The Andhra Agric. J 61(4): 897-902, 2014

Effect of Different Growth Regulating Compounds on Biochemical and Quality Parameters in Greengram

K Rajesh, S Narender Reddy, A Pratap Kumar Reddy and B Gopal Singh
Department of Crop Physiology, College of Agriculture, Rajendranagar, Hyderabad 30

ABSTRACT

A field experiment was conducted to study the Effect of different growth regulating compounds on biochemical and quality parameters in greengram during *rabi* 2009-10. Among the growth regulators, growth promoting substance NAA (20 ppm) recorded significantly higher values for biochemical parameters, photosynthetic rate where as relative chlorophyll content (SCMR) values were highest in chlormequat chloride 50% SL 375.0 g a.i ha^{-1}, mepiquat chloride 5% AS (5%) and NAA (20ppm) during reproductive stage. Among the quality parameters highest seed protein content (%) and highest nitrogen harvest index values were recorded with growth retarding substance chlormequat chloride (187.5 g a.i ha^{-1}) in greengram.

Key words : Biochemical parameters, Greengram, Plant growth regulators, Quality parameters.

The plant growth regulators (PGRs) play an important role in overcoming the hurdles in manifestation of biological productivity in pulses. The use of plant growth regulators are known to improve the physiological efficiency including photosynthetic ability of plants and offer a significant role in realizing higher crop yields (Murthy and Singh 1983). The PGRs are also known to enhance the source-sink relationship and stimulate the translocation of photo-assimilates, thereby increasing the productivity. Use of these regulators should be judicious in any given cropping system (Taiz and Zeiger, 2003). The present paper deals with the effect of certain growth promoting and retarding compounds on biochemical and quality parameters in greengram.

MATERIAL AND METHODS

A field experiment was conducted during *rabi* 2009-2010 at Student's Farm, College of Agriculture, Rajendranagar, Hyderabad. The experiment was laid out in randomized block design using the cv. WGG-37 with nine treatments viz, chlormequat chloride 50% SL (137.5 g a.i ha^{-1},162.5 g a.i ha^{-1}, 187.5 g a.i $ha^{-1}$and 375.0 g a.i ha^{-1}), Mepiquat chloride 5% AS, NAA (20 ppm), Brassinosteroid (20 ppm), Water spray and Control replicated thrice. Growth regulators were sprayed on 38 DAS (initiation of flowering). The photosynthetic rate (Pn) was measured by using Infra Red Gas Analyzer of PP systems (Model TPS-1). The SPAD-502 (Soil Plant Analytical Development) meter is used for measuring the relative chlorophyll content of leaves. The seed and plant samples were oven dried at 70°C and powdered. The same was used for estimating the nitrogen percentage by following the micro Kjeldhal method as given in AOAC (1980). The protein content was calculated by multiplying the nitrogen content with a factor of 6.25. The data were analyzed statistically following the method given by Panse and Sukhatme (1989) and wherever the results were significant, the critical difference (CD) was calculated at 5 per cent level of significance (P=0.05).

RESULTS AND DISCUSSION

SCMR (SPAD Chlorophyll meter reading) values were maximum at flowering stage and declined thereafter (Table 1and Fig.1). The application of chlormequat chloride (375.0 g a.i ha^{-1}), NAA (20ppm) and mepiquat chloride (5% AS) resulted higher chlorophyll content during reproductive stage. Higher SCMR values (32.13) at maturity by NAA 20 ppm can be attributed to the prevention of photooxidation of chlorophyll.

Table 1. Effect of different growth promoting and retarding substances on SCMR values during reproductive stage in greengram.

