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# IMPACT OF GROWTH REGULATORS AND NUTRIENTS ON JUTE PLANTS

## I. The influence of KNap, $C_3$ and nutrients on the growth, fibre content and composition of jute plants

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**Abstract**

Individual and combined effects of potassium naphthenate, chlormequate chloride and nutrient solution on growth, yield and chemical composition of jute plants have been studied by aerial applications. Potassium naphthenate alone has caused a significant increase in growth (with respect to height and total number of leaves), fibre yield and nitrogen uptake when applied in concentration from 5 to 10 ppm. On the other hand, chlormequate chloride and nutrients individually and their combination too, have created impact only on thickness of the leaves.

## Introduction

Growth regulators, now-a-days, have been gaining momentum for being used extensively in economic exploitation of agricultural and horticultural products, which, together with other cultural practices generate a sphere to be explored for increased production of economic importance.

Minute quantities of certain organic chemicals can produce remarkable changes in growth and behaviour of biological species. These chemicals are designated as growth regulators, some of them are of plant origin, and others are laboratory-synthesized compounds. The behaviour of the regulators is peculiar ; depending upon the conditions, the same chemicals can promote or retard the growth without causing any deformation during growth and development ( Humphries 1968, Mohsin and Smith 1972 ).

It is reported by many investigators notably, Cathey (1964), and Primost (1968), that growth retardants can usually suppress the stem elongation by reducing the span of internodes, and this retardation effect is of importance because it prevents lodging in cereals. Nevertheless, the shortening of the internodes has had no detrimental effect whatsoever on inflorescence, quality and quantity of yield. Potassium naphthenate (KNap) and chlormequate chloride ( $C_3$ ) in low concentrations were also found to produce

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promotive effect on the growth of a number of species of bush bean and sunflower plants (Fattah and Wort 1970, Mohsin and Afza 1971).

Biochemically these retardants act by suppressing the gibberellins (Lockhart 1962) and auxins ( Mishra and Mohanty 1968 ) formation in plants. Brown (1964) reported that the soil application of $C_3$ increased the percentage of nitrogen, phosphorus and potassium in poinsetta plants. Linser and Kuhn (1964) and Jaakkola ( 1967 ), however, found that the uptake of nutrients (mg/plant) remained unchanged or was reduced although soil treatment with $C_3$ increased the percentage of protein in wheat. Mohsin and Smith (1972), by contrast, reported that aminozide caused a significant increase in nitrogen, phosphorus, potassium, iron, manganese and magnesium (mg/plant) in chrysanthemum ; however, they noted a marked decrease of the above elements in French bean plants when treated with $B_3$ (3—chlorobenzyl-tri-n-butylammonium bromide), $B_4$ (4—chlorobenzyl-tri-n-butylammonium bromide) and $C_3$.

It has been noted by Wolf and Haber (1960) that the rate of uptake of nutrients could not keep pace with the enhanced rate of growth due to promoter application, resulting a temporary deficiency. Growth regulators in presence of fertilizers caused a significant increase in the uptake of nitrogen and phosphorus in cabbage plants ( Asadov 1965 ).

Jute, the most important cash crop of Bangladesh, is widely grown throughout Bangladesh and its increased yield depends on its height and on the thickness of fibre. Since many workers have suggested that growth regulators have a significant effect on both of these indices, an attempt, therefore, has been made to examine the effect of KNap and $C_3$ together with the added nutrients on the growth, yield and composition of the product on one of the two species of jute, namely, *Corchorus capsularis*.

**Experimental**

*Materials* : Collected sample of surface soil (0—15 cm), Savar series, Dacca is sandy clay with $p^H$—6.0, organic matter 1.8% and nitrogen 0.2%.

*Method* : Air-dried sample was mixed with cow-dung in the ratio of 2: 1; to it was added a basal dose of potassic (KCl) and phosphatic (Na $H_2PO_4$) 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 80 earthen-wire pots ( 30 cm × 25 cm size ) and seeded with *C. capsularis* ( cultivar 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.

