Institut de Recherches pour les Huiles et Oléagineux

Département du Centre de Coopération Internationale
en Recherche Agronomique pour le Développement (CIRAD)

GENERAL INSTRUCTIONS
FOR ASSISTED POLLINATION OF COCONUT

(I.G.P. COCONUT)

(1991)

11, Square Pétrarque 75116 Paris - Tél. : (1) 45 53 60 25 - Télex 630491 IRHO PARIS

C O N T E N T S

I.G.P. 1

G E N E R A L

1. Seeds cannot be produced on an industrial scale by hand pollination, which is costly and has a low output because of the depressive effect of the bag. So another method was worked out, consisting in planting seed gardens of mother-trees, to which the chosen pollen is brought by assisted pollination from plots of male parents.

2. While this method is relatively easy to apply, it does require strict daily checks to make sure that the seed produced is legitimate.

I.G.P. 2

A REMINDER OF SOME FEATURES OF THE COCONUT PALM'S FLORAL BIOLOGY

The coconut is monoecious and its inflorescences are hermaphrodite.

The inflorescence is a composite spadix constituted by a central rachis on which the spikelets are inserted.

The very numerous male flowers grow all along the spikelets, except at the base, where the female flowers are found (0 to 3 or more per spikelet).

The inflorescences appear roughly every month, the interval being shorter in the dry season (a little over 20 days) than in the rainy season (about 30 days).

As soon as the spathe opens flowering starts with the blooming of the male flowers at the tips of the spikelets, and spreads gradually all along the spadix.

Male flowering lasts about 20 days and is influenced by the seasons.

The average length of female flowering is from 3 to 5 days in Talls; it can be as much as 15 days in Dwarfs.

Each female flower is flanked by two accompanying male flowers, which open normally in the male phase and give viable pollen.

The female flower is receptive as soon as the stigmata open, at which time nectar is emitted; the stigmata necrose quickly (24 hours after the emission of nectar).

Natural pollination is carried out by wind and insects.

All the female flowers on an inflorescence do not give nuts. Usually anything up to 60 % of the flowers fall in the first six weeks. It has been proved that this is not due to lack of pollen.

At surrounding temperature the pollen keeps for several days; after 8 days it can be considered to be dead.

Coconuts are classified in four groups according to their mode of reproduction :

- Group I : short female phase with no overlapping with the male phase of the same inflorescence or with that of the following inflorescence : strict allogamy (W.A.T. 1st. population).

- Group II : Short female phase without overlapping by the male phase of the same inflorescence but with considerable or total overlapping with the male phase of the following inflorescence : indirect autogamy (W.A.T. 2nd. population, R.L.T., P.Y.T., M.L.T., N.H.T.).

- Group III : Long female phase completely overlapped by the male phase of the same inflorescence, with or without overlapping by the male phase of the following inflorescence : direct autogamy (M.Y.D., C.R.D., M.R.D., S.G.D.)

- Group IV : Short female phase partially overlapping with the male phase of the same inflorescence and with that of the following inflorescence : semi-direct autogamy (E.G.D., B.G.D., M.Y.D. x E.G.D., M.Y.D x W.A.T.).

I.G.P. 3

IMPLANTATION OF SEED GARDENS

I. MOTHER-TREES

Pollen is dispersed by wind and insects, and can therefore travel long distances, but its concentration in the air rapidly diminishes with increasing distance from the source of emission.

It is not possible to isolate a seed garden perfectly, but by creating or making use round its periphery of protective zones free from any coconuts, contamination can be reduced to a very low level - less than 1 %.

The minimum width of the protective or isolating zone depends on the characteristics of each site : climate, winds, size of the nearest coconuts (a Tall will spread its pollen further), etc ....

In many cases, a 300 - 500 m width of isolation will suffice, especially if it is formed of a natural (forest) or artificial (plantations) barrier.

If the seed garden is made up of several varieties intended to receive different pollens, then they must also be isolated from each other by 50 m.

II. MALE PARENTS

The male parents must, of course, be planted sufficiently far from the seed garden of mother-trees. On the other hand it does not matter if there are different varieties in neighbouring plots. The method of pollen harvesting ensures that there is little risk to seed production of contamination by extraneous pollen.

I.G.P. 4

SIZE OF SEED GARDENS

I. MOTHER TREES

350 mother-trees produce enough seeds to plant 100 ha per year. However, this number varies according to the type of mother-tree and the ecological conditions of the site in question, in particular the water deficit, which has a considerable influence on nut production.

