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Optimum stage for harvesting coconuts for different purposes

BY

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INTRODUCTION

The coconut palm *(Cocos nucifera)* is chiefly grown for the nuts it bears, though it yields a number of other useful products also. The nuts are being put to a variety of uses. The fresh kernel contained in the ripe nuts is widely used for culinary purposes. The kernel is also dried and converted on a large scale into edible or milling copra, and into desiccated coconuts in some countries such as Ceylon. The coconut oil expressed from copra finds considerable use for edible and industrial purposes while the residual cake is a cattle feed. The outer covering of the nuts, viz. husk yields coir fibre. In the tender stage the nuts are in great demand for the soft and sweet pulp and the nut water which provides a cool, sweet and refreshing drink. Out of the estimated total annual Indian production of 415 crores of nuts, 54 per cent. are utilised for edible and household uses and 46 per cent. for conversion into copra. About 27 crores of husks are estimated to be utilised for coir making annually. The demand for tender coconuts is very high in West Bengal; consequently, a major portion of the nuts produced there is reported to be harvested in the tendernut stage.

If the coconuts are to serve best the different purposes for which they are in demand, attention has to be bestowed in harvesting the nuts at the proper and correct stage of maturity demanded in each case. Otherwise the purpose may not be fully served and in some cases the growers may actually stand to lose a lot. It may be that in some cases the requirements may appear to be conflicting, but then we have to reconcile them so that the growers will ultimately be benefited to the maximum extent. It is the purpose of this article to discuss the problems involved and to place the results of research carried out so far before the coconut growers for their guidance.

BEARING CHARACTERISTICS OF THE PALM

The coconut palm is perennial in its habit of growth. Under normal conditions it begins to yield nuts in 6 to 7 years after planting, and lives for 60 to 80 years or more. The palm is unique in its bearing nature. When once it starts flowering and bearing nuts it continues thereafter to yield nuts throughout the year and all through its long life. In a regular and heavy yielding palm bunches are produced in succession, one in every leaf axil, at intervals of about a month, with the result that at any time of the year the palm will have in its crown 12 or more fully opened bunches in different stages of development from the very tender one or "button" to the fully mature nut. Besides, a mature bunch of coconuts will be ready for harvest almost every month which means that 10 to 12 harvests can be had in a year.

PATTERN OF DEVELOPMENT OF THE NUT

The female flowers borne on the bunches take normally about 12 months to develop and grow to maturity. The physical changes occurring during this period have been traced by Gangolly and Chathukutty Nambiar (1953) and the data in respect of some important constituents of the nut have been represented graphically in Fig. 1.

