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Research Paper

Influence of growth promoting and retarding compounds on dry matter production, growth parameters and yield in greengram during *Rabi*

K. RAJESH, S. NARENDER REDDY, A. PRATAP KUMAR REDDY AND B. GOPAL SINGH

See end of the article for authors' affiliations

Correspondence to :
K. RAJESH
Department of Plant Physiology, College of Agriculture, Acharya N.G. Ranga Agricultural University, Rajendranagar, HYDERABAD (A.P.) INDIA

ABSTRACT

An experiment was conducted to study the influence of growth promoting and retarding compounds on dry matter production, biochemical parameters and yield in greengram during *Rabi* with nine treatments. Among the treatments the growth promoting substances NAA (20 ppm) and brassinosteroid (20ppm) recorded significantly higher values for total dry matter production (TDM) over growth retardant treatments at all stages. Significant effect on growth parameters *viz*., CGR, RGR, LAI, LAR, and SLW was observed with the application of growth regulators. Highest seed yield was recorded with NAA (20 ppm) followed by mepiquat chloride 5% AS, brassinosteroid (20 ppm) and chlormequat chloride (137.5 g a.i ha^{-1}).

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Key words : Greengram, Plant growth regulators, Dry matter production, Growth parameters, Yield

INTRODUCTION

Pulses are cheap source of vegetable protein (20-25%). Among the pulses greengram is important 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 manipulating the source sink relationship in pulses there by increasing the production. In this direction an attempt was made to study the influence of both growth promoting (NAA and Brassinosteriod) and growth retarding substances (chlormequat chloride and mepiquat chloride) on *Rabi* greengram.

MATERIALS AND METHODS

A field experiment was carried out during *Rabi* 2009-2010 at Students Farm, College of Agriculture, Rajendranagar, Hyderabad with a Greengram cv WGG-37. The experiment consisted of 9 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 and Control. The experiment was laid out in Randomized Block Design with three replications. The spraying of growth regulators was done at flower initiation stage (38 DAS). The second row from either side in each plot was considered as sampling row and 5 plants were sampled at fortnightly intervals. After the plants were separated into leaves and stems, leaf area was electronically measured by using leaf area meter model LI-3100 of LICOR instruments. Later component parts were dried at 70^0C till constant weight was achieved and dry matter values were used to calculate growth parameters. At the time of harvest, plants from one m^2 area were harvested and were used to record the data on yield and yield components.

RESULTS AND DISCUSSION

Amount of total dry matter produced is an indication of overall efficiency of utilization of resources and better light interception by the leaf. The data recorded for total dry matter production revealed that there was a gradual increase in total dry matter upto harvest. The total dry matter recorded was more in NAA 20 ppm treatment (531.93g m^{-2}) followed by brassinosteroid 20ppm (524.82 g m^{-2}) over control (Table 1). The increase in the dry matter with NAA 20 ppm may be attributed to the increased SCMR values and photosynthesis. Patel and Saxena (1994) and Lakshmamma and Rao (1996) also reported increased dry matter production due to the application of NAA in blackgram. Growth analysis is a physiological probe on development of crop chronological sequence to elucidate and account the cause for differences in yield through the events that have occurred at different stages of growth (Krishnamurthy *et al.,* 1973). Leaf area index increased gradually from 30 to 60 DAS and decreased thereafter due to senescence and ageing of leaves. At 60 DAS, NAA 20 ppm recorded higher LAI (2.52) and followed by brassinosteroid 20 ppm (2.00) over the control (1.44). Leaf area index is considered to be one of the photosynthetic determinants in crop plants and in the present study, application of growth promoters NAA (20 ppm) and brassinosteroid (20ppm) resulted in higher LAI compared to growth retardants at 60 and 75 DAS (Table 2). Khan and Rashid (1983) and Shinde and Jadhav (1995) have reported that application of NAA 20 ppm, 50 ppm has significantly increased the LAI in chickpea and greengram, respectively.

The leaf area ratio values were maximum at 30 and 45 DAS later they were declined (Table 2). Among the growth regulator treatments maximum values were

Table 1: Effect of different growth promoting and retarding substances on total dry weight (g m^{-2}) in greengram

