

## Studies on the effect of plant growth regulators on Tobacco

by

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**Introduction :** Hitchcock (1935) found that application of indole propionic acid in lanolin paste (50 mg/gm.) to cut surface of decapitated tobacco stem inhibited the growth of terminal bud but stimulated the growth of buds in the middle and lower parts of the stem. Hitchcock and Zimmerman (1935) reported that the addition of 1 to 8 mg., per pot, of aqueous solutions of indole acetic acid, indole propionic acid, naphthalene acetic acid, phenyl acetic acid and phenyl propionic acid caused permanent swelling and bending of the stem. They (1942) found that when tobacco plants were sprayed with 300 p. p. m. of naphthoxy acetic acid, there was rapid growth of the plants, as compared to the check plants. When plants were treated with 200 p. p. m. of chlorophenoxy acetic acid, some formative effects were observed by them. According to McEvoy (1942) application of 2.5 p. p. m. of indole acetic acid at the rate of 250 ml. per sq. ft. was beneficial in stimulating the growth of tobacco plants. Liguori and Martino (1953) reported that the proprietary root promoting substances Rootone, Aumentone and Transplantone, when used for treating the beds of Turkish tobacco, there was slight reduction in the germination percentage, but the plants arising from Rootone-treated seeds showed better development than the control.

With a view to examine the effect of some plant growth regulators on tobacco, studies were undertaken in the Department of Agriculture, Annamalai University, Annamalainagar and the results are presented here.

**Materials and Methods :** Local chewing variety of tobacco (*Nicotiana tabacum* L.) was selected for these studies. Good quality seeds were collected and were soaked for 24 hours in 20 p. p. m. and 30 p. p. m. of aqueous solutions of indole acetic acid (IAA), indole butyric acid (IBA) and naphthalene acetic acid (NAA). Two grams of seeds were used for each treatment. After treatment the seeds were sown in raised nursery beds in the Pot Culture House. Germination counts were taken after an interval of seven days. The plants of uniform size arising from each of the treated beds were pulled after seven weeks and were transplanted in twelve-inch pots. Observations on the growth rate and other characters of these plants were recorded at periodical intervals.

To study the effect of spray treatment with plant regulators on tobacco plants, seven week-old healthy seedlings from untreated seeds were selected and planted in twelve-inch pots. After an interval of seven days the plants were sprayed with aqueous solutions of 50 p. p. m. of the plant growth regulators. Ten plants were included under each of the treatments. The plant height and length and breadth of the leaves were measured at periodical intervals. The leaf area was calculated using the formula  $\frac{2}{3} \times l \times w$ , where  $l$  is the length and  $w$  is the width of the leaf, as recommended by Sajnani and Dhyani (1959). Representative samples of five leaves, selected at random from each of the treatments, were collected and the average wet weight was taken. The dry weight of the leaves was obtained by keeping them in hot air oven at 100° C until a constant weight was obtained.

**Results :** 1. *Effect of seed treatment with plant growth regulators :* The tobacco seeds were treated with plant growth regulators for 24 hours as per details given above. The germination counts taken after seven days from the various treatments are recorded in Table I.

TABLE I.

*Effect of Growth Regulators on Seed Germination.*

Conc. in p. p. m.	IAA		IBA		NAA	
	No. of seeds germinated	% increase over control	No. of seeds germinated	% increase over control	No. of seeds germinated	% increase over control
20	...	...	1434	693.2	392	102.4
30	801	312	1553	700.5	480	147.4
0 (control)	194	...	...	...	...	...

These results indicate that in all the treatments there was more germination than in the control. The increase in germination percentage ranged from 102.4 to 700.5 over control, of which IBA at 30 p. p. m. gave the maximum of 1553 seedlings as compared to 194 seedlings in the control.

The results obtained on the rate of growth of the plants arising from the treated seeds are presented in Fig. 1. All the treatments seem to induce faster growth of the plants as compared

to the control. The percentage increase in the height varied from 25.3 to 59.1 by the end of 49 days after transplanting; the percentage increase in the leaf area also varied from 22.5 to 50.1, IBA at 30 p. p. m. being the best among the various treatments.