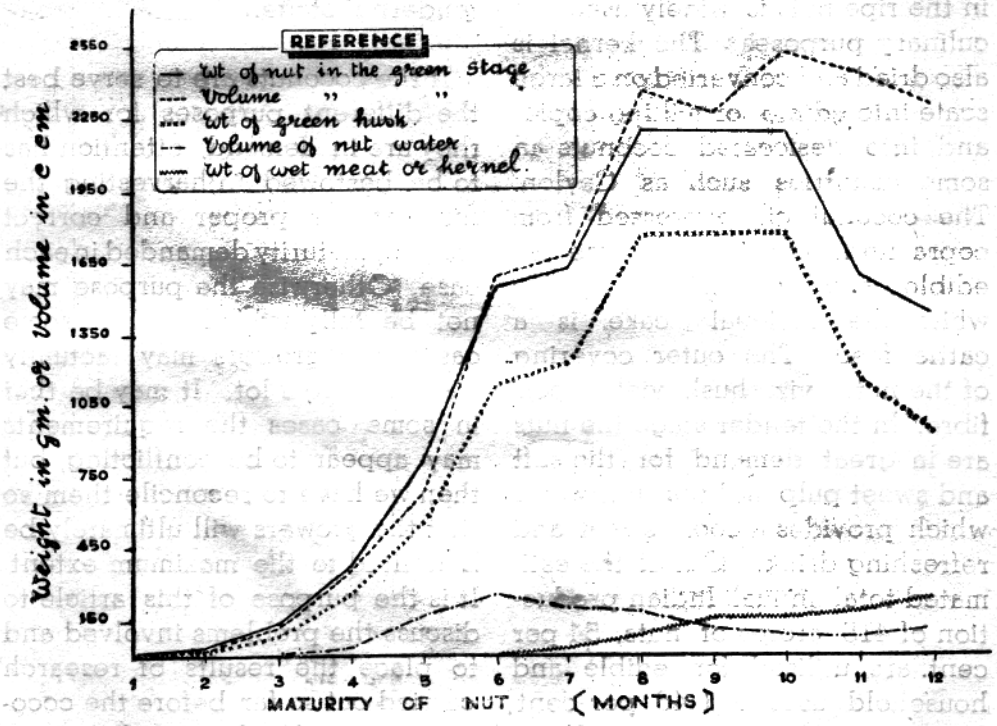

Fig. 1.—Pattern of development of certain important constituents of the coconut fruit during its growth.

In the earlier stages of development, i.e., up to about four months, the female flowers or buttons grow faster in length than in breadth accompanied by a marked increase in respect of weight and volume. Later on, growth is more in width than in length, but the weight and volume of the nut continue to increase up to the 10th month. Subsequently, with the onset of maturity, driage and shrinkage take place resulting in appreciable reduction in weight and volume.

The cavity inside the nut differentiates itself in the 2nd month and increases considerably reaching its maximum size in the 6th month and is full with nut water throughout this period. The meat starts forming as a thin and soft layer in the 6th month and increases in hardness and quantity to the very end though the rate of increase declines as the nuts ripen. With increase in the thickness of kernel the internal cavity gets reduced in size; there is also a progressive decrease in the quantity of nut water as the nuts ripen, resulting in the creation of a vacant space.

Sugars form an important constituent of the nut water, and changes in their composition and quantity during the development of the nut have been studied by Nathanael (1952). Sugars which are present only up to about 1 per cent. in the nut water of the button increases to a maximum of 5 per cent. in the 7-month - old nuts and then declines to about 2 per cent. in the nut water of the mature nut. The composition of the sugars of the nut water also changes during the growth of the nut. Up to the 6th month the sugars are present only in the form of reducing sugars (glucose and laevulose). From the 7th month onwards cane sugar makes its appearance in increasing proportions until in the fully mature nut it forms approximately 50 per cent. of the total sugars present. These changes in the content and composition of sugars in the nut water will be clear from Fig. 2.

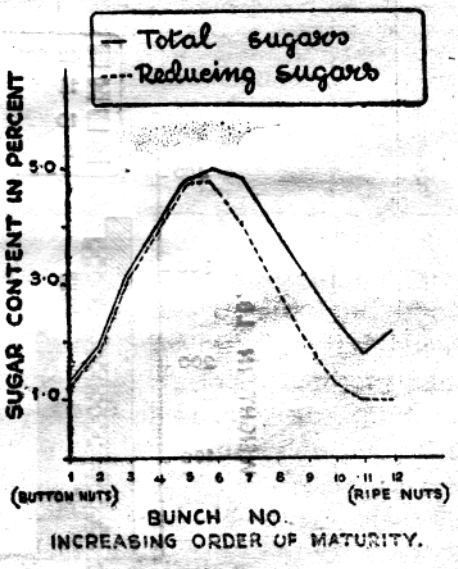

Fig. 2.— Sugar Content in coconut water at progressive stages of development.

The course of deposition of fat in the kernel of the developing nut has been studied by Kartha and Narayanan (1956). They have found that the percentage of the oil in kernel (on dry weight basis) which was about 31 per cent. in 7-month-old nuts reached practically the maximum value (70 per cent.) in 10-month-old nuts and remained round about that figure till full maturity. However, in view of the fact that the dry weight of the kernel increased to the very last, maximum quantity of oil was obtained only from fully mature nuts. This is in conformity with the findings of John *et al.* (1949).

Coir fibre strands can be distinctly seen in the tender nut stage itself and their growth both in length and thickness and lignification are practically complete by the 10th month. The changes that take place during the development of the fibre have been traced by Menon (1942).

