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Effect of gibberellic acid, kinetin and naphthylacetic acid on the growth of coconut seedlings

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SUMMARY

The effects of three growth regulators, namely gibberellic acid (GA_3), kinetin (6-furfuryl-aminopurine) and α-naphthyl-acetic acid (NAA), each at five concentrations (0, 25, 50, 10^2 and 10^3 mg/litre) on the growth of coconut seedlings (*Cocos nucifera*) were examined. GA_3 at 25 mg/litre increased growth in height; higher concentrations had no significant effect. Kinetin at 10^2 and 10^3 mg/litre and NAA at all concentrations reduced height growth compared with the control. No treatment caused a significant increase in total dry weight.

INTRODUCTION

The number of seednuts obtained from a coconut palm is comparatively low and it is imperative to raise the seedlings with maximum efficiency. Germination is slow and erratic and even after sprouting, leaf production and growth are not rapid. The most economic way of germinating the nuts on a large scale and an efficient way of raising them under Nigerian conditions have not been worked out.

Growth regulators have been reported to promote growth in plant tissue cultures (Green & Phillips, 1975; Sekiya, Yasuda & Yamada, 1977) although the growth of whole plants is not generally considered to be limited by the content of such compounds. In preliminary experiments at the Nigerian Institute for Oil Palm Research (NIFOR) gibberellin, ethrel, thiourea, hydrogen peroxide and potassium nitrate were used as germination promoters in the oil palm. Only gibberellic acid promoted the germination of fresh de-operculated kernels (Anon., 1973). None of the chemicals affected leaf production, floral initiation or floral differentiation. No work has been reported on the effect of regulators on the growth of coconut seedlings.

The analysis of coconut milk, the normal function of which is to provide nutritive material for the growth of the embryo, showed that it contains at least six substances active in promoting cell division (Fogg, 1966). Some of these have been identified. For example, Letham (1974) found that a large proportion of the cytokinin activity in n-butanol extracts of coconut milk was 9-β-D-ribofuranosyl-zeatin. Van Staden & Drewes (1975) identified zeatin and zeatinriboside in the milk and later, Van Staden (1976) reported that the major cytokinin in butanol extracts was zeatin glucoside.

This study was undertaken to investigate the possibility of using growth regulators to promote the growth of coconut in the nursery and reduce the time before transplanting to the field.

MATERIALS AND METHODS

Coconut seedlings (*Cocos nucifera*) were raised in Polythene bags outside and selected for uniformity at the two-leaf stage. The three growth regulators applied were GA_3, kinetin and NAA at concentrations of 25, 50, 10^2 and 10^3 mg/litre. The experimental design was a 3×5

factorial comprising the three growth regulators at the five concentrations. Each treatment had a sample size of five seedlings and these were replicated three times, giving 15 seedlings per treatment.

The growth hormones were applied at weekly intervals, as foliar sprays to run off, from 4 June to 8 August 1982 and 11 February to 13 May 1983. The experiment was terminated on 26 May 1983.

Height measurements and leaf number were taken at the beginning of the experiment and subsequently at monthly intervals. Height was taken from the nut to the tip of the longest leaf. At the end of the experiment, stem girth was measured and plants were separated into leaves, stem and roots and oven-dried to constant weight.

Analyses of variance were carried out on leaf, stem and root dry weight data as well as leaf number, stem girth and height.

RESULTS

Although there were significant increases in height and leaf number during the course of the experiment, these differences did not persist to the final harvest of 308 days.

There were no significant differences in stem girth at the final harvest and no regulator caused a significant increase in total plant dry weight. No regulator increased leaf dry weight but GA_3 (10^3 mg/litre), kinetin (25 and 50 mg/litre) and NAA (25 and 10^3 mg/litre) significantly decreased it.

GA_3 at 25 mg/litre, kinetin at 10^2 and 10^3 mg/litre and NAA at 50 mg/litre caused a 30% increase in stem dry weight and this was significant; 25 and 50 mg/litre kinetin was inhibitory.

Twenty-five mg/litre GA_3 and 10^3 mg/litre kinetin caused an increase of approximately 35% in root weight and these differences were significant. GA_3 at 10^3 mg/litre, 25 and 50 mg/litre kinetin and 25, 50 and 10^3 mg/litre NAA caused a significant reduction in root weight.

DISCUSSION

The effect of growth regulators on seedlings of *Cocos nucifera* in the present study are similar to their effects on isolated embryos (Anon., 1982). Thus NAA and kinetin were inhibitory to both root and shoot growth but GA_3 stimulated shoot growth and reduced root growth. GA_3 has also been shown to promote the growth of young seedlings of many oil palm progenies (Anon., 1980). Thus there is some apparent consistency in its effect. In spite of the stimulatory effects of GA_3 on shoot growth no treatment caused an increase in total plant dry weight. Thus no treatment has yet been found which would reduce the time before transplanting to the field. In the present study transient increases in height were caused by kinetin and to a lesser extent by NAA. The use of combinations of regulators, especially GA_3 with kinetin, might allow such increases to be made permanent. Experiments to test this are presently being carried out.

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