With a view to find out whether the increase in size of the plant is commensurate with the wet and dry weights of the plant, the samples were weighed as per details given under Materials and Methods. The results obtained are presented in Table II.

TABLE II.

*Effect of Growth Regulators on dry and wet wt. of leaves after pre-treatment of tobacco seeds.*

Treatment	Average wet wt. of the leaf (gms)	Average dry wt. of the leaf (gms)	Percentage moisture
IAA 30 p. p. m.	14.949	1.266	91.4
IBA 20 "	12.506	1.126	90.9
IBA 30 "	13.921	1.280	90.8
NAA 20 "	13.244	1.266	90.4
NAA 30 "	14.287	1.458	89.8
Control	14.466	1.435	90.02

As could be seen from the data obtained, there is no significant variation in the moisture content of the leaves from various treatments.

2. *Effect of plant growth regulator sprays on tobacco:* Potted tobacco plants, seven days after transplanting, were sprayed with aqueous preparations of plant growth regulators using an atomiser. Periodical observations were taken and the rate of growth, area of the leaves etc., as well as malformations or formative effects, if any, were observed. The details on growth rate and leaf area of the plants are presented in Fig. 2.

The results clearly indicate that there is relatively more growth in all the plants sprayed with plant growth regulators, reaching upto 21.8 per cent increase over control, after 28 days. The leaf area of the sprayed plants, however, was not increased in all cases; in the

cases of 50 p. p. m. of chlorophenoxy acetic acid (CIPA) and 2,4-D there was reductions in the area — these reductions were mainly due to formative effects caused by the chemicals. Though there has been slight increase in the leaf area due to the treatments with 2,4,5-trichlorophenoxy acetic acid (2,4,5.T), NAA and IBA at 50 p. p. m., this increase in the area was not uniform in all the leaves. The various types of formative effects observed in the treated plants are presented in Fig. 3 (A to D).

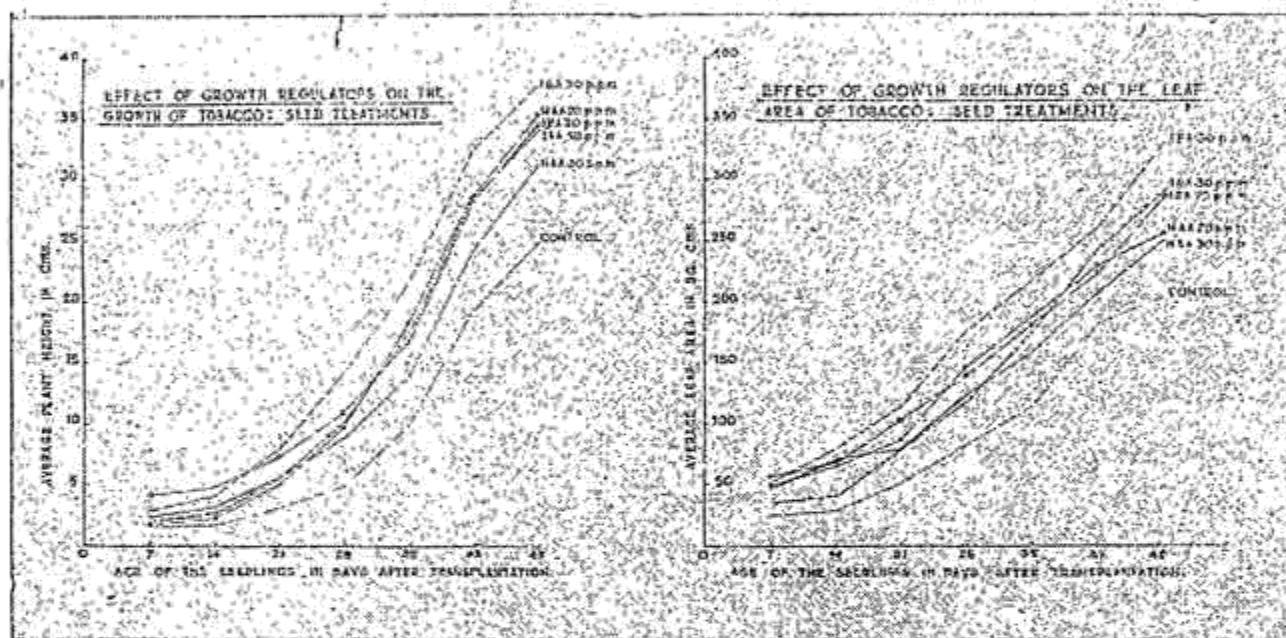


Fig. 1.

