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Influence of Brassinosteroid (BR) on Photosynthetic Pigments of Groundnut under Water Stress at Pod development Stage

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ABSTRACT

The influence of brassi no steroid (BR) (3µ M) as seed treatment, foliar spray (at 55 and 65 DAS) and seed treatment + foliar spray on photosynthetic pigments of groundnut under water stress was studied in pot culture in a completely randomized block design. The observations on concentration of photosynthetic pigments revealed that under water stress BR application had no effect on chl-a content but increased the level of Chl-b and it was found 44.0 percent high with BR foliar spray at 55 DAS over stressed plants.The influence of BR on chl-a / chl-b ratio and Carotenoid content of stressed plants was not noticed. Application of BR enhanced the total chlorophyll content and also retained it for longer period.

Key words: Brassinosteroid (BR), Groundnut ,Photosynthetic pigments, Water stress

Groundnut is an important oilseed crop of India with a mean productivity of 993 kg ha^{-1} compared to the world's average of 1336 kg ha^{-1} (The Hindu survey of Indian Agriculture, 2005). Among the oil seed crops, groundnut accounts for more than 40 percent of the total area cropped under oilseeds and 55 percent of the total oil seeds production. Groundnut crop is grown extensively during *rabi* season in coastal sandy loam soils of Andhra Pradesh in irrigated rice fallows, unirrigated upland areas and the crop is sown from December onwards till the end of January. Groundnut, being grown under rainfed and residual moisture conditions, is prone to drought stress at one or more of the growth stages. Varying intensities and durations of stress may occur at growth stage I (from sowing to 35 DAS) or growth stage II (35 DAS to 60 DAS) or in growth stage III (60 DAS to pod maturity) or may occur throughout the growing period of the crop. Water deficit affects groundnut growth depending on the stage of crop growth and the intensity of the drought. Drought causes changes in the concentration of photosynthetic pigments. Brassinosteroids are a group of naturally occurring plant steroidal compounds with wide range of biological activity that offer the unique possibility of increasing crop yields through both changing plant's metabolism and protecting plants from environmental stresses such as temperature, drought and salt . Foliar application of 0.01 or 0.05 ppm Epibrassinolide 2 or 3 times increased the photosynthesis and leaf chlorophyll content in tobacco (Han *et al*., 1988). BR at 0.5 ppm as foliar spray on field grown rice plants under irradiance stress (50% normal irradiance) resulted in highest chl-a(1.48 mg/g), chl-b(0.92 mg/g) and total chlorophyll content(2.40 mg/g) (Maibangsa *et al*., 1999). Foliar spray of BR showed higher chlorophyll content (3.81mg/g) in pearl millet (Siva Kumar *et al*., 2002). Applying BRs to seeds restored the pigment levels in Rice (Anuradha and Rao, 2003). Enthused by the results of these studies it was felt that the role of BRs in protecting the plants against environmental stress will be an important research theme for clarifying the mode of action of BRs and may contribute to the usage of BRs in agricultural production. Hence the present study, the influence of brassionsteroid on photosynthetic pigments of groundnut under water stress at pod development stage, was made.

MATERIAL AND METHODS

A potculture experiment was conducted at the deparment of Plant Physiology, Agricultural College, Bapatla during the *rabi* season of 2005-06 in a completely randomized block design with the following treatments.

T_1 : Control (without water stress)

T_2 : Water stress at pod development stage.

T_3 : Water stress + seed presoaking with brassinosteroid (3µM)

T_4	:	Water stress+ brassinosteroid foliar spray (3µM) at 55 DAS
T_5	:	Water stress+ brassinosteroid foliar spray (3µM) at 65 DAS
T_6	:	Water stress + seed presoaking + foliar spray at 55 DAS
T_7	:	Water stress + seed presoaking + foliar spray at 65 DAS

The experimental soil was clay loam, high in organic carbon, available N (188.0 kg ha^{-1}), P (150.0 kg ha^{-1}) and K (134.8 kg ha^{-1}) with pH 8.0 and EC 0.5 dsm^{-1}. To this FYM @ 15 t ha^{-1} was added and thoroughly mixed. Seeds of groundnut cv TMV-2 soaked in 3µM homobrassinolide for 8 hours were sown in pots (50 x 60 cm) filled with soil mixture @ 10 kg pot^{-1}. Each pot received a uniform application of N, P_2O_5 and K_2O as per the recommended schedule. Irrigation was given once in two days interval. Water stress was imposed by with holding the irrigation at 55 DAS and continued for 10 days and then relieved at 65 DAS. Brassinosteroid foliar spray was given at a concentration of 3µM at the time of imposition of stress (55 DAS) or at the time of relieving of stress (65 DAS).