Treatments	At Flowering	15DAF	At Maturity
Chlormequat Chloride 50% SL (137.5 g a.i/ha)	43.26	40.08	31.53
Chlormequat Chloride 50% SL (162.5 g a.i/ha)	43.30	40.02	31.86
Chlormequat Chloride 50% SL (187.5 g a.i/ha)	43.13	40.72	31.78
Chlormequat Chloride 50% SL (375 g a.i/ha)	43.73	39.40	30.12
Alpha naphthyl acetic acid (NAA) (20 ppm)	41.30	39.70	32.13
Mepiquat Chloride 5% AS (5%)	43.40	41.62	30.73
Brassinosteroid (20 ppm)	41.63	39.14	31.60
Water	42.43	38.30	27.20
Control	42.06	37.64	26.83
Mean	42.69	39.62	30.42
SEd	1.84	3.56	2.54
CD (P=0.05)	3.91	NS	5.39

Table 2. Effect of different growth promoting and retarding substances on photosynthetic rate (μmol m^{-2} s^{-1}) during reproductive stage in greengram.

Treatments	At Flowering	15DAF	At Maturity
Chlormequat Chloride 50% SL (137.5 g a.i/ha)	8.60	17.58	16.45
Chlormequat Chloride 50% SL (162.5 g a.i/ha)	12.54	20.52	17.58
Chlormequat Chloride 50% SL (187.5 g a.i/ha)	10.46	21.95	14.95
Chlormequat Chloride 50% SL (375 g a.i/ha)	9.25	16.65	15.45
Alpha naphthyl acetic acid (NAA) (20 ppm)	15.67	23.47	19.18
Mepiquat Chloride 5% AS (5%)	13.60	20.23	18.35
Brassinosteroid (20 ppm)	9.70	19.70	12.61
Water	4.55	17.15	13.92
Control	7.15	16.50	15.96
Mean	10.49	19.32	16.08
SEd	1.31	4.12	2.16
CD (P=0.05)	3.03	NS	NS

These results are in accordance with Jeyakumar and Thangaraj (1998) who explained that the application of mepiquat chloride to groundnut resulted in high chlorophyll content without the modification of leaf anatomy and delayed chlorophyll degradation. The delay in leaf senescence could also be attributed to higher chlorophyll content. Shinde and Jadhav (1995) have also reported that the foliar application of NAA (20 ppm) significantly increased chlorophyll content in cowpea.

Photosynthesis is the primary process, which form the basis for yield determination. In the present study, the photosynthetic rate increased from flowering to pod setting stage and thereafter decreased (Table 2 and Fig.2). At flowering stage there were significant differences in photosynthetic rate between treatments. Among the treatments NAA (20 ppm) recorded higher photosynthetic rate at pod setting stage (23.47 µmol m^{-2} s^{-1}) and maturity stage (19.18 µmol m^{-2} s^{-1}). The maximum photosynthetic rate with NAA 20 ppm treatment can be attributed to more SCMR values and more leaf area index values than in other treatments. The increase in rate of photosynthesis with application of growth regulators was also reported in soybean by Pankajkumar (1998).

The application of growth regulators showed significant effect on protein content in seed (Table 3 and Fig.3). Among the treatments Chlormequat chloride (187.5 g a.i./ha) recorded significantly higher seed protein content (20.63 %) followed by mepiquat chloride 5% AS and chlormequat chloride @ 162.5 g a.i./ha with 20.27 and 20.17% respectively.

The increase in the protein content due to application of growth regulators may be attributed to their effect on biosynthetic pathways related to protein synthesis. All growth regulator treatments did not show any significant effect on nitrogen harvest index. Though there were significant differences for total protein content in plant and seeds, nitrogen harvest index did not differ significantly (Table 3). Highest protein content values of 0.9 g in seeds and 5.44 g in plant were recorded with NAA 20ppm. However, the nitrogen harvest index was low in control (15.62) and more in chlormequat chloride @ 187.5 g a.i ha^{-1} (17.31).

Figure 1. SCMR values as influenced by growth regulators application during reproductive stage in greengram.