The area of a seed garden thus depends on the size of the annual planting programme.

II. MALE PARENTS

It is estimated that one male parent produces sufficient pollen to pollinate 20 Dwarf mother-trees or 60 Talls.

It takes an average 1.4 kg pollen per year to pollinate 1 ha of mother-trees (density 205 trees/ha) and 0.4 kg for Talls (density 143 trees/ha).

I.G.P. 5

START OF EXPLOITATION IN A SEED GARDEN

With the coconut, the date at which the first inflorescences appears varies from tree to tree.

Taking counts of flowering makes it possible to calculate the % flowering trees. Exploitation of a seed garden until at least 65 % of the trees have emitted an inflorescence.

Until this figure is reached, all inflorescences appearing are totally castrated.

TOTAL CASTRATION

This operation consists in cutting the unopened spathe at its base with a shears. Care must be taken to see that the inflorescence inside the spathe is sufficiently developed for it to be certain that the stalk has been cut below the lowest spikelets.

It is prudent to allow for a weekly visit by the castrator.

This ablation of the inflorescence favours the development of the young coconuts and consequently their production.

I.G.P. 6

VISITING THE TREES

I. PERSONNEL ORGANIZATION

I.1 - Pollen

Pollen Harvester

Each one visits about 150 trees/day and collects between 20 and 30 kg fresh male flowers.

Preparer

The number of persons depends on the daily quantities of fresh flowers to be dealt with. The work consists in crushing them and putting them in air-conditioned rooms. The next day the dried flowers are sieved. Crushing and sieving can be mechanized, thus reducing the staff needed.

Conditioner and Checker

In principle, one person suffices to condition the pollen and check quality.

I.2 - Seed Gardens

Emasculator

He is responsible for 250 - 300 trees which he visits several times a day, including Sunday and holidays. It is he who emasculates the inflorescences of the mother-trees.

Pollinator

A pollinator can visit 1,500 trees per day. He dusts the pollen-talc mixture on inflorescences with receptive female flowers.

I.3 - Supervisor

Pollen

There should be one supervisor for the harvesting of male flowers and the preparation, conditioning and checking of pollen.

Seed Gardens

Surveillance is assured by emasculation supervisors each checking 5 to 7 workers and pollination supervisors, each responsible for 4 - 5 workers.

One overseer checks the supervisors and the work quality of all the seed garden staff.

II. VISIT MANIFOLD NOTEBOOK

Pollen Harvester

No manifold.

Emasculator

Each day he marks in a notebook the field number of the trees on which he has emasculated an inflorescence.

Polliniser

No manifold.

I.G.P. 7

EQUIPMENT & PREMISES FOR ASSISTED POLLINATION

I. EQUIPMENT

(a) Crusher for male flowers (see diagram)

This apparatus consists of two cylinders turning in opposite directions, one fixed by its axis to the framework, the other adjustable, so that the spacing between them, which is set at roughly 2.5 mm, can be varied.

Both rollers are driven by two sets of chain cogwheels driven either by a handle or a motor.

There is also a hopper for filling and an outlet plate under the rollers.

The flowers can also be crushed by a single roller over a metal grid.

(b) Air-conditioned room for drying flowers

Ideal drying conditions are achieved with a temperature close to 30°C and a relative humidity of 45 - 50 %.

The best solution is to air-condition the room by a closed circuit system. It can also be equipped with air-conditioners, dehydrators and heating tubes, their capacities depending on the volume of the room and the quantities of flowers to be dried.

For small quantities of flowers a ventilated oven set at 39°C will be adequate.

(c) Shelves and drying trays for the room (see diagrams)

The shelves are made up of metal frames holding movable aluminium trays 2 mm thick.

Each tray is 62 cm wide and 96 cm long, with a 2 cm raised edge, and can take 1.5 kg fresh flowers.

The shelves are placed on either side of the room, leaving a central passage.

In each set of shelves, the first tray is 42 cm from the floor, the rest are 15 cm apart; there are 12 from top to bottom.

Maker : Local metal workshop.

(d) Pollen drying box (see sketches)

This isused for further drying of the pollen if it has to be stored for more than 15 days. The box must be air-tight and sterilizable. Sterilization is by two 1000-watt infra-red tubes, each raising the temperature to 150°C.

