STUDIES ON PHOTOPERIODIC RESPONSIVE REACTION IN COCONUT

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ABSTRACT

Coconut seedlings of West Coast Tall variety responded favourably to long day treatment during first year of the experimental period, but failed to do so during the second year. Illumination of plants throughout the night increased not only the vigour of the seedlings but also increased the chlorophyll fractions, besides promoting the initiation of inflorescence primordium.

INTRODUCTION

CONSIDERABLE progress has been made in the recent past in the investigations on the physiology of flowering in plants and the basic knowledge gained in such studies has been profitably used in artificial induction of early flowering (Chailakhyan, 1968). By controlled environmental treatments early flowering has been induced in glass house carnations (Harris, 1968), sugarcane (Perezantich and Antoni, 1969), and apples (V'Junov, 1967). However, most of such basic studies in woody plants have been mainly on the photoperiodic effect on vegetative growth (Nitsch, 1957). A most obvious problem on woody perennials is the long juvenile phase of growth. The lack of flowering in many trees until they have attained a given age is of great importance because it affects both productivity and breeding programmes, and also makes experiments slow and costly (Hillman, 1964).

The onset of flowering in the West Coast Tall (W.C.T.) variety of coconut palm commences at about the 45th leaf stage of growth of the palm after planting or at the age of 6-7 years. Wickramasurya (1968) reported that, in Ceylon, the spadix initiation and production in coconut palm are greater in March-September, when the average day length are at a maximum as compared to the rest of the year. The present study is aimed at investigating whether the W.C.T. variety of coconut reacts to photoperiodic effects, especially in regard to earliness in commencement of flowering.

MATERIALS AND METHODS

Coconut sprouts of W.C.T. variety, 45 days after sowing, were planted in experimental plots after randomisation, at a spacing of 1·22 m × 1·22 m. The three treatments, *viz.*, Long Day treatments, LD_1 with 24 hr light, and LD_2 with 18 hr light and the control with normal day light (12 hr) were replicated six times, with 24 sprouts per plot. The sprouts under LD treatments received additional light after sunset provided with 100 watts Tungsten lamps, about 1·22 m above leaf level, throughout the nights for LD_1 treatment and upto 12 midnights for LD_2 treatment. The sprouts received uniform irrigation throughout the experimental period during dry seasons.

Data on growth characters, *viz.*, height, girth at collar region, number of leaves, and roots produced were recorded. The chlorophyll fractions in the foliage were analysed following the method of A.O.A.C. (1966). The shoot apices of the representative samples collected from different treatment blocks were examined periodically in sections of 20 μ thickness, to observe the differentiation of cells in the apical meristem.

RESULTS

The data on growth characters and chlorophyll content recorded at the end of one year of the treatment period are presented in Table I. A significant increase in the height and girth

TABLE I

Effect of Long Day treatments on the growth characters and chlorophyll content in coconut seedlings (one year after commencement of treatment)

Factors studied	Control	LD_1	% increase (+) or decrease (−) over control	LD_2	% increase (+) or decrease (−) over control
Height (cm)	99·0	121·7*	+ 22·9	94·3	− 4·75
Girth at collar (cm)	17·1	22·7*	+ 32·7	14·4	− 15·79
Number of leaves	8	9	+ 12·5	7	− 12·50
Number of roots	19	22	+ 15·8	16	− 15·79
Total chlorophyll (mg/L)	1·26	1·77	+ 40·48	0·86	− 31·75
Chlorophyll *a* (mg/L)	0·88	1·25	+ 42·05	0·55	− 37·50
Chlorophyll *b* (mg/L)	0·37	0·52	+ 40·54	0·31	− 16·22

* Significant at 5 % level.

of seedlings under LD_1 treatment was observed as compared to other treatments. An increase in the number of leaves and roots as well as the contents of total chlorophyll, chlorophyll *a* and chlorophyll *b* was also observed in this set of plants. However, a decrease in the values of these characters obtained in plants under LD_2 treatment was not significantly different from that of the controls.

