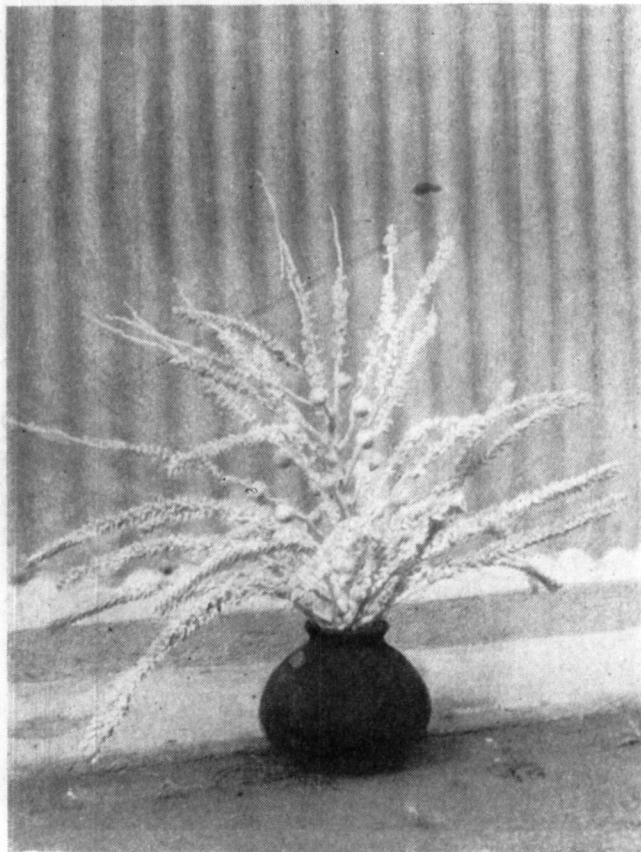


BREEDING BETTER COCONUTS BY ARTIFICIAL MEANS

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WHEN we put down a seed of any plant, say a coconut seed-nut, do we know how and why this produces on germination a plant similar in form and habits to the parent plant from which the seed was obtained?



A COCONUT INFLORESCENCE

showing male and female flowers on the same bunch

We have to understand that within the seed there are certain factors which bring about or cause this phenomenon to occur. These factors constitute the hereditary power possessed by plants and placed within their seeds to produce offspring similar (except under abnormal conditions) to their parents. The reproductive cells contain within them minute microscopic bodies, called genes which are the carriers of certain hereditary characters,—height, flowering and fruiting capacities, resistance to disease, etc.

We have, therefore, to be careful that the offspring we raise in the case of cultivated plants possess those characters which are advantageous to the plant in making it one of economic value to us. Thus in the case of a crop like paddy we would like to have plants which tiller freely and give a high yield, mature early, thrive on less irrigation, are disease-resistant, etc.; and in the case of the coconut, palms which come into bearing early, do not grow too tall, yield well, give a higher copra out-turn and higher oil content, and so on. Sometimes we can get, by the application of scientific methods of breeding, a combination of several useful characters in the offspring.

The formation of a new individual occurs by the fusion of the contents of the female

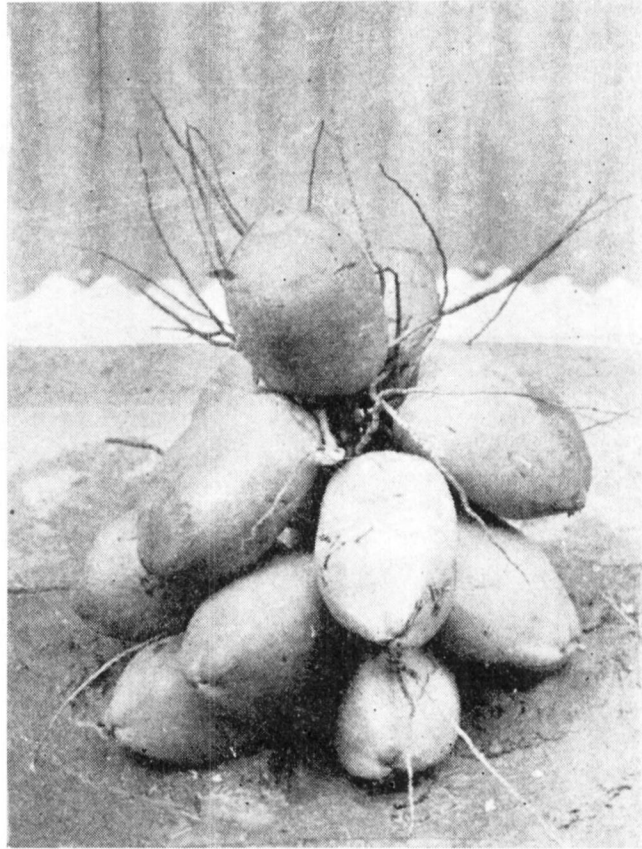
cell with the contents of the male cell. In certain plants, the male and female reproductive structures are borne on the same flower ; in some, male flowers and female flowers are separately borne on the flower stalk of the same plant (as in the case of the coconut) ; in others, female flowers and male flowers are borne on separate plants so that we get male trees and female trees. The first step in the formation of seed is the transference of the male element contained in the pollen of a flower to the stigma of the female organ of the flower. The next step is the fusion of the male cell with the female cell. This process is termed fertilization. During this process there is a combination or rearrangement of the chromosomes and genes of the two cells which determines the resulting offspring.