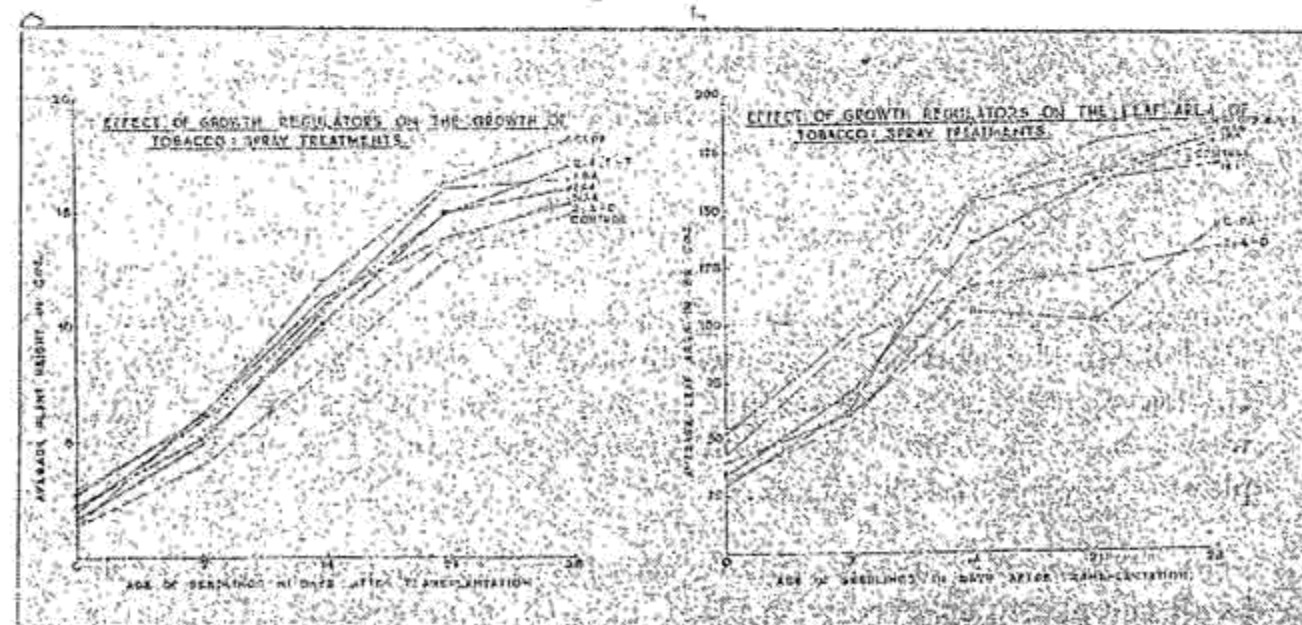


Fig. 2.

In order to compare the wet and dry weights as well as moisture percentage of the leaves, samples were collected and weighed as per the details mentioned earlier. The results are summarised in Table III.

TABLE III.

*Effect of Growth Regulators on dry and wet weights of leaves after spraying.*

Treatment	Average wet wt. of the leaf (gms)	Average dry wt. of the leaf (gms)	Percentage moisture
IAA 50 p. p. m.	17.806	1.040	94.10
IBA 50 "	13.570	1.153	91.50
NAA 50 "	11.820	0.914	89.70
2, 4, 5-T 50 "	12.950	1.230	90.50
2, 4-D 50 "	14.460	1.470	89.80
CIPA 50 "	13.570	1.070	92.10
Control	17.690	1.585	91.01

The moisture percentage seems to be slightly more in the case of plants treated with 50 p. p. m. of IAA, while in other cases there has been a slight increase or reduction in the moisture content.

