

CONTROLLED POLLINATION OF COCONUT PALMS

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Introduction

THE variety of coconut palms (*Cocos nucifera* L.) that is commonly grown on a commercial scale in Ceylon is largely cross-pollinated. This is brought about by the male phase preceding the female phase on an inflorescence; further the next inflorescence generally opens after the female flowers of the older inflorescence have passed receptivity. Sometimes, the younger inflorescence opens during the receptive stage of the female flowers of the older inflorescence, thereby making inter-spadix or self-pollination possible.

Coconuts can be propagated only with seeds and there are no known methods of vegetative multiplication. In any given stand of palms there is considerable variation in yield between palms. If the quality of seed-nuts is to be improved, controlled pollination is necessary so that both parents are from known types. The quality of the seed-nuts from high-yielding mother palms under natural pollination is erratic because the male parent is unknown.

Breeding work was started at the Institute towards the latter part of last year. Since then a number of estate proprietors have been interested in this work and are anxious to carry out their own programmes of controlled pollination so that they can have their own pool of quality seed supply. The main purpose of this article is to describe the methods employed for their guidance.

The Inflorescence

The coconut inflorescence is a massive structure, about 36 inches long and 34 inches across.



Fig. 1. Coconut inflorescence.

Towards the upper half of the central axis of the inflorescence are a large number of spikelets with male and female flowers (fig. 1). The female flowers are the spherical bodies situated towards the base of each spikelet and above them are a large number of male flowers closely arranged. Generally there are only one to two female flowers per spikelet.

Inflorescences open successively at intervals varying from 22 to 30 days, depending on the age of the palms and environmental conditions. From the second to the nineteenth day after the opening of the inflorescence, the male flowers open, liberate pollen and fall off. During most of this time the female flowers remain closed and about the twenty-second day become receptive. When a female flower is receptive, the ovary has protruded through the lobes that

were covering it earlier, the upper end is whitish in colour with three furrows running into the tissue. Further the furrows are wet with nectar secreted through three nectaries. The receptive stage lasts on each female flower for two to three days.



Fig. 2. Pollinator climbing a palm.

from the lowest whorl, so that the pollinator can get to the crown.

A record must be kept of dates of opening of inflorescences of each palm. The date of opening is taken as the day on which the sheath (spathe) enclosing the flowers burst open.

Bags and Bagging

Bags are made of cheap grey cloth with a transparent plastic window (fig. 3-A). The dimensions are indicated on figure 3. The cloth should be of sufficient texture so that any foreign pollen would not pass through. Below the transparent window on one side of the bag is placed a narrow pouch (fig. 3-B) through which a glass tubing can be introduced.

For our own experimental work when different crosses are done on the female flowers of a single inflorescence, miniature bags are used to enclose individual female flowers (fig. 7). But for mass

Selection of Parents

Parent palms should be selected on lines advocated in Coconut Research Institute leaflet No. 1. The selected palms should consistently yield more than 100 nuts and 50 lbs. of copra per year.

The ideal would be to use "proved" parents, *i.e.*, palms that are known to give always high-yielding progenies through progeny tests. But for immediate work this would not be possible as progeny testing with coconuts takes decades. These factors can be overcome to a certain extent, for we know that the yield depends on two basic factors, (a) the germ plasm of the plant, and (b) the environment, and if good yielders are selected on average or under average conditions of environment then the chances are that at least some of the high-yielding potentialities of the palm are due to its germ plasm.

Preparation of Parents

Husks are tied on to the stems of the parent palms at intervals of about two feet (fig. 2), to assist the pollinator to climb the palm. As the selected palms are heavy bearers, it would be necessary to remove one or two bunches

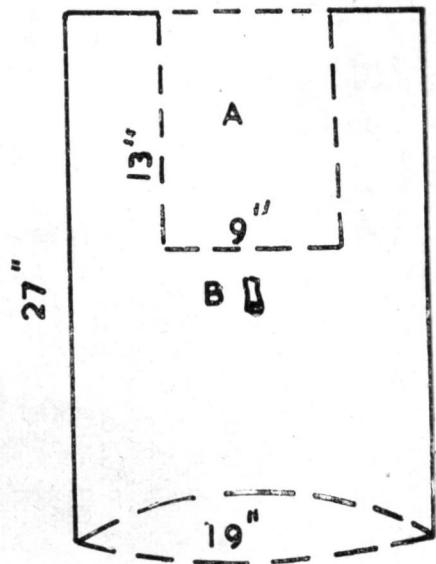


Fig. 3. Diagram of a cloth bag used in pollination work.

pollination work, it is sufficient if the entire inflorescence is enclosed in a large bag (fig. 6).

Seventeen days after the opening of the spathe each spikelet is cut about three inches above the female flowers and any remaining male flowers are removed—generally all of them would have fallen by that time. The bag is now introduced, a layer of cotton wool is spread round the stalk of the inflorescence and the bag is tied gently over the cotton wool with twine enclosing all the female flowers (fig. 6).

Pollen and Pollen Storage

The best period for the collection of pollen is from the third to the eighth day after the opening of the inflorescence. During other times only very little pollen is available from the male flowers either because they are too premature or too old. The spikelets are cut above the female flowers preferably in the evenings. They are dipped in test tubes containing water, mounted on a stand and are left in an inclined position over black cartridge paper (fig. 5). The spikelets are completely covered over with a box which is made up of a wooden frame $22 \times 19 \times 13$ (height) inches with brown paper pasted over the sides. A large quantity of pollen would have fallen on the black paper by about 10.00 a.m. next day. The pollen grains are collected with a fine camel hair brush and stored in vials plugged with cotton wool. The collection of pollen is done inside a closed room to avoid contamination with air-borne pollen. All apparatus used above including the paper should be sterilised with 10 per cent. formalin before they are used again.

