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Effect of Foliar Application of Growth Regulators and Nutrients on Growth and Yield in Soybean (Glycine max L)

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ABSTRACT

An experiment was conducted in FRBD (Factorial Randomised Block DE sign) to know the effect of growth regulators and nutrients on growth and yield in soybean at Agricultural College farm, Bapatla during rabi 2005-06 . The result reveald that maximum plant height (46.74 cm), no.of leaves per plant (14.6), no.of nodes per plant (9.01), no.of branches per plant (9.41), stem dry weight (6.63 g), leaf dry weight (5.37), pod dry weight (19.37g) total dry weight (25.65 g), leaf area per plant (783.73 cm^2), net assimilation rate, relative growth rate (90.00 mg g^{-1} d^{-1}) and seed yield (24.72 q ha^{-1}) has result ed with Triacontanol @ 1mL L^{-1} followed by SA @ 50 ppm and NAA @ 10 ppm .

Key words : Growth regulators and nutrients, Growth, yield, Soybean.

In India, soybean is an important grain legume and importance is increasing day by day due to higher nuirtive value. It has high proten content among all legume crops. Unfortunately there has been no significant increaseing the productivity of soybean in India (1.1 t ha^{-1}) as compared to the world (2.2 t ha^{-1}) and Asia (1.5 t ha^{-1}). The identified large gap between average yield of world in India can be decreased by using plant growth regulators. The present investingation was due to assess the effect of folior spray of growth regulators and nutrients on growth and yield in soybean .

MATIRIAL AND METHODS

A field experiment was conducted at college farm, Agricultural college, Bapatla, (AP) in black soil during *rabi* 2005-06 . Factorial randomized block design was adopted with 3 replications , two main factors (2 varieties JS-335 and Nirmal -111) and 8 sub factors with growth promoting chemicals consisting of T1- control , T2-water, T3 - GA_3 @10 ppm, T4-NAA @ 10 ppm, T5-SA @ 50 ppm, T6-CCC @ 50 ppm, Urea @ 1 %, T8- Triacontanal @ 1 mL L^{-1} . These treatments were imposed by foliar spray at 35 DAS and 45 DAS.

RESULTS AND DISCUSSION

The data on morphological parameters like plant height, no.of leaves per plant, no. of nodes per plant and days to flowering are presented in Table 1, which increased with age of crop. Among the genotypes JS-335 recorded significantly more plant height (45.40cm), no. of leaves per plant (14.47) no. of nodes per plant (8.85) and no. of branches per plant (9.10). Of all treatments Triacontanol @ 1mL L^{-1} recorded significantly heighest plant hight (46.74) no.of leaves per plant (9.41) followed by SA @ 50 ppm, NAA @ 10 ppm over control, but CCC @ 50 ppm recorded lowest plant height (40.88 cm) . Paleg (1965) and Mohmmad (1975) reported increase in plant height might be due to stimulation of cell division and cell elongation due to plasticity of internodes and cell wall . Maximum shoot extension obtained with the application of 0.06 mL L^{-1} Triacontanol in guava (Mandal and Ravi Kumar, (1989), 7.5 ppm Triacontanol in santorosa plum (Brar 2004) CCC@ 50 ppm a growth retardant reduced the plant height compared to control. The mechanism of reduction in plant height appear to be due to slow down of cell division and reduction in cell expansion Govindan et. al (2000) observed that the foliar spray of CCC reduced the plant height and dry matter production .

Significant differences observed with respect to no.of days to flowering genotypes but not with foliar sprays . Among two genotypes Nirmal-111 took more no.of days to flowering (32.37) as compared to JS-335 (30.72) .

Significant differences were observed to stem dry weight, leaf dry weight, dry weight of reproductive parts and total dry weight (Table 2). Stem dry weight, pod dry weight were increased with age of crop where as leaf dry weight increased upto 70 DAS. After it was decreased due to sensceens of leaves due to foliar sprays and genotypes . Among two genotypes JS-335 recorded higher stem dry weight (6.75 g), leaf dry weight (5.47 g) pod dry weight (19.11 g) and total dry weight (25.89 g). Of all treatements

