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Physiological effect of brassinosteroids on growth attributes of greengram crop (*Vigna radiata* L.)

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ABSTRACT

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 (Symons et.al.,2006).The results obtained from the experiment showed that Brassinosteroids applied in the form of Homobrassinols (HBLs) at 0.5 ppm,1.0 ppm,1.5 ppm,2.0. ppm,2.5 ppm,3.0 ppm and control (water spray).The harmone proved to be most effective at 1.5 ppm,2.0 ppm and 1.0 ppm followed by 2.5 ppm. HBL improved the seed yield which was highest in treatments where greengram plants were sprayed with 1.5 ppm of Homobrassinolides yielding 1025 kg/ha.The treatmental followed where the plants were sprayed with 2.0 ppm of HBL yielding 955 kg/ ha. of seed followed by plants with 1.0 ppm of foliar spray of HBL yielding 947 kg/ha.of seed. The generation of such response in the plants by the harmone (HBL) was possible with cumulative expressinon of accelerated rate of nitrate assimilation(Ma iet.al.,1989),Protein synthesis (Hayat *et al.*, 2001);preferential translocation of photosynthates to the sink (Fuji and Saka,2001).Similarly the same experiment was repeated during *Rabi* season ,2008to confirm the results of the *Kharif* with the same treatmental structure and conditions.The results repeated the same trend as those of *Kharif* season 2008.

Key words : BRs-Brassinosteroids, EBR - 24-epibrassinolide, RWC - Relative water content HBL -Homo Brassinolides, DMP - Drymatter production

INTRODUCTION

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 response has involved simple application studies such as spraying plants with BRs. 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 Application of BRs has resulted in reduced phytophthora infections in potato increased resistance (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 controles 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 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. Serial dilutions of Homo Brassinolides (HBL) Godrej Agromet Ltd., Mumbai. The HBL was serially diluted to 0.5ppm,1.0 ppm, 1.5 ppm, 2.0 ppm, 2.5 ppm, 3.0 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 were collected at maturity with 5 plants from each plot and recorded.

Biometric observations:

The biometric observations were recorded on five plants selected randomly in treated plots. Plant height (cm), root length (cm), drymatter production (DMP) (kg/ha.), no.of branches/plant, no.of seeds/pod, no.of filled seed/pod, 100 seedweight(g) and final yield kg 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 are as follow : T_1- Foliar application of Brassinosteriods Spray @ 0.5 ppm and RDF of NP, T_2- Foliar application of Brassinosteriods Spray @ 1.0 ppm and RDF of NP, T_3- Foliar application of Brassinosteriods Spray @ 1.5ppm and RDF of NP, T_4- Foliar application of Brassinosteriods Spray @ 2.0 ppm and RDF of NP, T_5- Foliar application of Brassinosteriods Spray @ 2.5 ppm and RDF of NP, T_6-Foliar application of Brassinosteriods Spray @ 3.0 ppm and RDF of NP, T_7- control (Water spray)

RESULTS AND DISCUSSION

The data obtained from present investigation are present in Table 1, 2, 3 and 4. The results obtained from the experiment showed that Brassinosteroids (BRs) applied in the form of Homobrassinols (HBLs) at 0.5 ppm, 1.0 ppm, 1.5 ppm, 2.0. ppm, 2.5 ppm, 3.0 ppm and control (water spray). The harmone proved to be most effective at 1.5 ppm, 2.0 ppm and 1.0 ppm followed by 2.5 ppm. The HBL favoured the total drymatter production, No.of pods per plant. The lean (thin when compared) vegetative

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

Sr. No.	Treatments	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 @ 25ppm+RDF of NP	4.5	19	9	7	77	3.2	724	1737
2.	T_2 FABS @ 50ppm+RDF of NP	5.1	24	10	8	80	3.8	947	2367
3.	T_3-FABS @ 75ppm+RDF of NP	5.4	38	10	9	90	4.1	1025	2152
4.	T_4-FABS @ 100ppm+RDF of NP	5.5	33	10	7	70	4.0	955	2578
5.	T_5-FABS @ 125ppm+RDF of NP	5.2	29	9	6	66	3.2	841	2607
6.	T_6- FABS @ 150ppm+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

