ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 4, Issue, 5, pp. 1110-1112, May, 2014

International Journal of
DEVELOPMENT RESEARCH

Full Length Research Article

EFFECT OF PLANT GROWTH REGULATING COMPOUNDS ON CHLOROPHYLL, PHOTOSYNTHETIC RATE AND YIELD OF GREENGRAM

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ARTICLE INFO

Article History:
Received 26th February, 2014
Received in revised form
19th March, 2014
Accepted 13th April, 2014
Published online 31st May, 2014

Key words:
Greengram,
Plant growth regulators,
Chlorophyll,
Photosynthetic rate and Yield.

ABSTRACT

A field experiment was conducted to study the influence of different growth regulating compounds on chlorophyll, photosynthetic rate and yield in greengram during *rabi* 2009-10. Among the growth regulators growth promoting substance NAA (20 ppm) recorded significantly higher values for photosynthetic rate, 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. However the seed yield was significantly more with NAA (20 ppm) followed by mepiquat chloride 5% AS, brassinosteroid (20 ppm) and chlormequat chloride (137.5 g a.i ha^{-1}).

INTRODUCTION

Greengram is one of the important pulse crops because of its high nutritive value, short duration and its ability to suit in any cropping system. 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. These plant growth regulators in general, help to increase the number of flowers on the plant when applied at the time of flowering. The flower and pod drop may be reduced to some extent by spraying various growth regulators on foliage (Ramesh and Thirumuguran, 2001).The PGRs are also known to enhance the source-sink relationship and stimulate the translocation of photo-assimilates, thereby increasing the productivity. (Taiz and Zeiger, 2003). The present paper deals with the effect of certain growth promoting and retarding compounds on chlorophyll, photosynthetic rate and yield in greengram.

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MATERIALS AND METHODS

A field experiment was conducted during *rabi* 2009-2010 at Student's Farm, College of Agriculture, ANGRAU, 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. Plants in one m^2 area were tagged separately and plants from each treatment were harvested at maturity to record data on yield attributes i.e., number of pods per plant, number of seeds per pod, number of seeds per plant and test weight. After threshing, cleaning and drying, seed yield from one m^2 area from each treatment was recorded and the data were used to express the seed yield on hectare basis. 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. Planofix (NAA) application would have protected chlorophyll molecule from photo-oxidation and thereby increased its content in black gram (Prakash et *al.,* 2003).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.

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

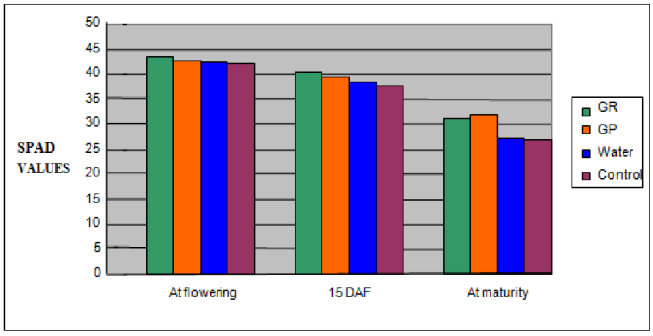
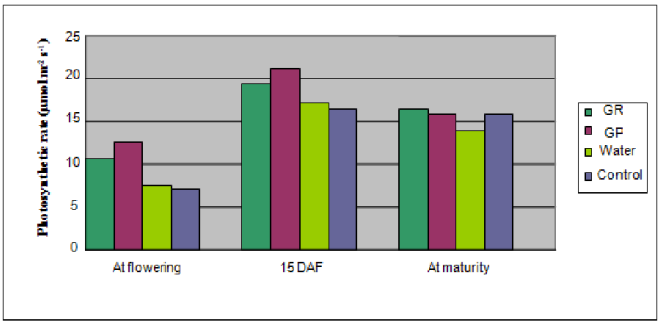


Figure 1. SCMR values as influenced by growth regulators application during reproductive stage in greengram

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).

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



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

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

The yield attributing characters like number of pods per plant, number of seeds per pod and test weight was significantly influenced by the application of growth regulators. Among the treatments highest seed yield of 1310 kg ha^{-1} was recorded in NAA 20 ppm followed by mepiquat chloride (5% AS) and brassinosteroid (20 ppm) with a yield of 1272 and 1234 kg ha^{-1} respectively. The highest seed yield with NAA 20 ppm application can be attributed to more value for the number of pods per plant (25.1), seeds per pod (7.0) and test weight (37.1 g) as compared to other treatments (Table 3). Though there was significant difference among the treatments for grain yield, no significant difference was observed in harvest index indicating that the increase in the yield was due to increase in the total dry matter rather than harvest index. The foliar application of NAA 50 ppm and 25 ppm significantly

Table 3. Effect of different growth promoting and retarding substances on yield and yield attributes in greengram

Treatments	Pods per Plant	Seeds per Pod	Seeds Per Plant	Test weight (g)	Yield (kg/ha)	HI
Chlormequat Chloride 50% SL (137.5 a.i/ha)	21.9	6.0	128.6	35.1	1208.64	36.71
Chlormequat Chloride 50% SL (162.5 a.i/ha)	21.5	6.8	143.4	32.2	1081.42	36.23
Chlormequat Chloride 50% SL (187.5 a.i/ha)	23.9	6.5	155.6	35.6	1094.14	36.90
Chlormequat Chloride 50% SL (375 a.i/ha)	21.9	6.1	133.6	32.3	1170.47	34.77
Alpha naphthyl acetic acid (NAA) (20 ppm)	25.1	7.0	176.9	37.1	1310.42	34.93
Mepiquat Chloride 5% AS (5%)	21.3	6.6	137.9	35.1	1272.26	36.94
Brassinosteroid (20 ppm)	20.4	6.9	138.2	32.5	1234.09	34.59
Water	19.8	5.9	115.4	31.8	1094.14	33.63
Control	19.4	5.7	109.5	31.4	1106.86	32.48
Mean	21.7	6.3	137.8	33.7	1174.71	35.24
SEd	2.8	1.1	19.9	0.2	104.46	5.12
CD 5%	6.8	2.6	NS	0.3	221.45	NS

increased the seed yield in mungbean (Patil *et al.,* 2005)). Similarly, Upadhyay (1994) and Radhika (2005) reported that NAA @ 20 ppm increased seed yield in chickpea.

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. The seed yield increased significantly with NAA (20 ppm) followed by mepiquat chloride 5% AS, brassinosteroid (20 ppm), chlormequat chloride (137.5.5 a.i/ha).

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