KNap at the rate of 0, 5, 10, 30 and 50 ppm alone and in combination with two levels of $C_3$ (0 and 1 ppm) and two rates of nutrients (N, P, K, Ca, Mg and S) (0 and 0.05%) ; 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 of leaves, thickness of leaves, and dry weights of leaves, stems, shoots and stalks, and for chemical analysis of nitrogen, phosphorus and potassium contents in shoots as well. The other half was used for the estimation of fibre yield.

*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 (Bouyoucos 1928), organic matter by wet oxidation method (Walkley and Black 1934), total nitrogen by Kjeldahl method, phosphorus by Vananomolybdophosphoric yellow colour method and potassium by Flame Photometric method using EEL Flame Photometer.

## Results and Discussion

The influence of foliar application of KNap, $C_3$ and nutrients separately, and the combination of KNap-$C_3$, KNap-nutrients, $C_3$-nutrients and KNap-$C_3$-nutrients on the growth parameters viz. height, total number of leaves, thickness of leaves, dry weights of leaves, stems, shoots and stalks, quantity of fibre and chemical composition of shoots of jute plants have been studied, and the results thus obtained are presented in Tables 1 and 2.

The foliar application of KNap exhibited a significant increase in height with concentration ( Table 1 ). However, the plants treated with KNap in any combination with $C_3$ and nutrients could not produce data significantly different from those of simply KNap-treated plants. The differences apparent in the appropriate columns (Table 1) were possibly due to the influence of KNap.

KNap alone has the capacity to retard defoliation of leaves, which got accentuated significantly in the presence of nutrients. $C_3$ or nutrients had failed to produce any effect in the total number of leaves. Nevertheless, the nutrients when applied together with KNap, caused a luxuriant growth. Nutrients possibly delayed the abscission layer formation and thereby decreased the rate of leaf fall.

**Table 1. Effect of KNap, $C_3$ and nutrients on the growth and yield of jute plant.**

| Nutrient | $C_3$ ppm | KNap ppm | Height cm/plant | Total leaf/ plant | Thickness/8 leaf discs | Fibre g/plant |
|---|---|---|---|---|---|---|
| 0.00 | 00 | 0 | 242.5 | 19.66 | 45.2 | 9.66 |
| | | 5 | 254.5 | 20.00 | 45.5 | 10.33 |
| | | 10 | 248.0 | 23.66 | 45.5 | 9.73 |
| | | 30 | 258.0 | 21.33 | 46.0 | 10.33 |
| | | 50 | 258.5 | 22.66 | 44.9 | 10.70 |
| 0.00 | 1.0 | 0 | 238.8 | 19.66 | 50.0 | 9.13 |
| | | 5 | 235.5 | 21.66 | 48.0 | 9.96 |
| | | 10 | 238.0 | 21.00 | 47.8 | 10.30 |
| | | 30 | 238.0 | 22.00 | 50.4 | 10.36 |
| | | 50 | 238.5 | 21.33 | 50.0 | 10.35 |
| 0.05 | 0.0 | 0 | 264.0 | 20.66 | 51.2 | 10.00 |
| | | 5 | 250.0 | 19.66 | 49.0 | 10.90 |
| | | 10 | 244.5 | 24.33 | 48.9 | 9.73 |
| | | 30 | 248.0 | 24.66 | 48.1 | 10.13 |
| | | 50 | 249.0 | 24.66 | 47.7 | 10.20 |
| 0.05 | 1.0 | 0 | 251.0 | 21.33 | 53.9 | 10.50 |
| | | 5 | 250.3 | 22.66 | 45.5 | 10.00 |
| | | 10 | 253.3 | 25.00 | 46.2 | 11.26 |
| | | 30 | 254.5 | 26.00 | 46.6 | 11.16 |
| | | 50 | 258.8 | 27.66 | 47.8 | 12.20 |

*Calculated on the basis of increase in weight.