OUTTURN OF COPRA, OIL AND FIBRE IN RELATION TO DIFFERENT MATURITY

The findings referred to in the previous paragraphs, though give an idea of the development of the nuts and indicate in a general way the optimum stage of harvesting them for different purposes, are not sufficient to give reliable data as to how the maturity of nuts affects the outturn of copra, oil and fibre. The results of trials carried out in a really big way by John *et al. (loc cit.)* are summarised below and also represented in the histogram (Fig. 3).

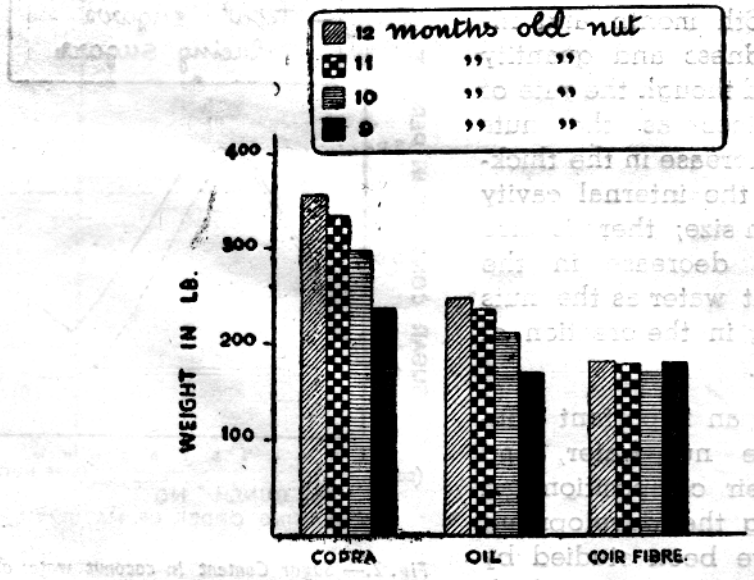

Fig. 3. — Outturn of copra, oil and fibre from 1000 coconut fruits of different maturity.

Product and maturity of nut	Calculated outturn (lb) per 1000 nuts	Quality of the product
Copra		
12 months	356	Very good, being crisp and of good colour and with brown and smooth testa; keeps well on storage.
11 months	335	
10 months	298	Poor, being soft, leathery and pliable with dark brown and wrinkled testa; is spoilt quickly on storage.
9 months	237	
Oil		
12 months	245	Very good, being clear and almost colourless and with low free fatty acids; possesses good keeping quality.
11 months	233	
10 months	208	Somewhat turbid; deteriorates rapidly on storage.
9 months	164	
Fibre		
12 months	175	Poor, being dark brown in colour, brittle and of low tensile strength.
11 months	173	Good, being golden brown in colour, elastic and of good tensile strength.
10 months	165	
9 months	174	Poor in tensile strength; fibre has plenty of pith attached to it.

The following conclusions are drawn from the data:

(i) Maximum quantity of copra is obtained from fully mature (12-month-old) nuts. By harvesting less mature nuts copra is lost to the extent of 6 per cent. in 11-month-old nuts, 16 per cent. in 10-month-old nuts and to as much as 33 per cent. in 9-month-old nuts. The copra from immature nuts is poor in quality and generally conforms only to the 'Rasi' type. It is soft, leathery and shrunken and does not give out oil freely on expression. On the other hand copra from 12 and 11-month-old nuts is of good quality and can be classed as first grade such as 'Dilpasand' or 'Office nottam'. On crushing, oil

flows out freely from this copra. Even preparation of copra is difficult from immature nuts. On drying, the kernel does not separate out freely and automatically from the shell as in the case of 11 and 12-month-old nuts.

(ii) Maximum quantity of oil is also obtained only from 12-month-old nuts. There is 5 per cent. decrease in the outturn of oil from 11-month-old nuts, 15 per cent. in 10-month-old nuts, and 33 per cent. in 9-month-old nuts. The oil from 12 and 11-month-old nuts is of good quality with low free fatty acids and keeps well on storage. In the fresh state the oil from 9 and 10-month-old nuts also shows low free fatty acids, but deteriorates rapidly on storage.