The box is in 2-mm-thick aluminium, W 45 cm x L 50 cm x H 35 cm. It has an air-tight door and contains 6 movable aluminium trays, 1 mm thick, 44 cm x 46 cm :

- 3 with 2-cm raised edges for silicagel,
- 3 perforated (holes Ø 2 cm) with 3 raised edges and one bent downwards, to take the pollen.

The trays of silicagel and pollen are alternated inside the box.

Maker : Local metal workshop.

(e) Equipment for conditioning pollen

When pollen is to be stored for more than 15 days, it must be vacuum-packed. For this, the flasks containing the pollen are placed in bell flasks connected to a pump; the bells are closed by rubber discs.

- Vacuum pump : BEAUDOIN, type MD 1404 - 1 & 3 rue Rataud, 75005 - PARIS, France or local.
- Bell flasks : size depending on pollen flasks used. MACHADO, Chemin des Rojats, Route de Moret, 77140 - NEMOURS, France.
- Balance : TORBAL, type DWL-2, maximum range 120 g, precision 2/100 g or local.
- Glass flasks (penicillin type), with pierced stoppers and aluminium capsules : Verrerries Générales, 29 route de Bonneuil, 94370 - SUCY-EN-BRIE, France.

  The flasks come in various sizes, depending on how much pollen they are to contain (e.g. a 38-ml flask will take 19 g of pollen).
- Sealing pliers for capsules : Société EMA, 92210 - ST..CLOUD, France.

(f) Freezer

Its volume depends on the amount of pollen to be stored. It is used in the 'conservation' position (- 20°C).

(g) Metal ladders of various sizes

Supplier : Local

(h) Material for pollen quality checks

- Ovens : 1 small oven adjustable to 35°C to germinate pollen.
  1 oven adjustable to 105°C for humidity checks.

  The same oven can be used for both types of test.

- Electric precision balance, maximum capacity 160 - 200 g, sensitivity 1/10 mg, 1 pan, closed case, direct reading.

- Binocular microscope, WILD M5 HEERBRUNG.

- Hypodermic syringe, volume in function of the flasks chosen.

(i) Small equipment

- Aluminium sieves ∅ 21 cm, fitted 100-mesh stainless steel wire cloth. Supplier : TRIPETTE & RENAUD, 39, rue J.J. Rousseau, 75001 - PARIS, France.

- 500 ml polythene wash-bottles. Each is mounted on a pole (length depending on the height of the tree to be pollinated), and connected to a rubber bulb at the base of the pole by a flexible tube (e.g. gas tube). See sketch.

- SANDVIK PRADINE or another make shears N° 3/23 or 3/20. Should be strong enough. Length : 20 to 23 cm (8 to 9 inches).

- Min/max thermometer and hygrometer.

- Apparatus for sealing plastic bags.

- Plastic bags for individual doses of pollen and talc.

- Synthetic bags (ventilated) to transport male flowers.

- Tarpaulin in CD 72 canvas made on the Station.
- Protective gloves.
- Pyrex Petri dishes, Ø 70 mm.
- Paintbrush.
- Low Pyrex weighing bottles, fitted cover, Ø 50 mm, capacity 30 ml, height 30 mm.
- 1-l polythene bottles with 100-ml dosimeter.
- Can in food-quality plastic, 10 or 20 l, for distilled water.
- Glass pencils.
- Bunsen burner.
- Sprayer, type BERTHOUD.

(k) Products

- Surgical spirit @ 95°
- Teepol or Heliopol
- Javel water
- Talc (or lycopodium)
- Silicagel
- Cotton wool
- Butane
- Agar-agar
- Sugar
- Distilled water
- Filter paper
- Oil for vacuum pump

N.B.

Each year, the Stations will send Head Office their order for material not manufactured on the spot, taking care to keep stocks for 6 months' operation in hand to allow for delays in delivery.

II. REPARTITION OF MATERIAL BY OPERATION

(a) Pollen harvest

Ladder, shears, gloves, tarpaulin and synthetic bags.

(b) Pollen preparation

Crushing and drying of flowers : Crusher or roller, air-conditioned room with shelves and trays, Berthoud

sprayer, Teepol, surgical spirit and Javel water.

Sieving and packing in flasks or plastic bags :

- Packing in flasks (medium-length storage or shipment) : drying box, silicagel, glass flasks with stoppers and capsules, balance.
- Packing in bags (short-term storage) : plastic bags and bag sealer.

Conditioning of pollen

- Medium-length storage : vacuum pump, bell flasks with rubber discs, sealing pliers for capsules, freezer.
- Short storage : freezer.