Now if one plant which we will take to be the female parent is generally good but lacks one particularly advantageous character which character is possessed by another plant of the same species which we will take to be the male parent, we may by artificial means be able to combine these desirable characters in a new offspring.

This method of raising "new" plants is termed Cross-breeding or Hybridization, and the offspring is a hybrid between two parents which differ from each other in respect of one or more characters.

Preliminary to adopting any method of effecting improvement in the coconut, in respect of high yield for example, it is necessary to know facts regarding the production and the structure of the flowers of the coconut palm.

The flowers of the coconut palm are enclosed within a "sheath" termed a spathe. When the spathe opens we see two kinds of flowers—small male flowers in abundance along the forepart of the flower branch and a lesser number of rounded bodies or "buttons" at the rear part of the same branch ; these latter are the female flowers. The male flowers are laden with pollen dust. The period during which the male flowers keep opening varies and may last for about 18 days. These flowers keep falling to the ground as they grow old and at the end of this period the female flowers or so-called "buttons" become receptive, that is to say, they are ready to receive the pollen. The exposed pointed end of the "button" is the stigma of the female flower



A BUNCH OF HYBRID COCONUTS

produced by a tall \times dwarf cross

and this becomes covered by a sugary liquid secreted by the flower to which insects may be attracted.

The pollen from a male flower of another tree in the case of the tall varieties of coconut, is carried by wind or insects to the stigma of the female flower, and this is the first step in the marriage ceremony termed pollination. In the case of dwarf varieties of the coconut, for example, the "King Coconut" the male phase overlaps the female phase so that it is possible for the pollen of the male flowers to be conveyed by insects to the stigmas of the female flowers on the same flowering bunch (inflorescence). We see, therefore, that in the case of tall varieties cross-pollination takes place while in the dwarf varieties self-pollination is common.

It is possible by adopting certain methods to control the pollination of the female flowers by natural means and effect pollination by artificial means. For instance, we could collect the pollen from one palm and dust the receptive female flowers of another palm with it, by hand; at the same time prevent the entry of any foreign pollen from any other palm by external agencies like wind and insects.

The technique employed in effecting artificial pollination is as follows :—

The essential precaution to take is to prevent pollen from an undesirable male tree reaching the flowers of the mother tree from which seed-nuts will be taken. In the first instance all the male flowers are stripped off their stalks. Next the female flowers are enclosed in a muslin bag so that no foreign pollen may reach them. The date on which the spathe opened is noted so that we can judge when the female flowers will be receptive or ready to receive pollen which we shall later place upon them.

A certain number of branchlets from newly-opened inflorescences of selected palms, are cut and placed in test-tubes of water with their cut ends dipping in the water. These are then placed in a room at a suitable angle over a clean sheet of white paper for about three days. The pollen dust that falls is then carefully collected for artificially pollinating the female flowers of the selected palms. Under ordinary atmospheric conditions this pollen will remain viable for only about two days, but under controlled conditions of humidity and temperature it can be kept for between 10-15 days.

The pollen thus collected is taken to the field preferably in a small glass-bottle provided with a cotton-wool plug. The female flowers of the selected mother palms, which have been covered earlier with suitable muslin bags against the entry of any foreign pollen, are next pollinated with this. In the process a trained person reaches the female flowers and with the aid of a camel-hair brush carefully dusts the powder from the bottle on the receptive regions of the individual female flowers or buttons. This has to be done cautiously through an opening in the bag, otherwise foreign pollen would enter the bagged female flowers, during the process. Once it is done the opening of the muslin bag is closed. It would not be possible to pollinate all the female flowers of a single inflorescence in a single day as the female flowers become receptive on different days. The operation of pollinating all the female flowers of a single inflorescence would therefore take more than one day. The pollinated "buttons" would then begin to mature and take about 11 months before becoming fully formed nuts.

In this way one could obtain first crosses and then back crosses between different varieties of palms like, say, Tall and Dwarf by collecting pollen from either of these and dusting it on the female flowers of the other.

We have already started work on artificial pollination and have since laid down a number of hybrid seedlings at Bandirippuwa and Ratmalagara Estates with a view to study their individual performances in respect of certain essential requirements which would be of value to us.