The fresh, fully expanded leaf samples were collected at 55, 65,75 and 85 DAS and chlorophyll content was estimated by extracting the leaves in dimethyl sulphoxide (Hiscox and Stam, 1979). Statistical analysis was carried out by adopting the procedure of Panse and Sukhatme (1997).

RESULTS AND DISCUSSION

Data presented in Table 1 revealed that brassinosteroid application significantly affected the contents of photosynthetic pigments. Before the induction of stress, i.e., at 55 DAS, chl-a(47.3%), chl-b(26.6%), total chlorophyll (38.2%) chl-a / chl-b (22.8%) and carotenoid (53.5%) contents were found high in BR seed treated plants.Similar effect of increased pigment levels in rice with BR seed treatment was reported by Anuradha and Rao (2003).The increase in chl-b content with the exogenous application of BRs was reported by Maibangsa *et al*., (2000) and Prakash *et al*., (2006).The increase in chl-a / chl-b ratio with BR application was reported by Sairam (1994) and Maibangsa *et al*., (2000) in wheat and rice, respectively. At the end of stress period (at 65 DAS) the influence of BR on chl-a in stressed plants was not significant. A significant increase (15.6%) in chl-b content was observed in stressed plants over control. Maximum total chlorophyll was observed in stress+BR foliar spray at 65 DAS. The ratio of chl-a / chl-b was observed high in stressed plants followed by seed treatment+foliar spray at 65 DAS. The increase in chl-a / chl-b ratio in water stressed plants could be due to increase in chl-a under stress. Similar observations were reported by Sairam (1994) and Maibangsa *et al*., (2000). A significant increase in carotenoid content was noticed in stressed plants over control plants. The increase in carotenoid content with BR application was on par with that of stress. The increase in carotenoid has been observed under water deficit conditions in rice by Boo and Jung (1999). Ten days after relieving stress (at 75 DAS) chl-a content in BR treated and stressed plants was similar. A significant increase in chl-b content was observed in stressed plants over control. The BR application to stressed plants enhanced the levels of chl-b over control plants. The higher total chlorophyll content was observed in stressed and stress + BR applied plants, which were on par with one another. The influence of BR on chl-a / chl-b ratio and carotenoid content of stressed plants was not-significant . Twenty days after relieving stress (85 DAS) chl-a content in BR treated and stressed plants was similar. A significant increase in chl-b content was observed in stressed plants over control. In addition the BR application to stressed plants, further enhanced the levels of chl-b over control plants. Finally application of BR to stressed plants resulted in maximum chl-b content. Among the BR applied treatments higher content was observed with BR foliar spray at 55 DAS. The increase in chl-b content with the exogenous application of BRs was reported by Maibangsa *et al*., (2000) and prakash *et al*., (2006). Water stress at Pod development stage resulted in lower total chlorophyll. BR application on water stressed plants enhanced the total chlorophyll content and also retained it for longer period. Among the BR applied treatments higher values were noticed in BR foliar spray at 55 DAS followed by seed treatment+ foliar spray at 55 or 65 DAS. These results were in confirmation with the results obtained by Han *et al.* (1988) Maibangsa *et al.* (1999), Siva Kumar *et al.,* (2002) Prakash *et al.* (2003) and Senthil *et al.* (2003). The influence of BR on chl-a / chl-b ratio and carotenoid content of stressed plants was not significant.

Table 1: Photosynthetic pigments of groundnut (mg g^{-1}) at different DAS as influenced by water stress and brassinosteroid

