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## Effect of plant growth regulators on jack (*Artocarpus heterophyllus* Lamk.)

by  
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Plant growth regulators are known to make effects on plant growth and development. One of such effects is to induce seed germination and to influence shoot and root growth of the plants. During the past four decades voluminous literature has accumulated on the subject. However, little attention has been paid on jack (*Artocarpus heterophyllus* Lamk.). Sonwalker (1951) had made some studies on the germination of jack seeds and reported the slow growth of the seedlings. Recently, Sinha and Sinha (1969) studied the effect of NAA on the germination of jack seeds. Investigations were undertaken to study the effect of plant growth regulators on seed germination and the root and shoot development of the jack seedlings.

**Materials and Methods:** Viable seeds of uniform age and weight of the local variety were selected. They were soaked in aqueous preparations of the growth regulators of potassium salt of gibberellic acid (GA 10%), indole-acetic acid (IAA), indole-butyric acid (IBA), naphthalene acetic acid (NAA) and chlorophenoxy acetic acid (CPA) at 100 to 500 ppm for 48 hours. Fifty seeds were treated under each treatment and concentration and sown in raised sand beds at a spacing of 25 cm either way. Periodical observations on the germination and malformation if any, were recorded. On the 60th day after germination ten plants of the same age were pulled out carefully to examine the shoot and root development.

2. One month old seedlings of uniform vigour, shoot and root lengths were chosen for seedling treatment. The seedlings were given (a) soak treatment in which the seedlings were soaked in the growth regulator solutions from 25 to 100 ppm for 24 hours and planted; (b) seedlings were sprayed at

25 to 100 ppm at weekly intervals and (c) growing tips of the seedlings were applied with lanolin paste from 0.1 to 0.4% at weekly intervals. Ten seedlings were treated under each treatment and concentration including the control.

Weekly observations on the plants were made to examine the growth rate of shoots and the final shoot and primary root lengths were recorded on the 56th day after treatment.

3. Wet and dry weight of shoots and roots of jack seedlings treated with GA by spray and lanolin paste methods were determined and compared with the respective control. For this purpose, the weights were recorded for five plants under each treatment, on the 56th day. The dry weight was taken after the material was dried in an hot air oven at 100°C until constant weight was obtained. The average data were obtained for each treatment.

**Results:** i) *Seed germination:* The effect of plant growth regulators on seed germination and seedling development of jack is presented in Table 1. Among the various growth regulators tried, GA in all the concentrations uniformly recorded 100% germination as against 80% in the control. It is interesting to note that the seeds of jack treated with 500 ppm. of GA put forth 20% twin seedlings as against single seedling from the control. In the case of CPA treatment, splitting of cotyledons was noticed and there was no proper germination.

With regard to seedling development due to pre treatment of seeds, GA invariably caused maximum shoot elongation when compared to other treatments. But in the case of primary root length except GA, all the other growth regulators induced more root length than the control and the maximum effect being recorded with IBA. GA failed to cause any increase in root length than the control.

ii) *Seedling treatment:* The effect of plant growth regulator treatments at different concentrations on the rate of shoot growth was examined by measuring the length at weekly intervals and depicted in Fig. 1. It could be seen that GA invariably caused the maximum shoot growth in all the three methods of treatment.

In respect of primary root length, the maximum increase was observed at 50 and 100 ppm of IBA, 100 ppm of IAA and NAA and 25 ppm of CPA in the soak method, 100 ppm of IAA, 50 ppm of IBA and NAA and 25 ppm of CPA in the case of spray treatment and 0.2% of IAA, 0.1% of IBA and CPA, 0.2 and 0.3% of NAA in the case of lanolin paste treatment (Table 2). It could also be seen that the growth regulators IBA and NAA in the form of spray and lanolin paste applied at weekly intervals found to increase the root growth than the other treatments including the control. It is quite interesting to note that the increase in shoot growth due to GA was not commensurate with the increase in root growth, which was either inhibited or unaffected.