**Discussion:** In the present studies significant increases in the germination percentage of the seeds treated with plant growth regulators were obtained. Also the plants arising from the treated seeds were found to be more vigorous than those of the control, indicating thereby that the chemicals could be used with advantage for pre-treating the seeds. Liguori and Martino (*loc. cit.*) in their studies with three proprietary plant growth regulators found that there was reduction in the germination percentage, but the ones arising from the treated seeds developed better than the control after one month. In the present studies it was found that 30 p. p. m. of IBA and 20 p. p. m. of NAA induced faster growth of the seedlings.

The spray treatments with the various plant growth regulators though increased the height and in some cases the leaf area, there has been formative effects to a lesser or greater extent, indicating thereby the harmful effects of the chemicals on tobacco plants,

at the concentrations tested. Hitecock and Zimmerman (1942) have reported on the formative effects caused by the application of (200 mg./l) or ClPA to tobacco plants. The formative effects obtained in the present studies with the same chemical by spraying at a concentration of 50 p. p. m., not only reduced the leaf size as seen in the figures given by the authors (*loc. cit.*), but also more intense and virus-like malformations were observed on the leaf. The formative effects caused by the chemicals on tobacco leaves seem to vary with the chemicals (Fig. 3).

Tobacco being a crop cultivated for its leaf, any increase in yield as well as in the average leaf area without affecting the quality would be most welcome. In the present studies it has been clearly indicated that by the seed treatments better plants with larger leaves could be obtained without much affecting the moisture content of the leaves, whereas by the spray treatments there may be either increase or reduction in the leaf area by the quality of the leaf may be affected either due to the formative effects or due to the changes in moisture percentage.

**Summary:** The effect of plant growth regulators on tobacco was tested by pre-treatment of seeds as well as by spray treatment of the potted plants. It was observed that IAA at 30 p. p. m., IB at 20 and 30 p. p. m. and NAA at 20 and 30 p. p. m. gave increase thereby the harmful effects of the chemicals on tobacco plants.

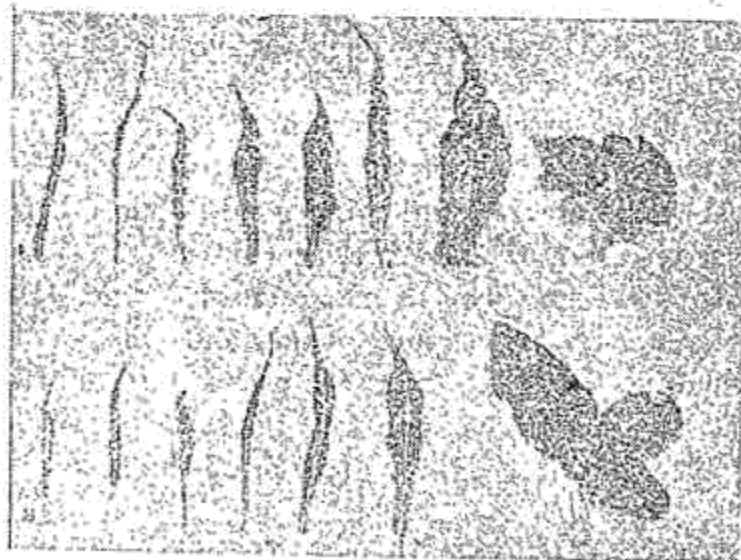


FIG. 3-A.

The Formative effects produced by ClPA. at 50 ppm  
( Various leaf modifications ).



FIG. 3-B.

Cup-like malformations of terminal leaves due to C/PA. sprays at 50 ppm.



FIG. 3-C.

Malformations of the leaves caused by the spraying of 2, 4-D at 50 p.p.m.



FIG. 3-D.

Virus-like symptoms caused by C/PA. sprays at 50 p.p.m.

germination of the seed, better growth, and more leaf area of the plant. The increase in germination percentage ranged from 102.4 to 700.5, the percentage increase in height ranged from 25.3 to 59.1 and the percentage increase in leaf area from 22.5 to 50.1, after 49 days 30 p. p. m. of IBA giving the best results.

Six plant growth regulators at 50 p. p. m. were sprayed on seven week-old potted tobacco plants. Though certain increases in the height and leaf area could be obtained, all the chemicals caused formative effects to a lesser or a greater extent.

The moisture percentage of the leaves obtained from the plants arising from pre-treated seeds was almost the same as that of the control whereas the leaves obtained from the sprayed plants gave varying results.

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