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IMPACT OF GROWTH REGULATOR-GA_3 AND NUTRIENTS ON JUTE PLANTS

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ABSTRACT

Individual and combined effects of aerial application of GA_3 and nutrient solutions on growth, quantity and strength of fibre, and chemical composition of jute plants have been investigated. GA_3 alone has caused a significant increase in growth parameters (execpt total number and thickness of leaves) and the yield of jute fibre. These increases have decidedly been boasted up when the growth regulator applied in conjunction with nutrient solutions. The individual treatments and their combinations, too, have favoured the uptake of nitrogen, phosphorus and potassium by the plants significantly. However, GA_3 appears to be ineffective so far the strength of jute fibre is concerned.

INTRODUCTION

Remarkable changes in the morphogenetic character and growth behabiour are caused due to the application of exogenous gibberellic acid (GA_3), a notable growth regulator, on a wide range of plant species (1). This chemical usually acts primarily in lengthening of stems or internodes of plants, notably *Chichorum endiva*, *Brassica oleracea* and *Lycomersicon esculentum*(2) and it also enhances the broadening of the girth of some plants' seedling (cherry trees and jute plants) (3,4). Furthermore, this chemical has also been found have direct bearing on total number of leaves of a number of plant species specially in tobacco seedlings and dicotyledonous plants (5). Impacts contrary to the above have also been reported on sugar beet(3).

Mentions are there in the literature about this compound with respect to the chemical composition of plants, but the findings are unfortunately not in accord with one another rather conflicting (7,8,9). This may probably be due to the plant-chemical interactions.

Wolf and Haber (10) remarked that the rate of nutrients uptake could not keep pace with the enhanced rate of plant growth due to promoter application, resulting a temporary deficiency. consequently, it may be presumed that growth regulators in presence of fertilizers may have significant effect on the growth of plants subject to the conditional factors.

Very recently it was observed(11) that the application of KNap along with fertilizers resulted in significant increases in growth, fibre yield of, and nigtrogen uptake by jute plants.

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Jute, the most important cash crop of Bangladesh, is widely grown throughou Bangladesh and jute fibre yield is much too dependent on height and the girth of the plants. Literature also reveals that GA_3 played a significant role in increasing the ball setting, thickness, strength of fibre in fibre yielding plants (*C. capsularies*, *Hibiscus*, *Cannebinus* and *Cannabis sativa*)([12,13]). It may reasonably be expected that GA_3 if applied in conjunction with fertilizers may play a great role in the betterment of quan ity and quality of *Chorcorus capsularies*.

EXPERIMENTAL

Materials. Collected sample of surface soil (0-15 cm), Savar series, Dacca is sandy clay with pH-6.0, organic matter 1.8% and nitrogen 0.2%.

Air-dried soil was mixed with cow-dung in the ratio of 2 : 1 ; to it was added a basal dose of potassic (KCl) and phosphatic (NaH_2PO_4) fertilizers at the rate of 64 lbs. (K_2O) and 20 lbs. (P_2O_5) per acre respectively. Nitrogenous fertilizer was applied as a foliar spray during growth of the jute plants. The treated soil was then potted in 63 earthen-wire pots (30 cm × 25 cm size) and seeded with *C. capsularies* (cultiuvar D 154). After a few days of germination the plants were thinned and only four healthy plants of uniform size were kept in each pot. Tap water was added to meet the water requirement of the plants at interval of time depending upon conditions.

Doses. GA_3 at the rate of 0, 0.50, 0.75, 1.00, 1.25, 1.30 and 3.00 ppm alone and in combination with three levels (0, 0.5 and 0.10) percent of nutrients (N, P, K, Ca, Mg and S) ; all aqueous solutions were spread initially at the age of 28 days and finally at 35 days of growth. The experiment was arranged in a split-plot design in the premises of the Soil Science Department, Dacca University, Dacca.

The plants were harvested after 12 weeks, and half of them was used for the measurement of height, number and thickness of leaves, dry weights of shoots and stalks, and for ehemical analysis of nitrogen, phosphorus and potassium contents in shoots as well. The other half was used for the estimation of quantity and strength of fibre.