EFFECT OF PLANT GROWTH REGULATORS ON THE GROWTH RATE OF SHOOT OF *ARTOCARPUS HETEROPHYLLUS*

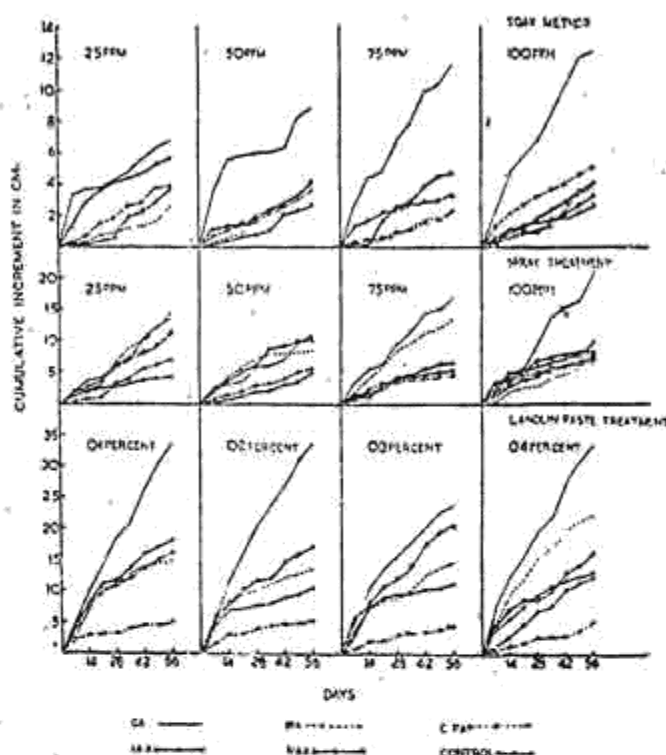


FIG. 1.

iii) *GA on fresh and dry weights of jack seedlings*: GA treated plants exhibited elongation of shoot growth in most cases. But there was no uniform increase or decrease in the root growth. With a view to examining whether the increase or decrease in shoot and/or root growth is commensurate with the

TABLE 3. Effect of GA on fresh and dry weight of Jack seedlings

Treatment	Shoot		Root	
	FW	DW	FW	DW
<i>Spray</i>				
25 ppm	8.69	4.09	2.34	0.92
50 ppm	9.96	4.15	1.99	0.79
75 ppm	9.87	2.91	2.16	0.87
100 ppm	10.66	3.83	2.48	0.86
Control	4.50	1.20	1.88	0.57
<i>Lanolin paste</i>				
0.1%	12.63	5.24	3.76	1.66
0.2%	8.69	2.91	2.30	0.90
0.3%	16.33	4.22	3.04	1.21
0.4%	9.03	2.88	2.16	0.92
Control	4.86	1.59	1.76	0.66

FW=Fresh weight in grams; DW=Dry weight in grams

increases in dry weights of the plant parts, this study was undertaken. Fresh and dry weights of five plants under each concentration were compared and the average data are presented in Table 3. It could be seen from the table that GA consistently increased the fresh as well as dry weights of shoots and roots in jack by the two methods of treatment than the respective control.

**Discussion:** Seed treatment by GA has been found to promote early germination and seedling growth of jack. This is in agreement with the findings reported by Barton (1955), Wittwer and Buckovac (1957), Brian (1959) and Shanmugavelu (1963). Sinha and Sinha (1969) reported the highest percentage of germination of 76.6 at 25 ppm. of NAA than 50% in the control. In the present study, NAA at 100 ppm gave 90% germination as against 80% in the control.

GA induced to produce 20% twin seedlings after the pre-treatment of seeds at 500 ppm. It may be assumed that the application of GA to these seeds, may have accelerated translocation and accumulation of auxins of normal seeds, which are below the optimum for the development of embryo and the enhancement of germination. The production of such twin seedlings, may be attributed to the increase in the concentrations of auxins towards the optimum in the embryo. This is evident from the findings of Haagen Smith *et al.* (1942) that auxin being transmitted to the embryo from endosperm during germination. Seedlings from the GA treated jack seeds showed better shoot elongation than those from the other treatments. Wittwer and Buckovac (1957) and Barton (1958) have reported increased shoot growth in some plant species due to pre-treatment of seeds. On the contrary to the shoot growth, the root development was not induced and it was either inhibited or unaffected.

Sonwalker (1951) reported that the growth of jack seedlings did not exceed an inch per month, whereas in the present study, it was obvious that with the application of GA, the slow growth of the jack seedlings could be made to grow vigorously and faster by pre-treating the seeds and also by seedling treatment. But the root development was not encouraging and was not commensurate with the increase in shoot growth. There are experimental evidences to show that GA has little effect on root growth or sometimes may inhibit root growth (Yabuta and Hayashi, 1939; Sumiki, 1952; Brian, 1959; Seth and Mathauda, 1959; and Dabral and Ghei, 1961).

GA consistently increased the fresh as well as dry weights of shoots and roots of the jack seedlings. The increase in fresh and dry weights of the plants due to GA treatment may be due to the increase in the overall assimilation and redistribution of materials within the plant (Brian *et al.*, 1954 and Shanmugavelu, 1966).

**Summary:** The effect of plant growth regulators on jack revealed  
 (1) GA caused better seed germination than the other growth regulators.  
 (2) GA induced enhanced shoot growth of the jack seedlings but has little effect on root growth. (3) Application of IBA or NAA either as spray or lanolin paste on the seedlings of jack increased the root growth and  
 (4) Seedlings treated with GA as spray and paste showed increase in fresh and dry weight of shoots and roots.

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