

Technique for Commercial Production of Coconut Hybrids



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Coconut palm is one of the major source of edible oil and it yields more oil per unit area than any other oilseed crop excepting oil palm. Traditionally, only Tall cultivars are grown on commercial scale but the higher yield potential of hybrid coconuts has been demonstrated in recent years. The first coconut hybrid which is popularly known by name T×D was produced in India in 1937. Subsequent researches have shown that the reciprocal combination D×T (with Dwarf cultivar as female parent and Tall as male) has more productive potential. These hybrids (T×D and D×T) were produced by hand pollination in earlier years. But production of hybrids by hand pollination is time consuming and large scale commercial production of coconut hybrids is very difficult. At CPCRI, a technique for the production of hybrids especially D×T on commercial scale was standardized and the details are described in this pamphlet.

FLORAL BIOLOGY: For efficient hybridization it is essential to know the breeding behaviour of the crop. In coconut, both male and female flowers are present on the same inflorescence (this condition is called monoecious). On the same spikelet the male flowers are located on the upper portion and the female flowers at the base (Fig. 1). Few male flowers are also present in between the female flowers. Eventhough the male and female flowers are present in the same inflorescence, in Talls they come to maturity at different periods. First the male flowers at the top attain maturity and by the time the male flowers at the base open it will be about 17 to 24 days depending on the season. The female flowers become receptive (ready to receive pollen) one or two days after all the male flowers are open and female phase lasts 3 to 5 days. So the chances of self-pollination are minimum. In Dwarf cultivars, however, there is a chance for self-pollination as the female flowers come to receptivity before the male phase is completed. Sometimes subsequent inflorescence also opens when the earlier inflorescence is in the female phase thereby increasing the chances for self-pollination. Therefore, while carrying out hybridization one should take adequate care to avoid the possibilities of self pollination described above.

EMASCULATION: The first step in hybridization is removal of male flowers from the inflorescence of the female parent to avoid self-pollination. This is called emasculation. A coconut inflorescence has hundreds of male flowers

and few female flowers. All the male flowers are to be removed, well before the female flowers come to receptivity. To avoid any chance of contamination it is better to do the emasculation as soon as the inflorescence opens on the first day itself. The emasculation can be done either by :



Fig. 1. Coconut inflorescence showing male and female flowers

1. Removing individual male flowers by hand (Fig. 2)
- or
2. By cutting the spikelets (with knife or secateurs) about 4 to 5 cm away from the last female flower and removing the remaining male flowers by hand (Fig. 3)

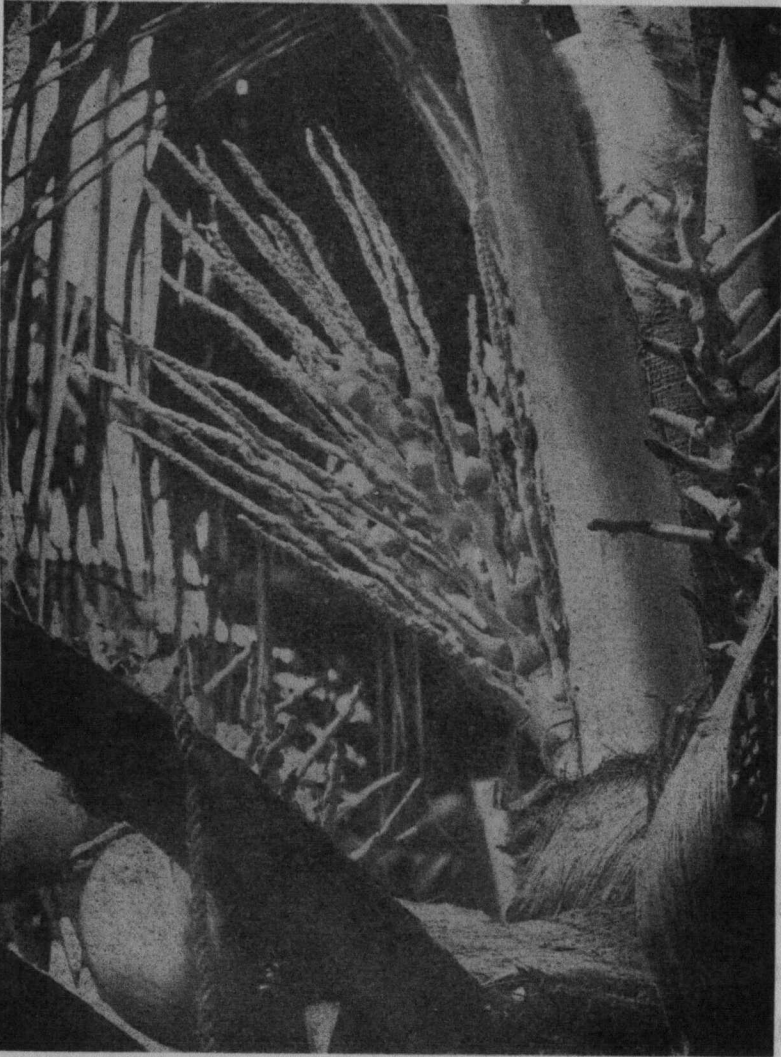


Fig. 2. Hand emasculated inflorescence



Fig. 3. Inflorescence with spikelets clipped

The second method is perfectly safe, convenient and fast but care should be taken to remove all the male flowers including those in between the female flowers by hand. To ensure that proper emasculation is carried out, the bunch should be inspected atleast once before the first female flower come to receptivity.