Analytical techniques. The pH of the soil was measured by using a Pye pH meter with glass electrode (the soil : water ratio being 1 : 2.5). Determinations were made of mechanical analysis by hydrometer method (14), organic matter by wet oxidation method (15), total nitrogen by Kjeldahl method, phosphorus by Vanadomolybdophosphoric yellow colour method and potassium by Flame Photometric method uing EEL Flame Photometer.

RESULTS AND DISCUSSION

The effect of foliar application of GA_3 and nutrients separately and in combination of growth indices (viz. height, total number and thickness of leaves, dry weights of shoots and stalks), quantity and quality of fibre, and chemical composition of shoots of jute plants have been investigated, and the results thus obtained are given in tables I to IV

The application of GA_3 exhibited a significant (at 0.1% level) increase in height with concentration upto 1.50 ppm thereafter the effect seems to be labelled off (Table I). However, the plants treated with GA_3 in any combination with nutrients could not produce data significantly different from those of simply GA_3 treated plants excepting those receiving 0.10 percent nutrients solution which induced accelerated growth only in combination with lower rate of GA_3 (upto the range of 1.50 ppm). This was possibly due to the increase in length of internodes which is in good agreement with the reported observa-

tion(1). The other differences apparent in the appropriate columns (Table 1) are possibly due to the influence of local factors.

The intermittent fluctuation in data with respect to the total number and thickness of leaves caused by GA_3 and nutrients in any combination have been found statistically insignificant (Table 1). This is also clear from the fact that the increase in height of the plants is due to the lengthening of the internodes instead of the number. The count of internodes also supports it.

TABLE I

EFFECT OF GA_3 AND NUTRIENTS ON THE GROWTH OF JUTE PLANTS

GA_3 (ppm) / *Nutrients (%)*		*0*	*0.50*	*0.75*	*1.00*	*1.25*	*1.50*	*3.00*
0	Height cm/plant	204.0	228.0	238.5	243.0	244.0	249.0	245.0
	Total leaves/ 10 plants	192	202	197	187	202	200	197
	Thickness mg/10 leaf discs	45.0	43.9	39.5	40.0	40.0	38.0	41.0
0.05	Height cm/plant	224.0	234.3	240.6	245.3	249.0	253.2	249.0
	Total leaves/10 plants	200	207	210	227	217	225	207
	Thickness mg/10 leaf discs	53.0	45.4	45.2	45.5	46.0	49.2	46.2
0.10	Height cm/plant	224.5	237.0	246.0	247.0	248.0	255.0	251.0
	Total leaves/10 plants	210	220	220	230	232	237	220
	Thickness mg/10 leaf discs	56.0	47.0	46.5	47.1	47.7	51.1	49.0

* Calculated on the basis of increase in weight.

Jute plants receiving different levels of GA_3 followed by nutrients showed a highly significant (at 0.1% level) increase in the dry weights of shoots and stalks (Table II). The dry matter content of shoots as well as stalks, in general, gradually increased with the increasing rates of GA_3 and nutrients.

Reference to Table III it is found that GA_3 has played a significant (at 1% level) role in increasing the fibre yield with concentration irrespective of nutrients. However, nutrients also followed the same sequence. The combined application of GA_3 and nutrients have produced a higher yield of fibre than the respective treatments. This may be associated with the favourable stimulation of the growth due to change in physiolo-

gical activities of plants by GA_3, which was further augmented by a better nutrition due to the foliar sprays of some of the essential nutrient elements. Nevertheless, the increased yield obtained by combined applications are found almost equal to the increases of the corresponding treatments in absence of each other when taken two together.