NS-Non significant

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

Sr. No.	Treatments	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 @ 25ppm+RDF of NP	4.5	17	8	6	75	3.2	724	1755
2.	T_2-FABS @ 50ppm+RDF of NP	5.3	35	10	8	80	4.1	988	2677
3.	T_3-FABS @ 75ppm+RDF of NP	5.4	42	10	9	90	4.4	1100	2250
4.	T_4-FABS @ 100ppm+RDF of NP	5.3	37	10	9	90	4.2	995	2422
5.	T_5-FABS @ 125ppm+RDF of NP	5.1	32	9	8	88	4.0	920	2705
6.	T_6- FABS @ 150ppm+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

NS-Non significant

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

Treatments	Plant height (cm).			Root length (cm).			DMP kg/ha.			H.I.
	Before spray	After I spray 30 days	After II spray 45 days	Before spray	After I spray 30 days	After II spray 45 days	Before spray	After I spray 30 days	After II spray 45 days	
T_1-FABS @ 25ppm+RDF of NP	18.2	26.4	32.2	3.7	6.3	10.1	749	1028	1521	0.41
T_2-FABS @ 50ppm+RDF of NP	19.5	32.3	44.0	4.2	7.4	13.0	790	1277	2175	0.40
T_3-FABS @ 75ppm+RDF of NP	20.1	37.5	47.7	4.5	8.3	12.3	870	1243	1963	0.47
T_4-FABS @ 100ppm+RDF of NP	19.5	30.1	40.2	4.3	8.7	13.6	792	1126	1822	0.37
T_5-FABS @ 125ppm+RDF of NP	18.6	27.3	37.4	4.0	6.4	13.0	762	1094	2160	0.32
T_6- FABS @ 150ppm+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

NS-Non significant

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

Treatments	Plant height (cm).			Root length (cm).			DMP kg/ha.			H.I.
	Before spray	After I spray 30 days	After II spray 45 days	Before spray	After I spray 30 days	After II spray 45 days	Before spray	After I spray 30 days	After II spray 45 days	
T_1-FABS @ 25ppm+RDF of NP	17.2	24.4	302	3.7	53	10.4	754	1089	1655	0.41
T_2-FABS @ 50ppm+RDF of NP	20.4	34.3	42.0	4.2	7.9	15.0	850	1311	2275	0.36
T_3-FABS @ 75ppm+RDF of NP	21.1	39.1	49.6	4.5	8.9	16.2	890	1300	1990	0.48
T_4-FABS @ 100ppm+RDF of NP	21.5	32.1	40.2	4.3	8.7	14.6	921	1226	1922	0.41
T_5-FABS @ 125ppm+RDF of NP	19.6	31.3	38.4	4.0	7.4	13.0	834	1194	2260	0.34
T_6- FABS @ 150ppm+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

NS-Non significant

growth of plants resulting from the foliar spray of water (control) gave poor yields which might be due to the 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 1.5 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 2.0 ppm of HBL yielding 955 kg/ha. of seed followed by T_2 where the greengram plants were sprayed with 1.0 ppm of foliar spray of HBL yielding 947 kg/ha.of seed.The seed weight was higher in $T_3>T_4>T_2>T_5$ *i.e.*,4.1g, 4.0g, 3.8g, 3.2g, respectively. Along with the test weight, no. of pods per plant were recorded highest *i.e.*, 38 in T_3 followed by T_4. *i.e.*, 33, followed by T_2 *i.e.*, 24 and by T_5 *i.e.*, 29.

The generation of such response 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). The healthy growth 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 1.5 ppm, 2.0 ppm and 1.0 ppm and 2.5 ppm. 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. fo0llowed by T_4 *i.e.* 995 kg/ha. Followed by T_2 *i.e.* 988 kg/ha. and T_5 *i.e.* 920 kg/ha. It is evident from the results that BRs are a new class of plant harmones possessing significant growth promoting activity. BRs found to ameliorate the abiotic and biotic stresses (Sasse, 2003).

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