Table 1. Effect of Foliar Sprays on Morphological Paramters

S.No.	Treatments	Palnt Height (cm) 90 DAS			No. of Leaves/Plant 70 DAS		
		JS - 335	Nirmal-111	Mean	JS - 335	Nirmal-111	Mean
T1	Control	44.04	42.90	43.47	12.66	10.93	11.80
T2	Water spray	44.32	43.34	43.83	13.76	11.00	12.38
T3	$G.A_3$@10ppm	45.55	44.36	44.96	14.20	11.51	12.86
T4	NAA@10ppm	46.40	45.13	45.76	14.90	13.23	14.07
T5	SA @ 50ppm	47.40	45.34	46.37	15.46	13.40	14.43
T6	CCC @ 50ppm	41.60	40.16	40.88	14.53	12.56	13.55
T7	Urea @ 1%	46.04	44.68	45.36	14.63	13.00	13.82
T8	Triacontanol @ Imll^{-1}	47.85	45.62	46.74	15.60	13.60	14.60
	Mean	45.40	43.94	-	14.47	12.49	-
		SEm+/-	CD (0.05)		SEm+/-	CD (0.05)	
	Growth regulators	0.934	2.70		0.366	1.056	
	Genotypes	0.462	1.35		0.183	0.528	
	Interaction	NS	NS		NS	NS	
	CV%	5.12			6.63		

S.No.	Treatments	No.of Nodes/Plant 90 DAS			No.of Branches/Plant			Days to Flowering		
		JS - 335	Nirmal-111	Mean	JS - 335	Nirmal-111	Mean	JS - 335	Nirmal-111	Mean
T1	Control	8.13	6.81	7.74	8.20	7.50	7.85	32.00	33.33	32.67
T2	Water spray	8.46	7.16	7.81	8.66	8.00	8.33	31.46	33.00	32.23
T3	$G.A_3$@10ppm	8.46	7.60	8.03	8.93	8.26	8.60	31.33	32.66	32.00
T4	NAA@10ppm	9.20	8.20	8.70	9.33	8.50	8.92	30.33	32.00	31.17
T5	SA @ 50ppm	9.26	8.33	8.80	9.66	8.53	9.10	30.00	32.00	31.00
T6	CCC @ 50ppm	8.86	8.06	8.46	8.93	8.26	8.60	30.66	32.33	31.50
T7	Urea @ 1%	8.86	8.06	8.46	9.20	8.46	8.83	30.66	32.33	31.50
T8	Triacontanol @ Imll^{-1}	9.33	8.69	9.01	9.86	8.96	9.41	29.33	31.33	30.33
	Mean	8.82	7.86	-	9.10	8.31	-	30.72	32.37	-
		SEm+/-	CD (0.05)		SEm+/-	CD (0.05)		SEm+/-	CD (0.05)	
	Growth regulators	0.189	0.544		0.220	0.634		NS	NS	
	Genotypes	0.094	0.272		0.110	0.317		0.367	1.060	
	Interaction	NS	NS		NS	NS		NS	NS	
	CV%	5.54			6.86			5.70		

Table 2. Effect of Foliar Sprays on Dry Morphological Paramters

S.No.	Treatments	Stem Dry Weight (g) 90 DAS			Leaf Dry Weight (g) 70 DAS			Dry Weight of Reproductive parts (g) 90 DAS			Total Dry Weight (g) 90DAS		
		JS - 335	Nirmal-111	Mean	JS - 335	Nirmal-111	Mean	JS - 335	Nirmal-111	Mean	JS - 335	Nirmal-111	Mean
T1	Control	6.34	5.10	5.72	4.95	3.18	4.07	18.16	16.44	17.30	24.50	20.54	22.52
T2	Water spray	6.43	5.30	5.87	5.11	3.38	4.25	18.20	16.95	17.58	24.82	21.09	22.96
T3	G.A$_3$@10ppm	6.45	5.40	5.93	5.21	3.55	4.38	19.01	17.07	18.04	25.55	21.47	23.51
T4	NAA@10ppm	6.99	5.81	6.40	5.68	3.98	4.83	19.45	17.46	18.46	26.44	22.27	24.36
T5	SA @ 50ppm	7.05	6.05	6.55	5.78	4.15	4.97	19.53	18.00	18.77	26.58	23.43	25.01
T6	CCC @ 50ppm	6.75	5.45	6.10	5.45	3.65	4.55	19.14	17.12	18.13	25.89	21.57	23.73
T7	Urea @ 1%	6.81	5.65	6.23	5.56	3.95	4.76	19.17	17.13	18.15	25.98	21.78	23.88
T8	Triacontanol @ Imll^{-1}	7.15	6.10	6.63	6.05	4.69	5.37	20.23	18.50	19.37	27.38	23.91	25.65
	Mean	6.75	5.61	6.18	5.47	3.82	-	19.11	17.33	-	25.89	22.01	-
		SEm+/-	CD (0.05)		SEm+/-	CD (0.05)		SEm+/-	CD (0.05)		SEm+/-	CD (0.05)	
	Growth regulators	0.135	0.361		0.104	0.301		0.408	1.179		0.510	1.474	
	Genotypes	0.067	0.181		0.052	0.150		0.204	0.590		0.255	0.737	
	Interaction	NS	NS		NS	NS		NS	NS		NS	NS	
	CV%	5.33			5.49			5.49			5.22		