Treatments	Days after sowing				
	30	45	60	75	At harvest
Chlormequat Chloride 50%SL (137.5 g a.i/ha)	36.56	161.78	274.25	420.79	485.38
Chlormequat Chloride 50% SL (162.5 g a.i/ha)	32.48	169.46	287.87	413.32	453.27
Chlormequat Chloride 50% SL (187.5 g a.i/ha)	36.45	164.95	296.35	401.20	492.93
Chlormequat Chloride 50% SL (375 g a.i/ha)	34.02	156.42	256.90	389.97	450.94
Alpha naphthyl acetic acid (NAA) (20 ppm)	30.54	174.21	320.92	435.65	531.93
Mepiquat Chloride 5% AS (5%)	31.58	185.90	289.58	459.66	510.05
Brassinosteroid (20 ppm)	28.80	167.80	308.75	473.02	524.82
Water	29.88	153.14	265.24	394.02	448.62
Control	28.68	146.08	254.34	372.86	427.05
Mean	32.23	163.80	283.83	417.66	480.55
S.E.±	1.84	19.87	16.02	16.15	21.09
C.D. (P=0.05)	--	NS	36.95	37.24	47.71

NS=Non-significant *Growth regulators were sprayed on 38 DAS.

Table 2 : Effect of different growth promoting and retarding substances on leaf area index, leaf area ratio (cm^2 g^{-1}) and specific leaf weight (mg cm^{-2}) in greengram

Treatments	Days after sowing											
	Leaf area index (LAI)				Leaf area ratio (LAR)				Specific leaf weight (SLW)			
	30	45	60	75	30	45	60	75	30	45	60	75
Chlormequat Chloride 50%SL (137.5 g a.i/ha)	0.31	1.18	1.86	1.28	86.46	73.60	68.00	30.55	7.64	8.54	7.14	7.47
Chlormequat Chloride 50% SL (162.5 g a.i/ha)	0.25	1.30	1.43	1.07	77.54	76.96	49.97	26.17	8.58	7.90	7.75	8.48
Chlormequat Chloride 50% SL (187.5 g a.i/ha)	0.29	1.20	1.94	1.11	81.47	73.16	65.81	27.74	8.13	8.32	7.11	8.66
Chlormequat Chloride 50% SL (375 g a.i/ha)	0.26	1.51	1.70	0.87	78.45	96.87	66.61	22.57	8.40	8.22	7.44	9.50
Alpha naphthyl acetic acid (NAA) (20 ppm)	0.23	1.48	2.52	1.30	79.08	85.57	78.92	30.08	8.40	7.61	5.98	9.03
Mepiquat Chloride 5% AS (5%)	0.24	1.52	1.75	1.30	77.36	81.99	60.80	28.57	8.75	7.10	7.37	7.96
Brassinosteroid (20 ppm)	0.27	1.42	2.00	1.50	96.06	85.26	65.01	31.97	6.98	7.53	7.66	8.39
Water	0.25	1.23	1.59	1.16	86.82	80.93	60.17	28.10	7.71	9.00	7.85	8.10
Control	0.19	1.35	1.44	1.10	69.62	92.76	57.00	31.39	9.23	6.75	7.64	8.50
Mean	0.25	1.35	1.80	1.19	86.81	77.69	63.58	28.73	8.20	7.89	7.33	8.45
S.E.±	0.04	0.23	0.32	0.34	7.27	6.97	7.34	1.21	1.42	1.36	1.49	1.23
C.D. (P=0.05)	0.09	NS	0.69	NS	16.77	NS	NS	2.79	3.28	3.14	3.45	2.84

*Growth regulators were sprayed on 38 DAS NS=Non-significant observed with chlormequat chloride 375.0 g a.i ha^{-1} (96.87 cm^2 g^{-1}) at 45 DAS. Similar results were reported by Rajamohan (1989) and Chougale (1997) in soybean and sesamum, respectively. The specific leaf weight an indicator of leaf thickness was more with chlormequat chloride 375.0 g a.i ha^{-1} (9.50 mg cm^{-2}) and NAA 20 ppm (9.03 mg cm^{-2}) (Table 2). Similar results were also reported by Rajamohan (1989) and Shinde and Jadhav (1995) with foliar application of NAA 20 ppm in soybean and cowpea, respectively.

There was significant difference in crop growth rate (CGR) due to growth regulator treatments at all the growth stages. CGR was maximum during 60 -75 DAS and decreased later. Among the treatments application of mepiquat chloride (5% AS) recorded significantly higher CGR (11.33 g $m^{-2}d^{-1}$) followed by brassinosteroid 20 ppm (10.95 g $m^{-2}d^{-1}$) at 60-75 DAS (Table 3). Similar increase in the CGR with the application of NAA 20 and 40 ppm in groundnut and blackgram was reported by Nawalagatti and Panchal (1991) and Prabhu and Hiremath (2003), respectively. The effect of different growth regulator treatments on RGR values decreased gradually from 30-45 DAS to harvest, because it depended upon the leaf dry weight which further depended upon leaf area index. Maximum RGR values were attained at 30-45 DAS, among the treatments maximum RGR was recorded by brassinosteroid 20 ppm (0.052 g $g^{-1}d^{-1}$), while the minimum was recorded by chlormequat chloride 137.5 and 187.5 g