POLLEN COLLECTION AND PROCESSING : In coconut inflorescence, the male flowers on the top and middle spikelets produce more fertile pollen compared to those on the lower spikelets. Therefore, collection of pollen from male flowers

of lower spikelet is to be avoided. Maturity of the male flowers is indicated by the bluish green tinge of the anthers. Collection of the pollen from an inflorescence between 6 to 8 days after opening is recommended. The method for pollen collection is as follows :

1. *cut the portion of spikelets containing mature male flowers ;*
2. *separate the male flowers from spikelets ;*
3. *place the male flowers between folds of thick papers and gently crush them with the help of a rolling pin (crushing is only for separating the perianth parts and should not damage/break the anthers) ;*
4. *keep the crushed male flowers in oven at 40°C for 24 hr ;*
5. *sieve to separate pollen from debris (use 0.2 mm mesh sieve) ;*
6. *test germination on sugar, gelatin and agar medium (8 : 2 : 2 sucrose: gelatin : agar). Only pollen with atleast 50% germination should be used for pollination;*
7. *collect pollen in glass vials and store in a desiccator over calcium chloride. Pollen so stored can be used for 10 to 15 days;*
8. *if longer storage is required, seal the glass vials and store them in deep freezer (-20°C). This pollen can be used for 3 to 5 months;*
9. *dilute the pollen with neutral talc powder in 1:9 proportion before use. If the pollen stored in deep freezer is to be used, first allow it to come to room temperature before diluting.*

If a pollen drying equipment called "Fluid-Bed-Drier" is available, the pollen can be collected within 4 hr. and used on the same day. The instrument is used for drying pollen by exposing the fresh male flowers to hot air. The air temperature and the speed can be regulated. At 40°C temperature and the blower speed of 5 to 6, the pollen can be dried in about 4 hr. This is especially useful in seed gardens where a large quantity of pollen is required every day. The pollen processing steps are same as detailed earlier except that at step 4 the crushed male flowers are fed to the "Fluid-Bed-Drier" instead of keeping in the oven.

POLLINATION : Unlike emasculation and pollen processing, the pollination technique to be used in a garden depends on the type of plantation. If the female parents are scattered in a garden and are interplanted with different types of Tall cultivars, "controlled hand pollination" technique is to be used. This method involves bagging of emasculated bunches for the entire period of female phase and

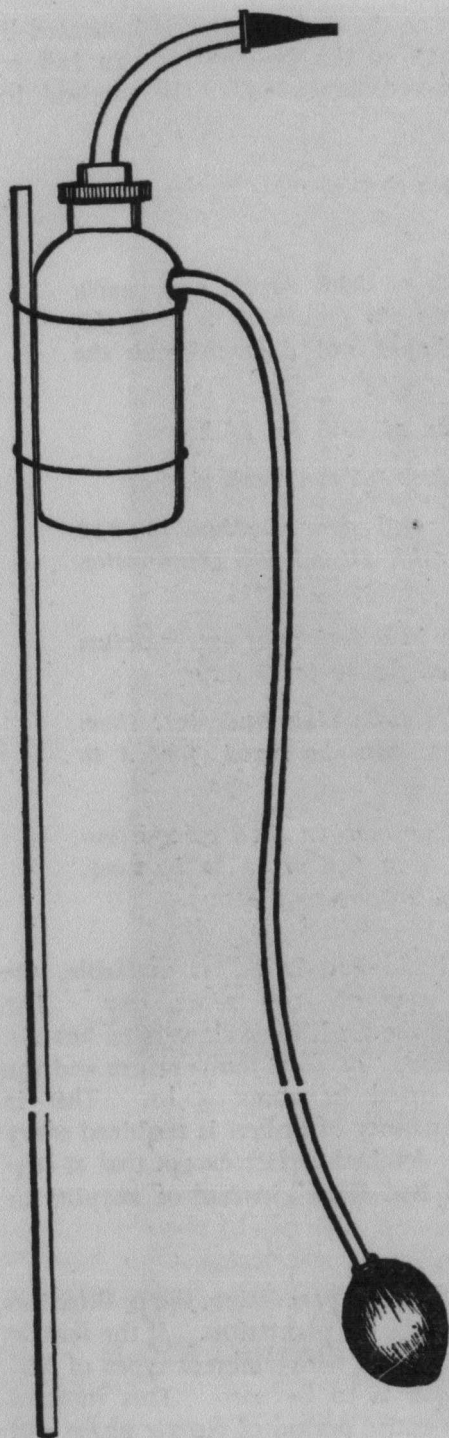


Fig. 4. Pollen applicator

pollinating with desired pollen. The same procedure is also to be followed in the production of T×D hybrids. However, this method is not amenable for commercial production of hybrids as it is tedious and time-consuming.