(iii) In terms of quantity the fibre obtained from the husks of 12, 11 and 9-month-old nuts is more than that obtained from 10-month-old husks. However, the fibre from 9-month-old husks will have a lot of pith attached to it while that from 12 and 11-month-old husks will be clean. From the point of view of quality, fibre from 12-month-old husks is definitely poor, being dark brown in colour, brittle and of low tensile strength. That from 11 and 10-month-old husks is equally good, being golden yellow in colour, elastic and of good tensile strength. Fibre from 9-month-old husks is poor in quality.

The quality of ball copra as influenced by different factors including the maturity of the nuts has been investigated by Verghese *et al.* (1955). They have concluded that though 11 to 13-month-old nuts can also be utilised for ball copra making, over-mature nuts alone are suitable, if the nuts are of big size.

RECOMMENDATIONS

The results of studies discussed in the previous paragraphs have been quite conclusive and, therefore, do provide a reliable basis for the formulation of the following recommendations regarding the optimum stage at which nuts are to be harvested for different purposes:

(i) Nuts to be used as tender nuts are best harvested when they are 6 to 7 months old. Nut water will then be present in the maximum quantity and with the highest sugar and amino acid concentration.

(ii) Where nuts are primarily intended for the manufacture of copra for oil crushing, the nuts should be harvested only when fully mature, so that they will be

yielding the maximum quantity of the best quality of copra. Fully ripe nuts can easily be distinguished by a few simple tests. They will emit a ringing and resonant sound on being tapped with the finger and will be comparatively light in weight. Such nuts will also contain relatively little of nut water and will produce a characteristic sound when shaken. Besides, on chipping a portion of the green husk, a distinct browning of the inner fibrous tissue will be noticed.

(iii) Nuts intended for the preparation of ball copra are better retained on the trees themselves till they are over-mature. Bunches may be harvested only when one or two nuts have fallen of their own accord. The husks of over-mature nuts will usually be dry even at the time of harvest.

(iv) Where green husks of the nuts are also in great demand for retting purposes and consequently fetch premium prices, the nuts may be harvested about a month earlier to full maturity, that is when they are about 11 months old. The increased income from the green husks will more than compensate for the loss that may arise from the decreased quantity of copra produced. Harvesting of still less mature husks is definitely inadvisable as the income from husks cannot compensate for the loss arising from the reduced yield and poor quality of copra or oil.

DISCUSSION

The recommendations especially those relating to copra, oil and fibre, are of great practical importance, particularly at the present time, when every effort is being made to step up the internal production which falls short of our requirements by 30 to 40 per cent. Measures designed to increase the area under the crop for increasing production are only of long term importance and cannot be of any assistance to meet the immediate problem facing us. Similarly, the short term methods such as popularising the use of improved methods of cultivation and manuring among growers also take sometime to become effective and show tangible results. On the other hand, if the growers were to be a little more vigilant in harvesting the nuts only at the proper stage of maturity in accordance with the recommendations made, there would be an immediate and substantial improvement both in the quantity and quality of copra produced, even in the absence of any increase in the overall production of nuts. This increased output of copra can serve to relieve to some extent the

tightness of the present supply position.

It is a generally accepted fact that the poor outturn and quality of copra and oil produced in the country is largely to be attributed to the widely prevalent practice of harvesting bunches before the nuts become fully mature. Early harvest is done not only from a lack of awareness of its bad effects but also from other considerations such as the need for cash, necessity to reduce harvesting costs, minimise loss through pilferage, etc. These latter aspects are also important from the point of view of the growers and have to be solved to their satisfaction if the recommendations are to have wide acceptance.

CONCLUSIONS

Based on the results of scientific investigations, recommendations have been drawn up regarding the optimum stage at which coconuts have to be harvested for purposes of tender nut, copra for oil crushing, ball copra and coir manufacture. It has been shown how the present practice of harvesting coconuts earlier to full maturity is defective and wasteful and how it can be improved by following the recommendations formulated for it.

The recommendations do not involve any financial investment or expenditure of effort and money, but only call for some care and attention on the part of the growers in harvesting the nuts at the proper stage of maturity. It is not to be ignored that apart from the lack of knowledge of the baneful effects of early harvest, there are also other factors contributing to it; but there is every hope and prospect that all the difficulties now confronting the growers will be resolved in due course and that they will be enabled to put the recommendations into practice leading to a fuller and better utilisation of the available resources.

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