Table 3 : Effect of different growth promoting and retarding substances on crop growth rate (g $m^{-2}d^{-1}$) and relative growth rate (g $g^{-1}d^{-1}$) in greengram

Treatments	Days after sowing							
	Crop growth rate (CGR)				Relative growth rate (RGR)			
	30-45	45-60	60-75	75-HAR	30-45	45-60	60-75	75-HAR
Chlormequat Chloride 50%SL (137.5 g a.i/ha)	8.34	7.49	9.76	4.30	0.043	0.015	0.012	0.004
Chlormequat Chloride 50% SL (162.5 g a.i/ha)	9.13	7.89	8.36	2.66	0.047	0.015	0.010	0.002
Chlormequat Chloride 50% SL (187.5 g a.i/ha)	8.56	8.76	6.99	6.11	0.043	0.016	0.008	0.005
Chlormequat Chloride 50% SL (375 g a.i/ha)	8.16	6.69	8.87	4.06	0.044	0.014	0.012	0.004
Alpha naphthyl acetic acid (NAA) (20 ppm)	9.57	9.78	7.64	6.41	0.050	0.017	0.008	0.005
Mepiquat Chloride 5% AS (5%)	10.28	6.91	11.33	3.35	0.051	0.012	0.013	0.003
Brassinosteroid (20 ppm)	9.28	9.39	10.95	3.45	0.052	0.017	0.012	0.003
Water	8.21	7.47	8.58	3.64	0.047	0.015	0.011	0.003
Control	7.80	7.21	7.90	3.61	0.047	0.016	0.011	0.003
Mean	8.80	7.95	8.93	4.17	0.040	0.010	0.010	0.004
S.E.±	0.06	0.20	0.07	0.17	0.020	0.010	0.010	0.002
C.D. (P=0.05)	0.15	0.46	0.16	0.40	0.050	NS	NS	0.006

NS=Non-significant *Growth regulators were sprayed on 38 DAS.

Table 4: 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 g a.i/ha)	21.9	6.0	128.6	35.1	1209	36.71
Chlormequat Chloride 50% SL (162.5 g a.i/ha)	21.5	6.8	143.4	32.2	1081	36.23
Chlormequat Chloride 50% SL (187.5 g a.i/ha)	23.9	6.5	155.6	35.6	1094	36.90
Chlormequat Chloride 50% SL (375 g a.i/ha)	21.9	6.1	133.6	32.3	1170	34.77
Alpha naphthyl acetic acid (NAA) (20 ppm)	25.1	7.0	176.9	37.1	1310	34.93
Mepiquat Chloride 5% AS (5%)	21.3	6.6	137.9	35.1	1272	36.94
Brassinosteroid (20 ppm)	20.4	6.9	138.2	32.5	1234	34.59
Water	19.8	5.9	115.4	31.8	1094	33.63
Control	19.4	5.7	109.5	31.4	1107	32.48
Mean	21.7	6.3	137.8	33.7	1175	35.24
S.E.±	2.8	1.1	19.9	0.2	104	5.12
C.D. (P=0.05)	6.8	2.6	NS	0.3	221	NS

NS=Non-significant *Growth regulators were sprayed on 38 DAS a.i. ha^{-1} (0.043 g g^{-1}d^{-1}) (Table 3). RGR declined with the advancement of crop growth due to decline in crop growth rate (CGR) as well as in the rate of dry matter production. Patil (1994) reported that the foliar application of mepiquat chloride significantly increased the RGR in soybean. Prabhu and Hiremath (2003) reported that NAA @ 40 ppm was more effective in increasing RGR in blackgram. Similar results were reported by Radhika (2005) with NAA @ 20 ppm in chickpea.

The highest seed yield was recorded with NAA 20 ppm (1310 kg ha^{-1}) highest yield in this treatment can be attributed to more values for the number of pods per plant (25.1), seeds per pod (7.0) and test weight (37.1) as compared to other treatments (Table 4). 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 the harvest index.

Authors' affiliations:
S. NARENDER REDDY AND B. GOPAL SINGH, Department of Plant Physiology, College of Agriculture, Acharya N.G. Ranga Agricultural University, Rajendranagar, HYDERABAD (A.P.) INDIA
A. PRATAP KUMAR REDDY, Department of Agronomy, College of Agriculture, Acharya N.G. Ranga Agricultural University, Rajendranagar, HYDERABAD (A.P.) INDIA

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