It is evident from Table III that there is no statistically significant change in the strength of fibre due to the application of GA_3 nutrients and their combinations. It seems that the growth promoter has played role only in increasing growth without much affecting

TABLE II

EFFECT OF GA_3 AND NUTRIENTS ON THE DRY WEIGHTS OF SHOOTS AND STALKS OF JUTE PLANTS

Nutrients (%)	0		0.05		0.10	
GA_3 (*ppm*)	*Dry weight of shoots g/plant*	*Dry wight of stalks g/plant*	*Dry weight of shoots g/plant*	*Dry weight of stalks g/plant*	*Dry weight of shoots g/plant*	*Dry weight of stalks g/plant*
0	22.09	17.87	24.20	24.20	29.16	25.87
0.50	27.66	21.50	32.85	32.85	32.28	25.12
0.75	26.72	23.50	31.21	31.21	35.93	26.50
1.00	29.27	26.25	33.52	33.52	37.40	29.00
1.25	29.58	27.00	35.17	35.17	37.57	30.62
1.50	31.31	27.12	33.93	32.37	39.15	32.87
3.00	26.85	20.40	31.58	29.02	32.19	30.00

TABLE III

EFFECT OF GA_3 AND NUTRIENTS ON THE QUANTITY AND QUALITY OF JUTE FIBRE

Nutrients (%)	*Yield in g/plant*			*Strength in Kg/mg.*		
GA_3 (*ppm*)	0	0.05	0.10	0	0.05	0.10
0	7.55	9.65	9.90	3.27	3.13	3.18
0.50	9.10	9.75	10.85	3.18	3.04	3.45
0.75	9.80	11.25	11.37	2.86	3.18	3.22
1.00	10.95	11.30	11.82	3.31	2.77	2.81
1.25	11.15	12.90	13.25	2.27	2.99	3.36
1.50	11.27	13.82	14.52	3.31	3.08	3.13
3.00	11.00	12.65	12.65	2.99	3.36	3.27

the fibre composition with respect to the crystalinity and or conformation. This result seems to contradict the observation of Atal(12).

The total uptake of nitrogen, phosphorus and potassium increased significantly (at 0.1% level) with increasing concentration of GA_3 and nu rients in all treatments (Table IV). From the nutrient uptake data, it may not be out of place to emphasise the fact fact that GA_3 created a demand for more nitrogen, phosphorus and potassium physiologically and thereby encouraged the plants to take them up accordingly, which are generally believed to be essentital for luxuriant growth.

However, the fact remains to be explored fully with respect to the increase in different aspects of the jute plants as becausee the threash-hold value of the nutrients in foliar application is yet to be ascertained. It may be argued that if the levels of nutrients were increased beyond the level used, the results comparable to the highest in the Tables (I to IV) could have been obtained even in absence of GA_3. Notwithstanding the fact it is hard to cast any doubt about the stipulating effect of GA_3 on jute plants ; and hence even keeping in account this skeptist view one simply can not under estimate the effect or influence of GA_3, not to speak of the combined application (GA_3 and fertilizers). Possibly the efficacy of GA_3 might have become exponent in presence of increased rates of fertilizers.

TABLE IV

EFFECT OF GA_3 AND NUTRIENTS ON THE NITROGEN, PHOSPHORUS AND POTASSIUM CONTENTS (mg/100g DRY MATTER) IN SHOOTS OF JUTE PLANTS

GA_3 (ppm) / *Nutrients* (%)		*0*	*0.50*	*0.75*	*1.00*	*1.25*	*1.50*	*3.00*
	Nitrogen	1.140	1.102	1.118	1.095	0.965	0.921	1.039
0	Phosphorous	0.354	0.346	0.361	0.331	0.334	0.348	0.358
	Potassium	3.900	3.970	3.860	3.930	3.950	3.870	3.880
	Nitrogen	1.267	1.110	1.147	1.137	1.075	1.070	1.149
0.05	Phosphorous	0.446	0.444	0.421	0.425	0.411	0.408	0.407
	Potassium	3.960	4.280	4.310	4.340	4.330	4.400	4.420
	Nitrogen	1.230	1.200	1.132	1.180	1.132	1.192	1.130
0.10	Phosphorous	0.466	0.425	0.423	0.458	0.400	0.432	0.425
	Potassium	4.250	4.290	4.520	4.540	4.560	4.590	4.520

Statistical examinations indicate that there is no interaction between the two treatments. So it may be assumed fairly well that the treatments have rather purely additive effect with respect to the growth indices (total number and thickness of leaves, dry weights of shoots, stalks), fibre yield, and chemical composition of jute plants. Nevertheless, the additive effect is also of immence importance for promoting jute yield. Fortunately they have been found not to be incompatible.

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