The data on the ontogenic studies of the shoot apices of treated plants during the first year of treatment period are given in Table II. In plants under LD_1 treatment.

TABLE II

Effect of Long Day treatments on the initiation of inflorescence in coconut

Treatments	No. of plants in which initiation of inflorrescence primordium was observed. Leaf axil Nos.										
	10	11	12	13	14	15	16	17	18	19	Percentage initiation
LD_1	2	..	..	4	3	3	1	4	1	1	79·18
LD_2	..	..	..	3	1	2	3	1	1	..	64·71
Control	..	3	1	4	2	2	1	3	1	..	53·13

initiation of inflorescence primordium was observed in 19 out of 24 plants studied (79·2%) and in 2 of the 19 plants, the initiation of the primordium had commenced at the 10th leaf axil itself. In plants under LD_2 treatment the earliest record of initiation of the primordium was in the 13th leaf axil. In case of LD_2 treatment as well as in the control plants the initiation was only to the extent of 64·7 % and 53·0% respectively.

The data on the growth characters and chlorophyll fractions recorded at the end of the second year of the experimental period (Table III) showed a significant reduction in the chlorophyll fraction both in the LD_1 and LD_2 treatment plants as compared to that of the control. In respect of the growth characters also no significant variations between treatments was observed.

DISCUSSION

The present results suggest that W.C.T. variety of coconut responds to Long Day treatment, for a period of about a year, especially for earliness in commencement of flowering. That, an extension of the treatment period beyond one year fails to induce a favourable reaction, is also observed. Favourable response to Long Day treatments, especially in vegetative growth, has been reported in the case of *Citrus* species (Piringer *et al.*,

TABLE III

Effect of Long Day treatments on the growth characters and chlorophyll content (two years after commencement of treatment)

Factor studied	Control	LD_1	% increase (+) or decrease (−) over control	LD_2	% increase (+) or decrease (−) over control
Height (cm)	171·3	188·4	+ 9·98	125·3	− 26·85
Girth at collar (cm)	28·0	31·2	+ 11·43	21·7	− 22·50
Number of leaves	14	15	+ 7·14	13	− 7·14
Number of roots	41	39	− 4·88	22	− 46·34
Total chlorophyll (mg/L)	2·51	1·85*	− 26·29	1·92*	− 23·51
Chlorophyll *a* (mg/L)	1·42	1·04*	− 26·76	1·10*	− 22·54
Chlorophyll *b* (mg/L)	1·09	0·81*	− 25·69	0·83	− 23·85

* Significant at 5 % level.

1961) and apple (Piringer and Downs, 1959). Attainment of a certain stage of vegetative growth before floral induction is known in several tree crops and Hillman (1964) states that because of effects on vegetative growth, photoperiodic treatment can indirectly hasten flowering. Enhancement of vegetative growth and consequent induction of flowering was reported in 50% of *Betula verrucosa* plants that were given continuous light treatment, in one year as against a requirement of 5 years under normal conditions (Longman and Wareing, 1959). The enhancement of vegetative growth observed in coconut plants under continuous light treatment during the first year of the present study, is thus, of interest. On the other hand, it is also evident from this study that under normal conditions also this variety of coconut is capable of initiating inflorescence primordium as early as in the 11th leaf axil (Table II) and what happens in nature is the abortion of the initiated primordia. Large scale abortion of inflorescence in coconut during the commencement of flowering has been reported (Menon and Pandalai, 1958). Studies conducted in oil palm (Hartely, 1967) and areca palm (Bavappa, 1970) have indicated abortion of initiated inflorescence primordia and this abortion is related to a critical stage. These results thus suggest that if by controlled manipulation the initiated inflorescence could be assured of full development, the pre-bearing age of this variety of coconut can be reduced considerably.

ACKNOWLEDGEMENT

The authors are thankful to Mr. Jacob Mathew, Junior Statistician, for his help in preparing the layout and statistical analysis of the data and to Mr. P. S. Ravindran, formerly Research Assistant, for his help in laying out the experiment.

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