(c) Emasculation

Ladder, shears.

(d) Pollination

Bags and bag sealer, talc, wash bottles mounted on poles.

(e) Pollen quality check

Vacuum : hypodermic syringe

Viability : Petri dish, agar-agar, sugar, dosimeter flask with distilled water, Bunsen burner, butane, filterpaper, paintbrush, oven at 35°C, glass pensil.

Humidity : Weighing bottle, precision balance, oven at 105°C.

III. PREMISES

The size of the premises depends on the amount of pollen to be prepared.

The plan proposed here (drying in a room) allows for the preparation of three different types of pollen. There are therefore three distinct units, each with four rooms : crushing (C), drying (D), sieving (S) and conditioning (C); there is also a common room for storage, vacuum obtainment and despatch (St).

I.R.H.O.

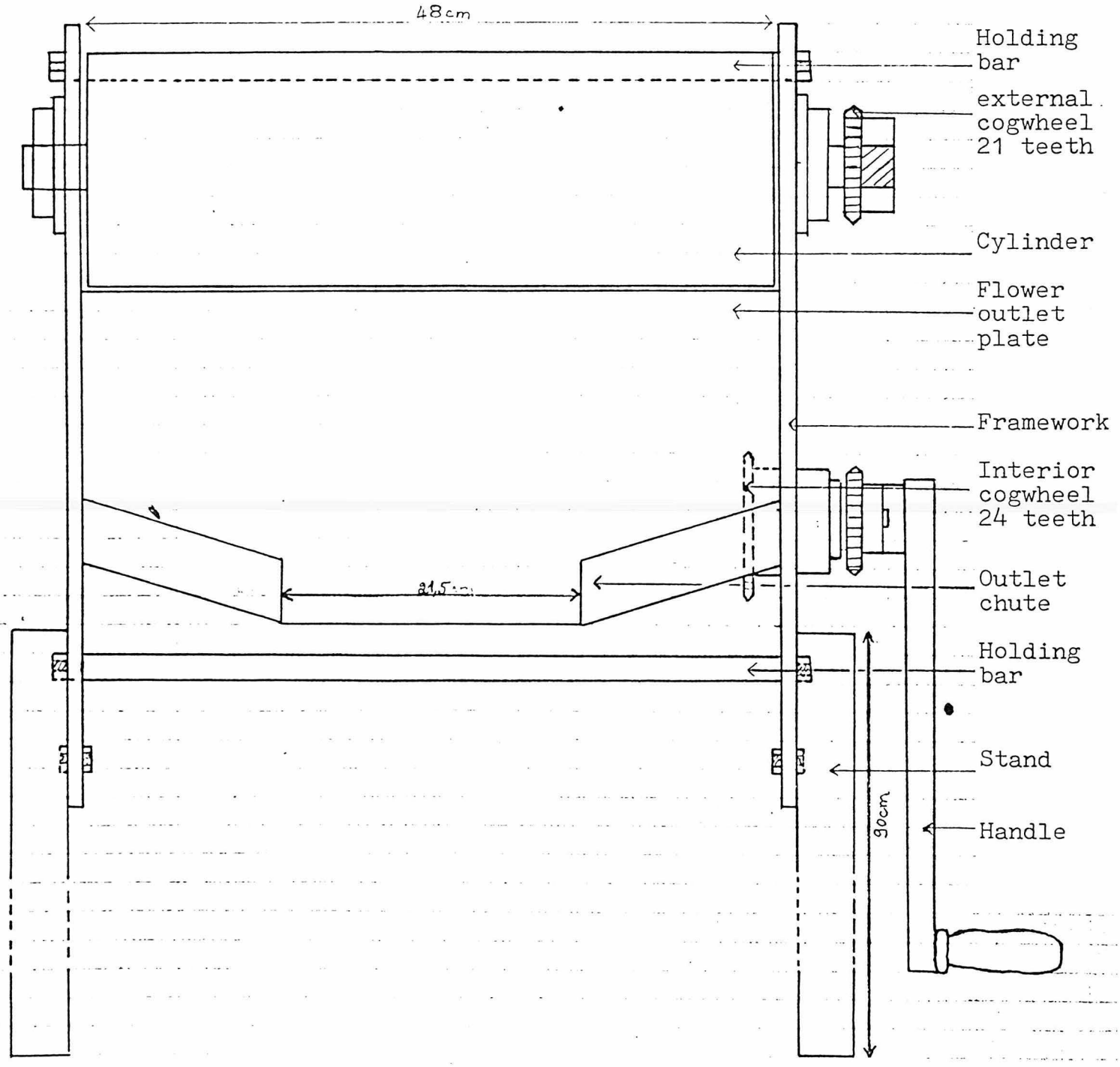
COCONUT I.G.P. 7.6

MALE FLOWER CRUSHER

(Front view)

