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Effect of different growth regulating compounds on biochemical and quality parameters in greengram

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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 whereas 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.

INTRODUCTION

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[1]. 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 [2]. The present paper deals with the effect of certain growth promoting and retarding compounds on biochemical and quality parameters in greengram.

MATERIALS 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°Candpowdered. The same was used for estimating the nitrogen percentage by following the micro Kjeldhal

method. The protein content was calculated by multiplying the nitrogen content with a factor of 6.25. The data were analyzed statistically and wherever the results were significant, the critical difference (CD) was calculated at 5 per cent level of significance [3].

RESULTS AND DISCUSSION

SCMR (SPAD Chlorophyll meter reading) values were maximum at flowering stage and declined thereafter (Table 1andFig.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. The application of mepiquat chloride to groundnut resulted in high chlorophyll content without the modification of leaf anatomy and delayed chlorophyll degradation [4]. The delay in leaf senescence could also be attributed to higher chlorophyll content and the foliar application of NAA (20 ppm) significantly increased chlorophyll content in cowpea [5].

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 μ mol m⁻² s⁻¹) and maturity stage (19.18 μ mol 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.

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	7.55	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

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 ga.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.



Figure 1: SCMR values as influenced by growth regulators application duringreproductive stage in greengram

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

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). 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 [6, 7].

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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) Chlormequat Chloride 50% SL (162.5 g a.i/ha) Chlormequat Chloride 50% SL (187.5 g a.i/ha) Chlormequat Chloride 50% SL(375 g a.i/ha) Alpha naphthyl acetic acid (NAA) (20 ppm) Mepiquat Chloride 5% AS (5%) Brassinosteroid (20 ppm) Water Control Mean SEd CD (P=0.05)	0.82 0.85 0.80 0.84 0.90 0.77 0.84 0.66 0.52 0.77 0.44 0.12	$ 19.70 \\ 20.17 \\ 20.63 \\ 19.20 \\ 20.00 \\ 20.27 \\ 19.80 \\ 18.70 \\ 18.20 \\ 19.62 \\ 0.14 \\ 0.31 \\ $	$\begin{array}{c} 4.60\\ 5.01\\ 4.80\\ 4.92\\ 5.44\\ 4.36\\ 5.20\\ 4.05\\ 3.85\\ 4.69\\ 0.87\\ 0.33\end{array}$	17.20 17.06 17.31 16.49 16.78 17.05 16.66 16.44 15.62 16.73 1.26 NS





GP = Growth Promoters, GR = Growth Retardants

CONCLUSION

Among the growth regulators growth promoting substance NAA (20 ppm) recorded significantly higher values for photosynthetic rate whereas 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.

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