.5	30.1	40.2	4.3	8.7	13.6	792	1126	1822	0.37
T_5-FABS @ 12.5ppm+RDF of NP	18.6	27.3	37.4	4.0	6.4	13.0	762	1094	2160	0.32
T_6- FABS @ 15.0ppm+RDF of NP	19.1	25.1	31.0	3.5	5.3	11.5	727	1001	2240	0.35
T_7-Control (water spray)	16.5	26.1	32.0	3.1	5.7	10.6	754	654	1690	0.40
S.E. $\pm$	0.45	0.82	0.94	0.05	0.25	0.55	9.4	17.3	106.8	0.06
C.D. (P=0.05)	NS	2.21	2.09	NS	0.16	0.70.	NS	37.1	201.7	0.09

N.S.-Non significant

Table 4 : Effect of brassinosteroids foliar spray on growth attributes of greengram during *Rabi*, 2008-2009

Treatment particulars	Plant height (cm)			Root length (cm)			DMP kg/ha			H.I.
	Before spray	After 1 spray 30 days	After 11 spray 45 days	Before spray	After 1 spray 30 days	After 11 spray 45 days	Before spray	After 1 spray 30 days	After 11 spray 45 days	
T_1-FABS @ 2.5ppm+RDF of NP	17.2	24.4	302	3.7	53	10.4	754	1089	1655	0.41
T_2 FABS @ 5.0ppm+RDF of NP	20.4	34.3	42.0	4.2	7.9	15.0	850	1311	2275	0.36
T_3-FABS @ 7.5ppm+RDF of NP	21.1	39.1	49.6	4.5	8.9	16.2	890	1300	1990	0.48
T_4-FABS @ 10.0ppm+RDF of NP	21.5	32.1	40.2	4.3	8.7	14.6	921	1226	1922	0.41
T_5-FABS @ 12.5ppm+RDF of NP	19.6	31.3	38.4	4.0	7.4	13.0	834	1194	2260	0.34
T_6- FABS @ 15.0ppm+RDF of NP	17.1	25.1	33.0	3.5	6.5	11.5	933	1201	2440	0.34
T_7-Control (water spray)	15.5	26.1	31.0	3.1	5.7	10.6	788	1054	1690	0.35
S.E. $\pm$	0.46	0.90	0.84	0.04	0.26	0.47	9.7	18.5	111.2	0.05
C.D. (P=0.05)	NS	2.25	2.11	NS	0.17	0.72	NS	39.1	240.1	0.08

N.S.-Non significant

The healthy groeth obviously had an input on the productivity.

Similarly the same experiment was repeated during *Rabi* season (*Rabi*, 2008) to confirm the results of the *Kharif* with the same treatmental structure and conditions.The results repeated the same trend as those of *Kharif* season.The HBL responded well at 7.5ppm,10.0ppm and 12.5ppm applied treatments (Foliar spray) gave higher yields *i.e.*,$T_3>T_4>T_2>T_5$.The DMP, Plant height,root lenth,pods/plant,test weight followed the same trend as that of *Kharif*. The yield obtained was highest in T_3 *i.e.*,1100 kg/ha. followed by T_4 995 kg/ha.

Followed by T_2 988 kg/ha.It is evident from the results that BRs are a new class of plant harmones possessing significant rowth promoting activity. BRs found to ameliorate the abiotic and biotic stresses (Sasse, 2003).

REFERENCES

Anuradha, S. and Rao, S.S.R. (2001). Effect of brassinosteroids on salinity stress induced inhibition of seed germination and seedling growth of rice (*Oriza Sativa* L.). *Plant Growth Regul.,* **33** : 151-153.

Catala, R.,Ouyang, J., Abreu, I.A.,Hu, Y., Seo, H., Zang, X. and Chua, N.H. (2007). Tharabidopsis E3 SUMO ligase SIZ1. regulates plant growth and drought responses. *Plant Cell*, **19**: 2952-2966.

Clouse, S.D. and Sasse, J.M. (1998). Brassinosteroids: essential regulators of plant growth and development.*Annu. Rev. Plant Physiol. Plant Mol. Biol.,* **49** : 427-451.

Dhaubhadel, S.,Chaudhary, S., Dobinson, K.F. and Krishna, P. (1999). Treatment with 24 –epibrassinolide,a brassinosteroid, increases the basic thermotolerance of *Brassica napus a*nd tomato seedlings.*Plant. Mol. Biol.,* **40**: 333-342.

Fujii, S. and Saka, H. (2001). Distribution of assimilates to each organ in rice plants exposed to low temperature at the ripening stage and effect of brasinolide on the distribution. *Plant Prod. Sci.,* **4**: 136-141.

Haubrick, L.L., Torsethaugen, G., Assmann, S.M. (2006). Effect of brassinolide,alone and in concert with absciscic acid on control of stomatal aperture and potassium currents *Vicia faba g*uard cell protoplasts.*Physiol Plant,* **128** : 134-143.

Hayat,S.,Ahmed,A.,Hussain,A. and Mobin,M.(2001). Growth of wheat seedling raised from the grains treated with 28-homobrassinolideActa *Physiol.Plant,* **23**:27-30.

Iwahori, S., Tominga, S. and Higuchi. S (1990).Retardation of abscission of citrus leaf and fruitlet explains by brassinolide. *Plant Growth Regul*., : 119-125.

Kagale, S., Divi, U.K., Krochko, J.E., Keller, W.A. and Krishna, P. (2007). Brassinosteroid confers tolerance in *Arabidopsis thaliana* and *Brasica napu*s to a range of abiotic stresses, *Planta,* **225** : 353-364

Kalinchi, J.F., Mandava, N.B. and Todhunter, J.A. (1985). Relationship of nucleic acid metabolism on brasinolide-induced responses in beans. *J. Plant Physiol.,* **120** : 207-214.

Panse, V.G. and Sukhatme, P.V. (1967). *Statistical Methods For Agricultural Workers.* ICAR Publication, New Delih.

Krishna, P. (2003). Brassinosteroid –mediated stress responses. *J. Plant Growth Regul.,* **22** : 289-297.

Mai, Y.,Lin, J.M., Zheng, X.L. and Pan, P.J. (1989). Effect of homobrassinolide on the activity of nitrate reductase in rice seedlings. *Plant Physiol.Comm.,* **2**: 50-52.beans

Nakashita, H., Yasudha, M., Nitta, T., Asami, T., Fujioka, S., Arai, Y., Sekimata, K.,Takatsuto, S., Yamaguchi, I. and Yoshida, S. (2003). Brassinosteroid functions in tobacco and rice. *Plant J.,* **33**: 887-898.

Sai ram, S.K. (1994). Effect of brassinolide application on plant metabolism and grain yield under irrigated and moisture –stress conditions of two wheat varieties. *Plant Growth Regul.,* **14** : 173-181.

Sasse, JM. (2003). Physiological actions of brassinosteroids: An update. *J.Plant Growth Reg,* **22**:276-288.

Schilling, G., Schiller, C. and Otto, S. (1991). Influence of brassinosteroids on organ relations and enzyme activities of sugar beet plants.In Cutler HG,Yokota, T., Adam G. (eds). Brassinosteroids: Chemistry, Bioactivity and Applications (ACS Symposium Series 474).American Chemical Society,Washington DC,pp 208-219.

Symons, G.M., Davies, C., Shavrukov, Y., Dry, I.B., Reid, J.B. and Thomas, M.R. (2006). Grapes on steroids: brassinosteroids are involved in grape berry ripening. *Plant Physiol.,* **140** : 150-158.

****
*****