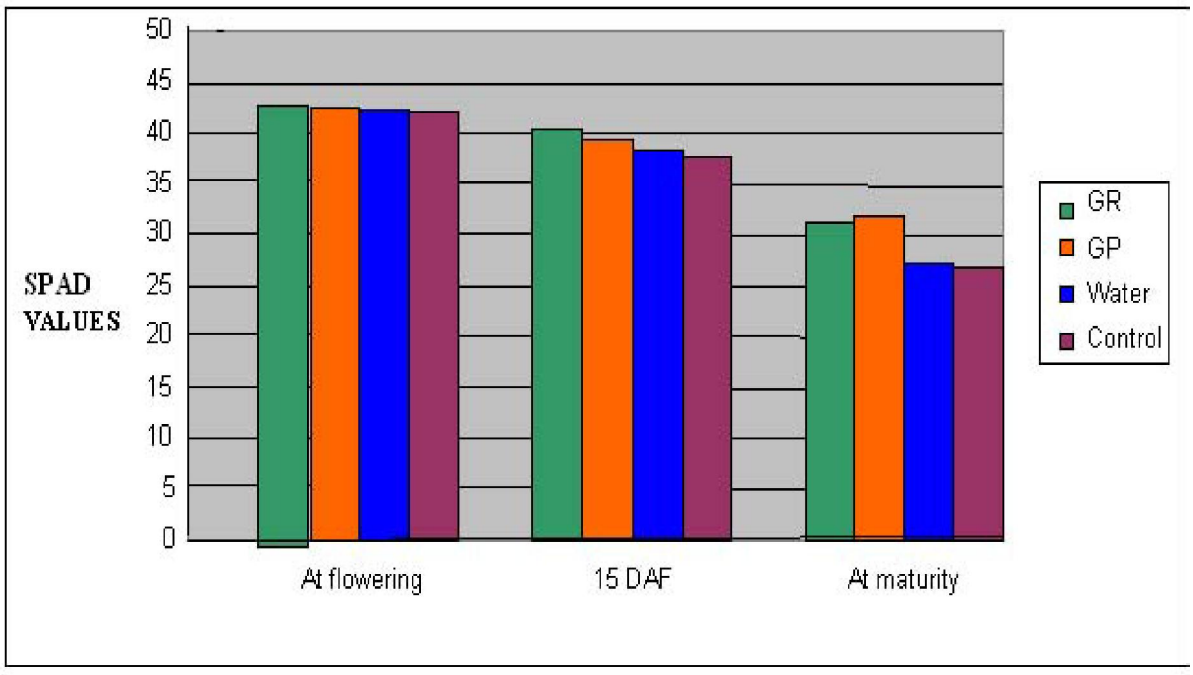
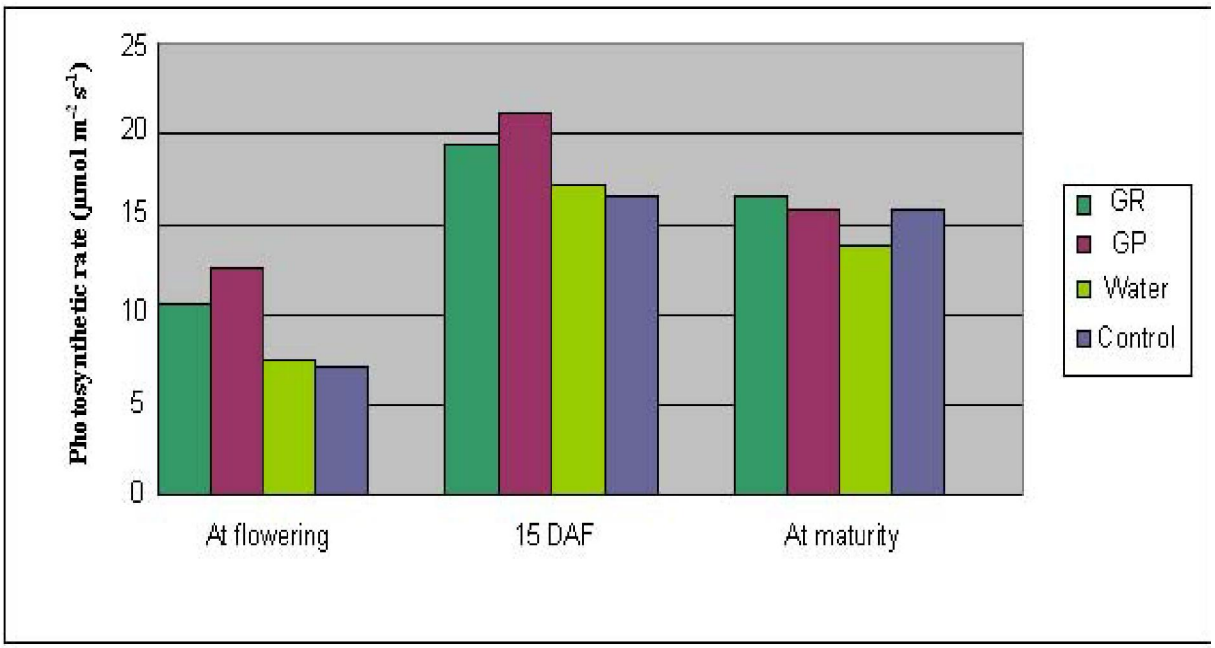