Pollen grains remain viable only for two days under atmospheric conditions. It is often necessary to keep them for 12 to 15 days for pollination work. We have found that when the vials containing the pollen samples are stored over 43.4 per cent. Sulphuric acid in a desiccator at room temperature (30°C . approximately), about 50 per cent. of the pollen grains remain viable even on the 15th day of storage. The same effect was observed when pollen samples were stored in a refrigerator at 3°C .

Pollination

Pollen from the selected male unit is introduced to the female flowers when they are receptive. The receptive stage can be easily recognised by examining the female flowers through the transparent window of the bag enclosing the inflorescence.

The receptivity of each female flower lasts two to three days and begins about the 22nd day after the opening of the inflorescence.. All female flowers are not receptive together, but the time gap between the first and the last to be receptive is normally five to six days.

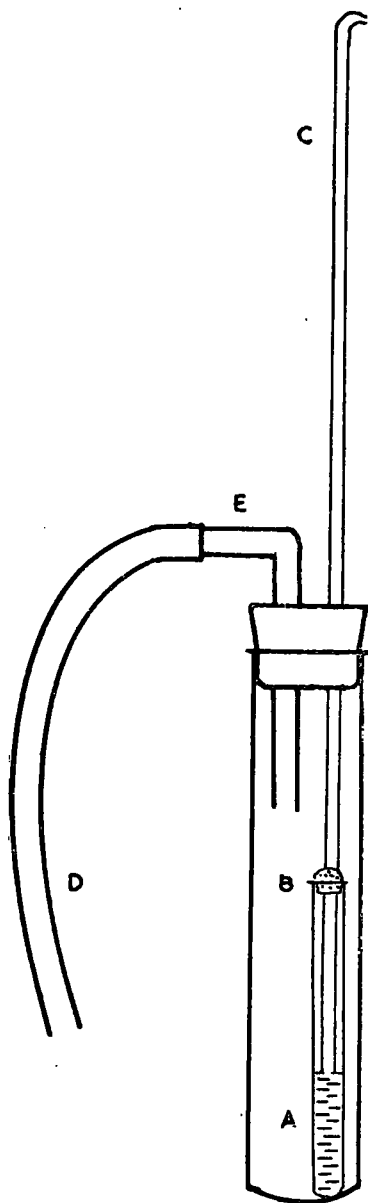


Fig. 4. The apparatus used for pollination.

The following apparatus is used for pollinating the female flowers;—6 × 1 inch test tube with a two-holed rubber cork to fit; a piece of glass tubing of diameter 5 mm. and 18 inches long (fig. 4-C); another shorter glass tubing of diameter about 7 mm. bent at right angles (fig. 4-E) with a piece of rubber tubing about 12 inches long attached to it (fig. 4-D). They are assembled as shown in figure 4.

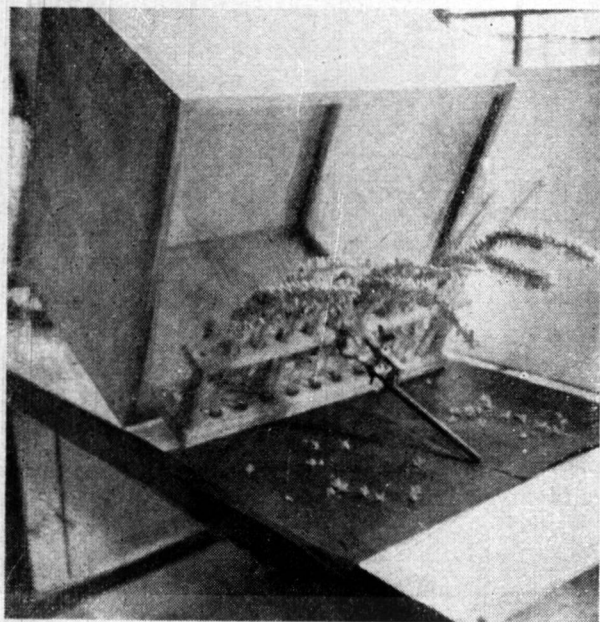


Fig. 5. Collection of pollen.

The vial containing the pollen sample (fig. 4-A) is placed inside the test tube and the cork is replaced after adjusting the lower end of the piece of glass tubing (fig. 4-C) to touch the pollen grains. The mouth of the pollen-vial is plugged with cotton wool (fig. 4-B).

The above apparatus is arranged inside the room where pollen is collected and is taken to the crown of the palm by the pollinator. The long tube (fig. 4-C) is introduced to the bag enclosing the inflorescence through the pouch (fig. 3-B), the narrow end of the tube is brought opposite the receptive region of a female flower and the pollinator blows gently through the rubber tubing (fig. 6). The pollen grains are carried through the glass tubing and are spread over the wet stig-

matic surface of the female flower. After pollinating each receptive female flower in this manner, the tube is withdrawn and the pouch is sealed with a clip.

The pollinator must be able to climb trees skilfully and carry out this delicate process of pollination intelligently. Pollination should be done either early in the morning or late in the evening. Each inflorescence should be pollinated every other day on two or three occasions depending on the duration of receptivity of the female flowers. The bag is removed on the third day after the last pollination and a permanent label is attached to the inflorescence. The seednuts will be ready for harvesting eleven to twelve months later.



Fig. 6. Pollination after enclosing entire inflorescence in a single bag.



Fig. 7. Pollination after enclosing individual female flowers in separate bags.