

PHOTOSYNTHETIC EFFICIENCY IN RELATION TO ANNUAL YIELD AND CHLOROPHYLL CONTENT IN THE COCONUT PALM*

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ABSTRACT

Rate of apparent photosynthesis in the West Coast Tall variety of coconut palm was significantly correlated with annual yield of nuts and chlorophyll content in leaves. The chlorophyll content was also significantly correlated with annual yield of nuts.

INTRODUCTION

In a study on the factors associated with variation in yield of nuts in the West Coast Tall variety of coconut palms, Patel (1938) reported that in an adult palm, the length of stem and number of leaves on the crown are significantly correlated with average yield. Satyabalan (1972) found a similar highly significant correlation between height, number of leaves on the crown, and yield of nuts of under-planted young coconut palms of the same variety. However, the physiological basis for variation in yield in the coconut has not been investigated so far. In the present investigation, the rate of apparent photosynthesis in coconut was related with chlorophyll content, number of leaves on the crown and average annual yield of nuts.

MATERIALS AND METHODS

One hundred coconut palms of the West Coast Tall variety, aged 35-40 years and growing under normal management schedules in the Institute farm, were used in the study. Representative leaf samples for determination of chlorophyll content were collected from the crown by the method standardised earlier (Chacko Mathew and Ramadasan, 1973). Chlorophyll content was estimated as described in AOAC (1966). Leaf tissue samples for determination of rate of photosynthesis were collected as described earlier (Chacko Mathew

and Ramadasan, 1974). The rate of apparent photosynthesis was measured manometrically (c.f., Forsyth and Hall, 1965). The number of leaves on the crown of the palms was recorded while collecting samples for studying the rate of photosynthesis. The annual mean yield of palms was calculated from the yield data for the years 1969-73. The study of photosynthetic rates was undertaken during September-October, 1973.

RESULTS AND DISCUSSIONS

The mean values for rate of apparent photosynthesis, total chlorophyll content, number of leaves, and yield of palms in relation to the three yield groups, low (< 40 nuts annually), medium (40-80 nuts annually) and high (> 80 nuts annually) are presented in Fig. 1. An increase in the factors studied was seen with increase in the yield of nuts. The correlations between the factors studied were highly significant (Table I).

Positive correlations between photosynthetic rate and yield of economic product have been reported in sugarcane (Irvine, 1967), 'mung' bean (Izhar and Wallace, 1967), and potato (Meil and Rothacker, 1963). In the present study, similar results were obtained in coconut palm also.

Positive correlation between photosynthetic rate and chlorophyll content has been reported in a variety of plants (Gabrielsen, 1948; Tanaka, Fiejita, and Kikuchi, 1974); and

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TABLE I

Coefficient of correlations between the characters studied

| Sl. No. | Characters | r |
|---------|---------------------------------------------------------------|------------|
| 1. | Rate of apparent photosynthesis vs. annual yield of nuts | +0.6137* |
| 2. | Rate of apparent photosynthesis vs. total chlorophyll content | +0.2233* |
| 3. | Total chlorophyll content vs. annual yield of nuts | +0.2735** |
| 4. | Number of leaves on the crown vs. annual yield of nuts | +0.7028*** |

* P = 0.05 ; ** P = 0.01, *** P = 0.001.

in cotton, an increase in chlorophyll content has been associated with enhanced photosynthesis (Tagi-Zade, 1957). In the present study also, an increase in chlorophyll content was seen to be associated with increased annual yield (Fig. 1). Chacko Mathew and Ramadasan (1973) had already observed higher chlorophyll content in the two high yielding coconut hybrids, T × D and D × T, as compared to that in the WCT variety. The significant positive correlations between chlorophyll content, and rate of apparent photosynthesis and annual yield of nuts and also between the annual yield of nuts and number of leaves on the crown noted in the present study suggests that in coconut palm, the presence of large

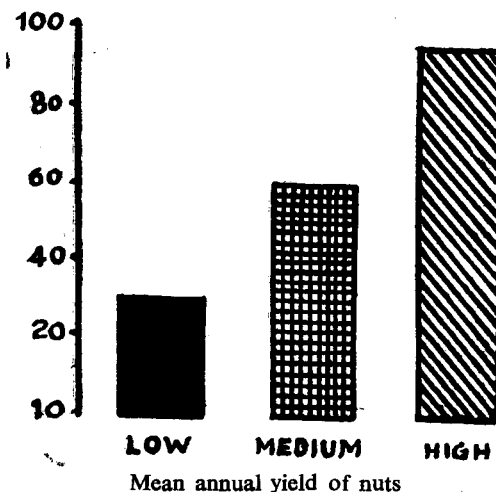
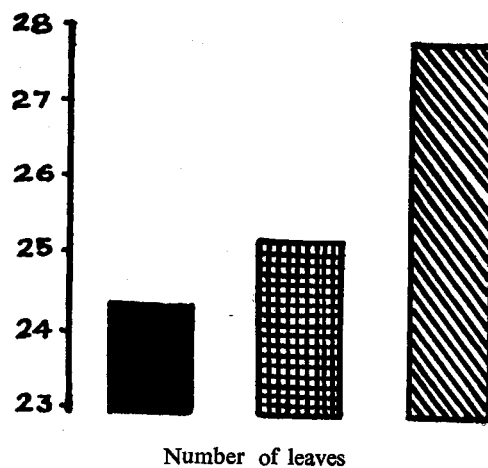
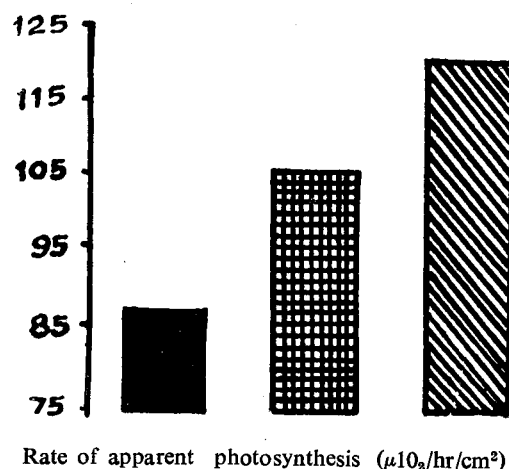
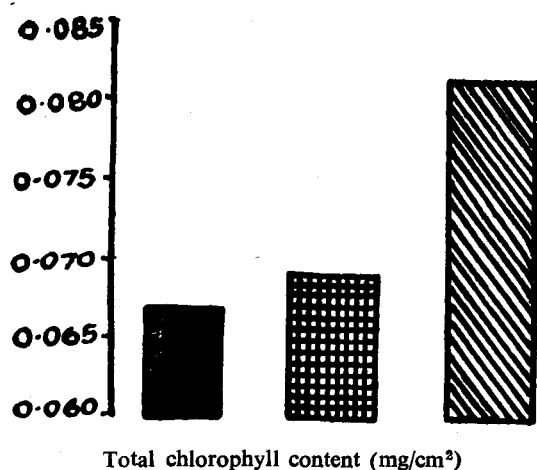


FIG. 1. Total chlorophyll content, rate of apparent photosynthesis and number of leaves in relation to yield of nuts.

numbers of leaves on the crown is perhaps one of the important determinant characters for productivity.

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