The plantations of pure blocks of Dwarfs and Dwarfs interplanted with a single Tall cultivar are suitable for commercial production of coconut hybrids. The former is more suitable than latter. When the Talls and Dwarfs are interplanted, only a single combination of hybrid can be produced in that garden without bagging. In this case all the inflorescences in Dwarf palms are to be emasculated so that only the pollen from Tall is available in the garden. All the nuts collected from the Dwarfs after emasculation will be hybrid nuts. However, to increase the setting percentage, assisted pollination with the Tall pollen is advisable. In the plantations of pure blocks of Dwarfs more flexibility is possible. Depending on the need, by changing the pollen in the assisted pollination technique, different combinations of hybrids can be produced. But with one caution—while in the interplanted garden the assisted pollination is optional, it is mandatory in the pure blocks of Dwarfs. As the procedure is simple, it is very easy to produce a large number of hybrids from this (pure blocks of Dwarfs) type of gardens.

For effective and speedy pollination, a simple device has been developed. It consists only a polythene squeeze bottle, a rubber tube and a bamboo pole. The squeeze bottle is tied at the end of a bamboo pole (or aluminium rod) of 2 to 3 m length. A rubber tube with a rubber bulb at one end is connected to the bottle just below the neck (Fig. 4). When the rubber bulb is pressed, it injects air into the squeeze bottle

and in turn the pollen-talc mixture present inside the bottle is released as a cloud. When the receptive female flowers are to be pollinated, the nozzle of the bottle is placed near the inflorescence and the rubber bulb is pressed. The pollen-talc mixture released will cover the inflorescence effecting pollination (Figs. 5 & 6). The process is repeated on alternate days twice (*i.e.*, 1-3-5 days) starting from the day when first female flower comes to receptivity as indicated by the drop of nectar secretion at the stigmatic end. When the stigma turns brown/black the female



Fig. 5. Pollination using pollen applicator



Fig. 6. Pollen-talc mixture released as a cloud

flower is no longer receptive. By this method, most of the Dwarf palms can be pollinated from the ground itself. The reach of the pollen applicator is about five meters. Even the few Dwarf palms which are taller can be reached with the help of a small ladder. As the laborious process of tree climbing can be avoided, a single pollinator can attend to about 150 trees in a day. The setting percentage is very high (40%) (cover photo) even when compared to that in nature (20-25%).

SOME USEFUL ESTIMATIONS

1. 1 kg of fresh male flowers after processing will give 18 to 20 g of pollen.
2. 20 g of pollen when mixed with neutral talc (1 : 9) will be sufficient to pollinate 45 to 50 palms.
3. In an year about 30 to 40 hybrid nuts can be produced from one Dwarf palm (@ 5/6 bunches with 6/7 nuts)
4. One person can emasculate around 50[♂] to 60 Dwarf palms in a day and a pollinator can pollinate about 150 Dwarfs a day.
5. One emasculator can look after 1 ha of seed garden while one pollinator can manage pollinations in 2 ha.

Note : It is estimated that on a single day only a quarter of the total palms in the garden need to be either emasculated and/or pollinated.

IMPORTANT DO's AND DON'Ts :

1. *Do the emasculation properly by ensuring that all the male flowers including those which lie in between the female flowers are removed. Even if a bunch is not to be pollinated don't leave it without emasculation. It will contaminate other bunches. Each and every inflorescence in a seed garden (Dwarf block) should be emasculated.*
2. *Collect the pollen only from top and middle spikelets. Don't collect from basal spikelets. Use pollen only if its germination is over 50%. Never use the pollen without checking the viability.*
3. *Clean all the equipments used for collection of pollen properly before and after use to avoid contamination in the pollen.*
4. *Pollen-talc mixture should be prepared just before use. Never store the mixture for the next day.*
5. *Use only a single type of pollen in one squeeze bottle. Keep a label tied to the nozzle for identification. It is better to store different pollen in different desiccators.*
6. *Pollinate bunches only after inspecting the accuracy of emasculation. Don't pollinate if new male flowers left over by oversight have already opened when the female flowers are in receptive condition.*

7. *In a seed garden, it is always better to use a single type of pollen for all the trees at a given time. If another combination of hybrid is also to be produced in the same garden give atleast a gap of two days before the second pollen is used for pollination.*
8. *It is advantageous to tag the bunches with date of pollination. This will help in identification of the pollen batch used.*