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EFFECT OF GROWTH REGULATORS AND PHOSPHORUS LEVELS ON GROWTH AND YIELD OF SOYBEAN

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ABSTRACT

Foliar spray of different growth regulators significantly influenced the plant growth and yield attributing characters. Highest yield response was obtained by triacontanol (13.51 q/ha) closely followed by kinetin (12.95 q/ha), as compared to control (12.02 q/ha). Significant increase in the uptake of N, P and K was observed due to application of growth regulators. Triacontanol significantly increased N, P and K uptake whereas Kinetin increased N and P uptake over control. LAI was significantly increased due to application of all the three growth regulators where the chlorophyll content was significantly increased only due to triacontanol.

Growth regulators which can improve the physiological efficiencies including photosynthetic ability of plants offer a signficant role in raising the crop yields. Phosphorus plays a key role in root development, nodulation, energy transformation and various vitally important metabolic processes in the plants. Beneficial effects of phosphorus are ascribed to better translocation of desired metabolities in the yield containing parts.

MATERIALS AND METHODS

A field experiment was conducted during kharif season of 1986 at Rajasthan College of Agriculture, Udaipur to study the effect of various growth regulators and phosphorus levels on growth, yield and nutrient uptake of soybean. The treatment comprised three growth regulators viz. triacontanol (1 ppm), Kinetin (2×10^{-5}M) and GA (15 ppm) along with a control and four levels of phosphorus viz. 0, 20, 40 and 60 kg P_2O_5/ha laid out in a Factorial Randomised Block Design with three replications. Soybean cultivar 'Gaurav' was used as a test crop.

Table 1. Effect of phosphorus and growth regulators on leaf area index and chlorophyll content of leaves.

Treatment	LAI	Chlorophyll content of leaves (mg/g) fresh wt. of leaf
(A) Growth regulators :		
Control	1.93	1.33
Triacontanol	2.47	1.39
Kinetin	2.28	1.29
GA	2.08	1.28
S.Em ±	0.03	0.03
CD at 5%	0.10	0.08
(B) Phosphorus levels : (kg P_2O_5/ha)		
0	2.01	1.16
20	2.09	1.19
40	2.22	1.38
60	2.43	1.56
S.Em ±	0.03	0.03
CD at 5%	0.10	0.08

RESULTS AND DISCUSSION

LAI and Chlorophyll content of leaves: Among various growth regulators tried triacontanol gave the highest LAI (2.47) which was significantly higher than that obtained with Kinetin, GA and control. Application of triacontanol, Kinetin and GA resulted in 27.9, 18.1 and 7.7% increase in LAI, respectively as compared to control (Table .1). There was a significant variation in leaf area index to application of phosphorus. Highest leaf area index (2.43) was obtained with 60 kg P_2O_5/ ha which was significantly higher than that produced by 40 kg P_2O_5/ha, (2.22) and 20 kg P_2O_5/ha (2.09). As compared to 40 kg and 20 kg P_2O_5/ha application of 60 kg P_2O_5/ha increased the leaf area index by 9.4 and 16.2% respectively. Chlorophyll content of leaves was signficantly affected due to application of growth regulators. Triacontanol gave the highest chlorophyll content of leaves (1.39 mg/g) as compared to control (1.33 mg/g). It was noted that application of 60 kg P_2O_5/ha gave highest chlorophyll content (1.56 mg/g) of leaves which represented 34.4, 31.0 and 13.0% increase over control, 20 and 40 kg P_2O_5/ha levels, respectively.

Increase in plant growth might be due to higher quantity of chlorophyll formation in the leaf tissues and delayed senescence of the plant leaves

Table 2. Effect of growth regulators and phosphorus levels on N, P and K uptake.

Treatment	Total N P K uptake (kg/ha)		
	N	P	K
(A) Growth regulators :			
Control	97.3	11.4	36.2
Triacontanol	110.2	12.8	40.5
Kinetin	105.4	12.3	38.6
GA	98.2	11.5	35.9
S.Em ±	2.51	0.3	0.9
CD at 5%	7.2	0.8	2.8
(B) Phosphorus levels :			
(kg P_2O_5/ha)			
0	80.6	9.4	30.0
20	90.4	10.6	33.6
40	112.5	12.9	41.1
60	127.6	15.0	46.5
S.Em ±	2.5	0.3	0.9
CD at 5%	7.2	0.8	2.8

which ultimately reflected in increased dry matter production and LAI. These results are in close conformity with the findings of Ries *et al.* (1978) with triacontanol; Bessonova *et al.* (1974) with Kinetin. LAI and chlorophyll content of leaves both were increased significantly following the phosphorus application. The increased LAI might have provided full coverage of surface area which in turn resulted in better interception, absorption and utilization of radient energy in photochemical reactions leading to higher photosynthetic rate per unit leaf surface. An increase in leaf area index due

Table 3. Effect of growth regulators and phosphorus levels on yield and harvest index (%).

Treatment	Yield (q/ha)		H.I. (%)
	Grain	Stover	
(A) Growth regulators :			
Control	12.02	16.93	41.51
Triacontanol	13.31	19.22	40.91
Kinetin	12.95	17.87	42.01
GA	12.00	16.62	41.92
S.Em ±	0.31	0.52	0.45
CD at 5%	0.91	1.51	NS
(B) Phosphorus levels :			
(kg P_2O_5/ha)			
0	9.90	14.40	40.74
20	11.00	16.08	40.62
40	13.66	19.24	41.51
60	15.73	20.91	42.93
S.Em ±	0.31	0.52	0.45
CD at 5%	0.91	1.51	1.31

to phosphorus application has been reported by Roy and Mishra (1974). Chlorophyll content of leaves was signficantly increased due to application of higher levels of phosphorus (40 and 60 kg P_2O_5/ha).