Treatments	Chl-a				Chl-b				Total chlorophyll				Chl-a/Ch-b				Carotenoid			
	55 DAS	65 DAS	75 DAS	85 DAS	55 DAS	65 DAS	75 DAS	85 DAS	55 DAS	65 DAS	75 DAS	85 DAS	55 DAS	65 DAS	75 DAS	85 DAS	55 DAS	65 DAS	75 DAS	85 DAS
T_1: Control	0.38	0.59	0.50	0.30	0.30	0.32	0.32	0.17	0.68	1.08	0.82	0.47	1.27	1.61	1.60	1.80	0.28	0.37	0.40	0.30
T_2: Stress at flowering	0.39	0.71	0.65	0.47	0.31	0.37	0.48	0.25	0.70	0.91	1.13	0.72	1.27	2.20	1.35	2.05	0.29	0.42	0.41	0.33
T_3: Stress + seed treament	0.54	0.67	0.59	0.56	0.35	0.38	0.41	0.33	0.89	1.05	1.00	0.89	1.56	1.74	1.45	1.73	0.35	0.43	0.40	0.42
T_4: Stress + foliar spray at 55 DAS	0.45	0.69	0.61	0.58	0.31	0.39	0.43	0.36	0.76	1.08	1.04	0.94	1.49	1.76	1.40	1.64	0.32	0.44	0.41	0.43
T_5: Stress + foliar spray at 65 DAS	0.47	0.78	0.57	0.55	0.32	0.41	0.37	0.34	0.79	1.19	0.94	0.88	1.48	1.90	1.53	1.60	0.32	0.43	0.40	0.42
T_6: Stress + seed treatment + foliar spray at 55 DAS	0.52	0.72	0.64	0.58	0.36	0.35	0.48	0.34	0.88	1.06	1.12	0.92	1.45	2.07	1.35	1.70	0.33	0.44	0.41	0.41
T_7: Stress + seed treatment + foliar spray at 65 DAS	0.56	0.76	0.62	0.58	0.38	0.36	0.42	0.31	0.94	1.12	1.04	0.89	1.47	2.13	1.49	1.88	0.43	0.43	0.41	0.40
SEm±	0.02	0.04	0.02	0.04	0.02	0.01	0.03	0.01	0.03	0.04	0.05	0.04	0.04	0.03	0.07	0.13	0.03	0.01	0.01	0.03
C.D.(0.05)	0.06	NS	0.06	0.12	NS	0.03	0.09	0.03	0.09	0.12	0.15	0.12	0.12	0.09	NS	NS	0.09	0.03	NS	NS
CV%	8.31	9.36	6.14	14.58	11.15	2.07	13.08	2.50	5.93	6.15	8.87	8.96	4.85	3.12	7.82	12.30	13.62	2.21	1.61	14.76

LITERATURE CITED

Anuradha S and Rao S S R 2003 Application of brassinosteroids to rice seeds(*Oryza sativa L.*) reduced the impact of salt stress on growth, prevented photosynthetic pigment loss and increased nitrate reduced activity. Plant Growth Regulation 40 (1) : 29-32.

Boo Y C and Jung J 1999 Water deficit-induced oxidative stress and antioxidative defenses in rice plants.Journal of Plant Physiology 155: 255-261.

Han J F, Qi Q G, Zhang X M and Zhao YY 1988 Study of physiological effects of 24-epibrassinolide on the growth and development of tobacco. Proceedings of the 9th International Tobacco Scientific Congress. Guangzhou China pp 107-108.

Hiscox J D and Stam J G F 1979. A method for the extraction of chlorophyll from leaf tissue without maceration. Canadian Journal of Botany 57 : 1332 - 1334.

Maibangsa S, Thangaraj M and Roy S 1999 Alleviation of low irradiance stress in rice (*Oryza sativa* L.) by growth regulators. Annals of Plant Physiology 13 : 133-142.

Maibangsa S, Thangaraj M and Stephen R 2000 Effect of brassinosteroid and salicylic acid on rice (*Oryza sativa* L.) grown under low irradiance condition.Indian Journal of Agricultural Research 34 (4) : 258-260.

Panse V G and Sukhatme P V 1997 Statistical methods for agricultural workers. Indian Council of Agricultural Research Publication pp 48-67.

Prakash M, Saravanan K, Sunil Kumar and Ganesan J 2003 Effect of brassinosteroids on certain biochemical parameters in groundnut. Indian Journal of Plant Physiology 8 (3) : 313-315.

Prakash M, Saravanan K, Sunil Kumar B, Sabeasan T, Gokulakrishnan J, Suganthi S and Ganesan J 2006. Response of brassinosteroids on growth and pod yield of gorundnut. Crop Research 31 (3) : 419-423.

Sairam R K 1994. Effect of homobrassinolides application on plant metabolism and grain yield under irrigated and moisture stress condition of two wheat varieties. Plant Growth Regulation 14 : 173-181.

Senthil A, Pathmanaban G and Srinivasan P S 2003 Effect of bioregulators on some physiological and biochemical parameters of soybean (*Glycine max* L.). Legume Research 26 (1): 54-56.

Sivakumar R, Pathmanaban G, Kalarani M K, Mallika Vanagamudi and Srinivasan P S 2002 Effect of foliar application of growth regulators on biochemical attributes and grain yield in pearl millet. Indian Journal of Plant Physiology 7 (1) : 79-82.

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