Triacontanol @ 1mL L^{-1} attained highest stem dry weight (6.63 g), leaf dry weight (5.37 g), pod dry weight (19.37 g), total dry weight (25.65 g) . Mehetre and Jamadagni (1996) studied to the biomass partitioning and plant architecture in 41 soybean cultivers and reported that the soybean plant has tendency to accumulate 19.77, 8.05, 29.42, 30.85, and 11.41 percent assimilates into seed, pod wall, stem, roots, and leaves respectively .

Mayers etal., (1991) observed positive relationship between seed yield dry matter production in soybean. SA @ 200 ppm was most effective in increasing no.of branches, total dry matter in soybean (Kothule et al ., 2005). Board and Modali (2005) observed that total dry matter accumulation at first flowering i.e. (200 g m^{-2}) and total dry matter accumalation at start of seed filling (600 g m^{-2}) were valid predicators for optimal yield in soybean . Castro and Moreas (1980) observed decreased plant height and increased total dry matter accumulation in soybean with spraying of CCC@ 200 ppm concentration . Similarly foliar application of NAA @ 25 ppm hastened the dry matter accumulation cowpea (Shah and Patel 2004).

The data on leaf area duration (LAD), relative growth rate (RGR) and net assimilation rate were presented in table-3. Significant differences were observed with respect to these parameters due to genotypes and folior sprays. Among two genotypes JS-335 recorded higher leaf area (855. 21 cm^2) leaf area duration (63.18 days), RGR (91.46 mg $g^{-1}d^{-1}$) , NAR (23.18 mg m^{-2} d^{-1}) . Triacontanol @ 1m L L^{-1} recorded heighest leaf area (787.73 cm^2) , LAI (1.76), RGR (90.00 mg g^{-1} d^{-1}) , NAR (22.00 mg dm^{-2} d^{-1}) in all treatements .

In soybean canopy photosynthesis decreases during early seed filling period and reaching zero near physiological maturity (Hayati et al 1995) and leaf dry weight had strong positive correlation with leaf area (Dopte et al., 1995) . Due to positive effect on cell division and cell elongation leading to enhanced leaf growth and leaf area the LAI increased in all treatements compared to control by foliar application of growth regulators and nutrients. Highest leaf number per plant and leaf area were recorded with foliar application of 50 ppm Triacontanol in straw berry (Thakur *et al.,* 1991) . Application of SA on soybean seedlings at 7 leaf stage increased growth rates (Zhao et al 1995), Kelaiya *et al .,* (1991) reported that foliar spray of growth regulators like CCC (500 ppm) , GA_3 (200 ppm) , NAA (40 ppm) and Triacontanol (200 mL ha^{-1}) improved dry weight per plant and leaf area index when sprayed at 25 and 50 DAS in ground nut .

LAD (Table - 2) significantly increased in all treatements with the application of growth regulators compared to control. Morandi *et al.,* (1984) and Kulakarni (1993) also reported the increased LAD due to application of CCC in soybean.

RGR and NAR (Table – 3) were higher at 30-50 DAS and declined after because of their dependence upon the leaf dry weight . Leaf area and LAI also declined after 50 DAS . GA_3 application at 10 ppm concentration was found to be more effective in promoting leaf number; leaf area and plant dry weight at 60 and 80 DAS interval.

It is evident from table – 3; genotypes and folior sprays significantly affected the seed yield (q ha^{-1}). Among two genotypes higher seed yield was found in JS-335 (24.20 q ha^{-1}). That is 16 % more than other genotype Nirmal -111 (20.85 q ha^{-1}). Of all treatments Triacontanal recorded highest seed yield (24.72 q ha^{-1}) i.e. 20 % more than control (20.61 q ha^{-1}). Narasimha Rao *et al .,* (2005) also reported that the increased seed yield may be due to the application of Triacontanal together with boron which might have increased pod set in chickpea.

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