Table 3. Effect of different growth promoting and retarding substances on protein content and Nitrogen harvest index in greengram

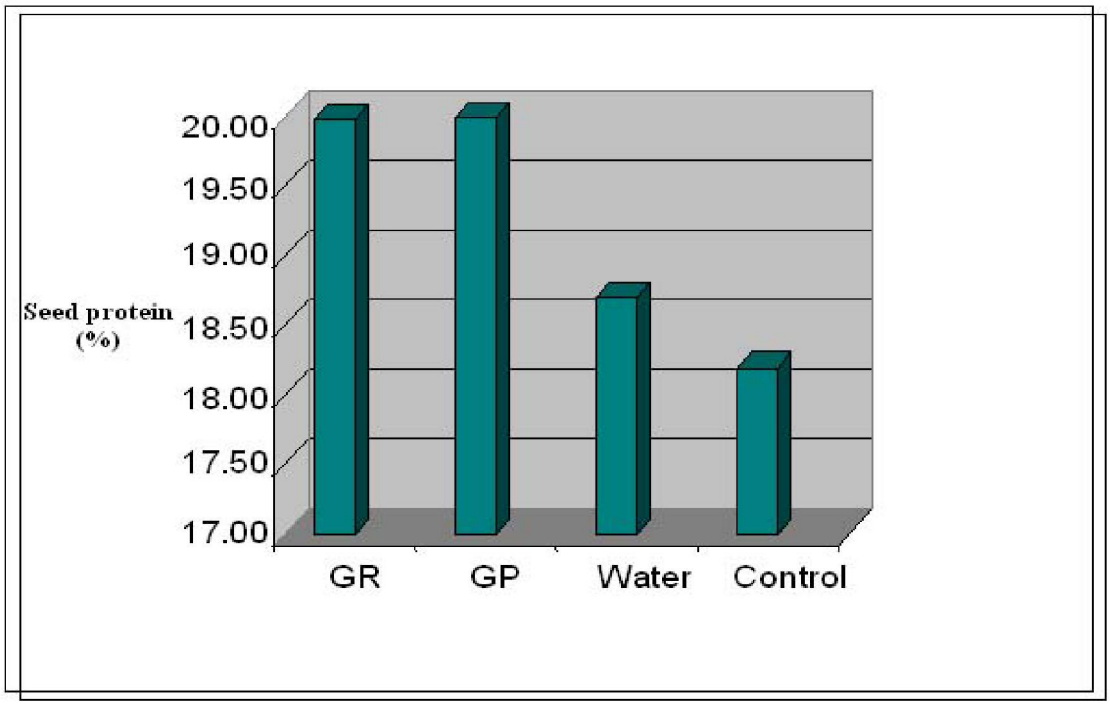
Treatments	Total protein content in seed (g plant^{-1})	Seed protein (%)	Total protein content in plant (g plant^{-1})	Nitrogen Harvest Index
Chlormequat Chloride 50% SL (137.5 g a.i/ha)	0.82	19.70	4.60	17.20
Chlormequat Chloride 50% SL (162.5 g a.i/ha)	0.85	20.17	5.01	17.06
Chlormequat Chloride 50% SL (187.5 g a.i/ha)	0.80	20.63	4.80	17.31
Chlormequat Chloride 50% SL (375 g a.i/ha)	0.84	19.20	4.92	16.49
Alpha naphthyl acetic acid (NAA) (20 ppm)	0.90	20.00	5.44	16.78
Mepiquat Chloride 5% AS (5%)	0.77	20.27	4.36	17.05
Brassinosteroid (20 ppm)	0.84	19.80	5.20	16.66
Water	0.66	18.70	4.05	16.44
Control	0.52	18.20	3.85	15.62
Mean	0.77	19.62	4.69	16.73
SEd	0.44	0.14	0.87	1.26
CD (P=0.05)	0.12	0.31	0.33	NS