Nutrient uptake : Data presented in Table 2 reveal that application of different growth regulators brought out significant increase in nitrogen, phosphorus and potassium uptake by soybean as compared to control. Application of triacontanol gave the highest uptake of N, P and K (110.25, 12.89 and 40.55 kg/ha) respectively, which was 13.2, 12.9 and 11.7% higher than control. Similarly application of Kinetin also resulted in signficant increase in N and P untake, while potassium uptake was not affected significantly. Application of Kinetin resulted in 8.2 and 7.8 per cent higher N and P uptake as compared to control, respectively. GA did not cause any significant change in nutrient uptake as compared to control. The results further show that application of phosphorus brought out significant increase in N, P and K uptake as compared to control. It is evident from the data that application of 20, 40 and 60 kg P_2O_5/ha increased nitrogen uptake by 12.2, 39.5 and 58.2% over control, respectively. Respective increase in phosphorus uptake were 12.7, 36.9 and 58.7% and those were 11.9, 37.0 and 54.7% in case of potassium uptake.

The uptake of nutrients is primarily a function of total biomass production and secondly of nutrient content at the cellular level. Thus marked increase in the uptake of N, P and K following the application of growth regulators in the present investigation mainly appears to be due to increased photosynthetic efficiency. Uptake of N, P and K showed significant increase dut to phosphorus application over control, which is due to cumulative effect of increased dry matter production and nutrient content on account of higher availability of nutrients with increase in phosphorus fertilization.

Yield : Data on effect of different growth regulators and phosphorus levels on grain, stover yield and harvest index have been presented in Table 3. Results show that application of different growth regulators brought out significant increase in grain yield of soybean as compared to control. Application of triacontanol gave the highest grain yield (13.31 q/ha) which was 10.7% higher than control. Similarly application of Kinetin resulted in significant increase (7.7%) in grain yield over control. Grain yield did not undergo any signficant change due to application of GA. Among various growth regulators it was noted that triacontanol gave significantly higher stover yield (19.22 q/ha) representing 13.5% increase over control. Other growth regulators, however, did not cause any significant variation in stover yield. Different growth regulators did not bring out any significant variation in harvest index of the crop. Results further reveal that grain yield of soybean increased significantly in response to increassing levels of phosphorus. Highest grain yield (15.73 q/ha) was obtained with 60 kg P_2O_5/ha level and was signficantly higher than that produced by 40 kg P_2O_5 (13.66 q/ha) and 20 kg P_2O_5/ha (11.0 q/ha). Application of 20, 40 and 60 kg P_2O_5/ha increased the grain yield by 11.1, 37.9 and 58.8% respectively, as compared to control. An examination of data presented in Table 3 show that application of 20, 40 and 60 kg P_2O_5/ha increased the stover yield by 1.68, 4.84 and 6.51 q/ha over control, representing 11.6, 33.6 and 45.2% increase, respectively.

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SEED TREATMENT OF CABBAGE SEEDS BY CHEMICAL AND NON CHEMICAL METHODS ON THE VIABILITY

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ABSTRACT

Influence of seed treatment with fungicides, bactericide, hot water and antagonists on the viability of cabbage seeds was assessed. Seeds treated with carbendazim at 2 g per kg, in hot water at 50°C for 30 min and thiram at 2 g per kg resulted in higher germination.

Seed treatment with fungicides to control the seed borne fungi and maintain the seedling vigour is essential. In Denmark, a profit of 8 to 9 million dollars was obtained in a single year by cereal seed treatment with fungicides (Stapel 1966). Sivaprakasam *et al.* (1975) reported higher germination in sorghum seeds treated with thiram, benomyl, carbaxin and captan at 2 g per kg throughout the period of 8 months of storage. The present study reports the efficacy of fungicides, bactericide, hot water and antagonists on the viability of cabbage seeds during storage.

MATERIALS AND METHODS

The seeds of cabbage cv. September obtained from the State Department of Horticulture and Plantation Crops were treated with fungicides by dry seed dressing. The seeds were shaken with the fungicides in a plastic container for 15 min. In case of antibiotics, the seeds were soaked in antibiotic solutions (0.01 per cent) for 2 h and shade dried. In case of combination of seed treatment with fungicides and antibiotics the seeds were treated first with antibiotics and 24 h later with fungicides. Hot water treatment was given by dipping the seeds in water bath at 50°C for 30 min.

Trichoderma viride and *T. harzianum* grown on PDA medium for 14 days were suspended in sterile distilled water blended and filtered through a muslin cloth. The filtrate containing conidia was centrifuged at 3000 g for 10 min. The supernatant was discarded and the conidial pellet was resuspended in sterile distilled water. The process was repeated again and finally the conidia were suspended in 10 ml of 0.1 per cent carboxy methyl cellulose solution. The concentration was adjusted to 4.8 to 5.2 x 10^9 conidia per ml using a haemocytometer. Three ml of this suspension was used to coat 10 g of cabbage seeds following the method of Sivan *et al.* (1984).