**Table 2. Effect of KNap, $C_3$ and nutrients on the N, P and K contents (% dry weight) in shoots of jute plants.**

| Nutrients → | 0.00 | | | | | | 0.05 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $C_3$ (ppm) → / KNap (ppm) ↓ | 0.0 | | | 1.0 | | | 0.0 | | | 1.0 | | |
| | N | P | K | N | P | K | N | P | K | N | P | K |
| 0 | 0.893 | 0.324 | 3.72 | 1.000 | 0.374 | 3.99 | 1.044 | 0.412 | 4.02 | 1.124 | 0.431 | 3.51 |
| 5 | 1.012 | 0.309 | 3.23 | 1.000 | 0.374 | 3.24 | 0.945 | 0.323 | 3.84 | 1.016 | 0.339 | 3.89 |
| 10 | 1.059 | 0.289 | 3.83 | 1.050 | 0.400 | 3.81 | 1.007 | 0.298 | 3.91 | 1.017 | 0.340 | 3.54 |
| 30 | 0.979 | 0.304 | 3.24 | 1.102 | 0.401 | 3.28 | 1.135 | 0.223 | 4.52 | 1.135 | 0.358 | 3.50 |
| 50 | 1.002 | 0.330 | 3.49 | 1.083 | 0.459 | 3.24 | 1.198 | 0.315 | 4.37 | 0.887 | 0.354 | 3.41 |

The application of KNap alone or in combination with others could not produce any change in the leaf thickness effectively : however, $C_3$ and nutrients individually have the tendency to modify the thickness, and the two together have produced cumulative effect on this parameter. It has been noted that KNap alone has got no effect on the thickness though, but when applied in conjunction with other treatments has had significant reverse effect. This may possibly be attributed to the rapid elongation and broadening of leaves which was noticed to happen and discussed in the previous section. The modifying tendency of $C_3$ and nutrients might be due to the fact that $C_3$ caused a reduction of leaf area which in presence of sufficient amount of nutrients increased the production of photosynthetic products, thereby increasing the leaf thickness.

Besides these, the other growth indices viz. dry weights of leaves, stems, shoots and stalks were also studied, but all the treatments failed to cause any significant effect on them.

Only KNap has played a significant role in increasing the fiber yield of the jute plants with increasing concentration in absence of arially added nutrients and $C_3$. However, $C_3$ and nutrients, when applied separately or in combination with others, no substantial change in yield was observed. The positive effect of KNap on height generally causes a lanky growth resulting in the production of thin fibre and ultimately low yield. This may be attributed to the fact that the over-all luxuriant growth of the plants due to KNap application probably caused in increased yield of fibre in this investigation.

Table 2 shows that only KNap caused a significant effect on nitrogen content of shoots with concentration upto 10 ppm, beyond which the effect was levelled off. It is also evident from the results that no treatments either individually or combined together produced any significant effect on the percentage of phosphorus and potassium content in the shoots of jute plants.

From the above observations, it is apparent that KNap in the concentration range used in this experiment has had positive correlation with over-all better growth of jute plants with respect to height, total number of leaves, etc. The other growth promoter, $C_3$ alone or in combination with KNap and nutrients apparently appears to be ineffective in causing the vigorous growth in the concentration used. Possibly this is due to very limited range of concentration of $C_3$. This is contrary to what one may reasonably expect. Perhaps this promoter could have attained the efficacy in promoting growth if the limit of concentration range was otherwise optimum. So from these data, it is not possible to draw any conclusion.

Foliar application of nutrients failed to produce any significant effect on growth in general, though it has influenced the growth in some cases when applied in conjunction with KNap only. With these, again, the results can not be treated as conclusive. Moreover, foliar application of nutrients might not have been retained on the leaf due to low spreading co-efficient, or possibly these could not penetrate into the leaves where it could have been profitably used.

From the nutrient uptake data, it may not be out of place to emphasise the fact that KNap created a demand for more nitrogen physiologically and thereby encouraged the plants to take up nitrogen accordingly, which is generally believed to be essential for luxuriant growth.

Statistics indicates that there is no interaction among the treatments of any order whatsoever ; this, of course, does not rule out the possibility of having inter-relationship among the treatments used if the limit of the concentration range and conditions, and to some extent the nature of species, used, is elaborated appreciably.

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