Figure 2. Photosynthetic rate as influenced by growth regulators application during reproductive stage in greengram.



GP = Growth Promoters GR = Growth Retardants DAF = Days after flowering

Figure 3. Effect of growth regulators on seed protein (%) in greengram.



GP = Growth Promoters, GR = Growth Retardants

The maximum seed protein percentage (20.63) and nitrogen harvest index (17.31) was recorded in chlormequat chloride (187.5 g a.i/ha).

The higher uptake as well as mobilization of nitrogen might have resulted in enhanced synthesis of amino acids and thereby higher protein content in seeds. Chougale (1997) and Vardhini and Rao (1998) reported increased protein content due to the application of growth regulators in sesamum. Senthilkumar and Jayakumar (2004) reported that nitrogen and protein contents were increased in seed with NAA @ 10 ppm in greengram.

CONCLUSION

Among the growth regulators, growth promoting substance NAA (20 ppm) recorded significantly higher values for photosynthetic rate where as relative chlorophyll content values were highest in chlormequat chloride 50% SL 375.0 g a.i ha^{-1}, mepiquat chloride 5% AS (5%) and NAA (20ppm) during reproductive stage. Among the quality parameters highest seed protein content (%) and highest nitrogen harvest index values were recorded with growth retarding substance chlormequat chloride (187.5 g a.i ha^{-1}) in greengram.

LITERATURE CITED

AOAC 1980 Association of official analytical chemists1980.Official methods of analysis.12th edition. William Star Wet Glad (Edn) Washington DC.

Chougale D Y 1997 Influence of growth regulators on productivity potential in sesamum (*Sesamum indicum* L.) genotypes. M.Sc. (Agri.) Thesis, *University of Agricultural Sciences,* Dharwad.

Jeyakumar P and Thangaraj M 1998 Physiological and biochemical effects of mepiquat chloride in groundnut (*Arachis hypogaea*). *Madras Agricultural Journal,* 85: 23-26.

Murthy Y S and Singh K 1983 Flower abscission response of *Vicia faba* to treatments with growth substances. *Acta Botanica Indica,* 11 : 65-68.

Pankajkumar 1998 Influence of growth regulators on physiological aspects in soybean (*Glycine max* (L.) Merrill). M.Sc. (Agri.) Thesis, *University of Agricultural Sciences,* Dharwad.

Panse V G and Sukhatme P V 1989 Statistical methods for agricultural workers. Indian Council of Agrcultural Research, New Delhi. pp145-150.

Senthilkumar N and Jayakumar R 2004 Effect of plant growth regulators on yield and quality of greengram (*Vigna radiata* L. Wilczek) under graded levels of nitrogen. *Madras Agricultural Journal,* 90(1-3):92-95.

Shinde A K and Jadhav B B 1995 Influence of NAA, ethrel and KNO_3 on leaf physiology and yield of cowpea. *Annals of Plant Physiology,* 9: 43-46.

Taiz L and Zeiger E 2003 Auxin – the growth hormone. Plant Physiology, Panima Publishing Croporation, New Delhi pp. 423-456.

Vardhini V B and Rao S R 1998 Effect of Brassinosteroids on growth, metabolite content and yield of *Arachis hypogaea*. *Photo chemistry,* 48: 927-930.

(Received on 15.04.2013 and revised on 20.05.2013)