Scale 1 : 4 cm

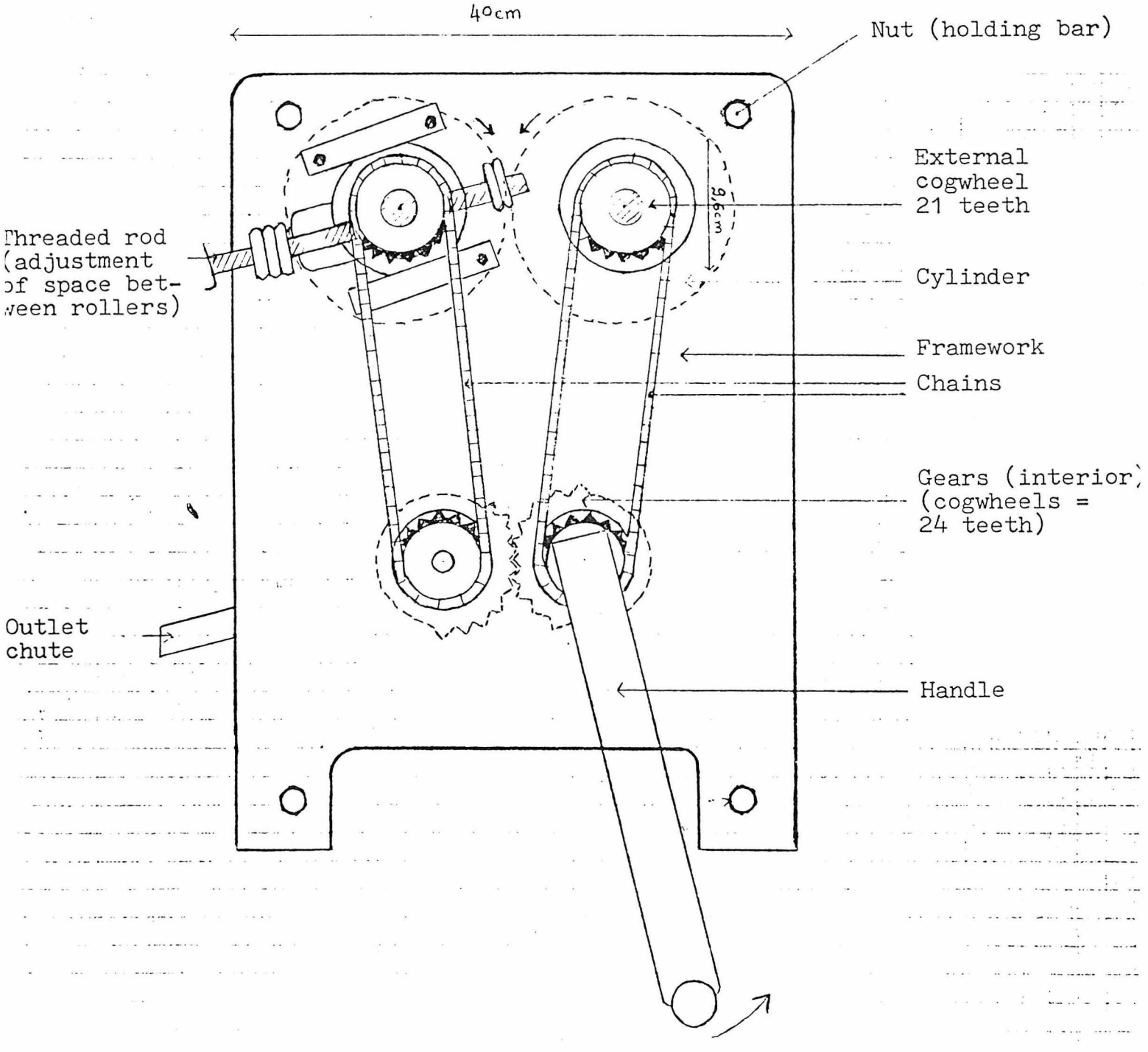
(chain-pulleys not shown)



MALE FLOWER CRUSHER

(Right side)

Scale 1 : 4 cm



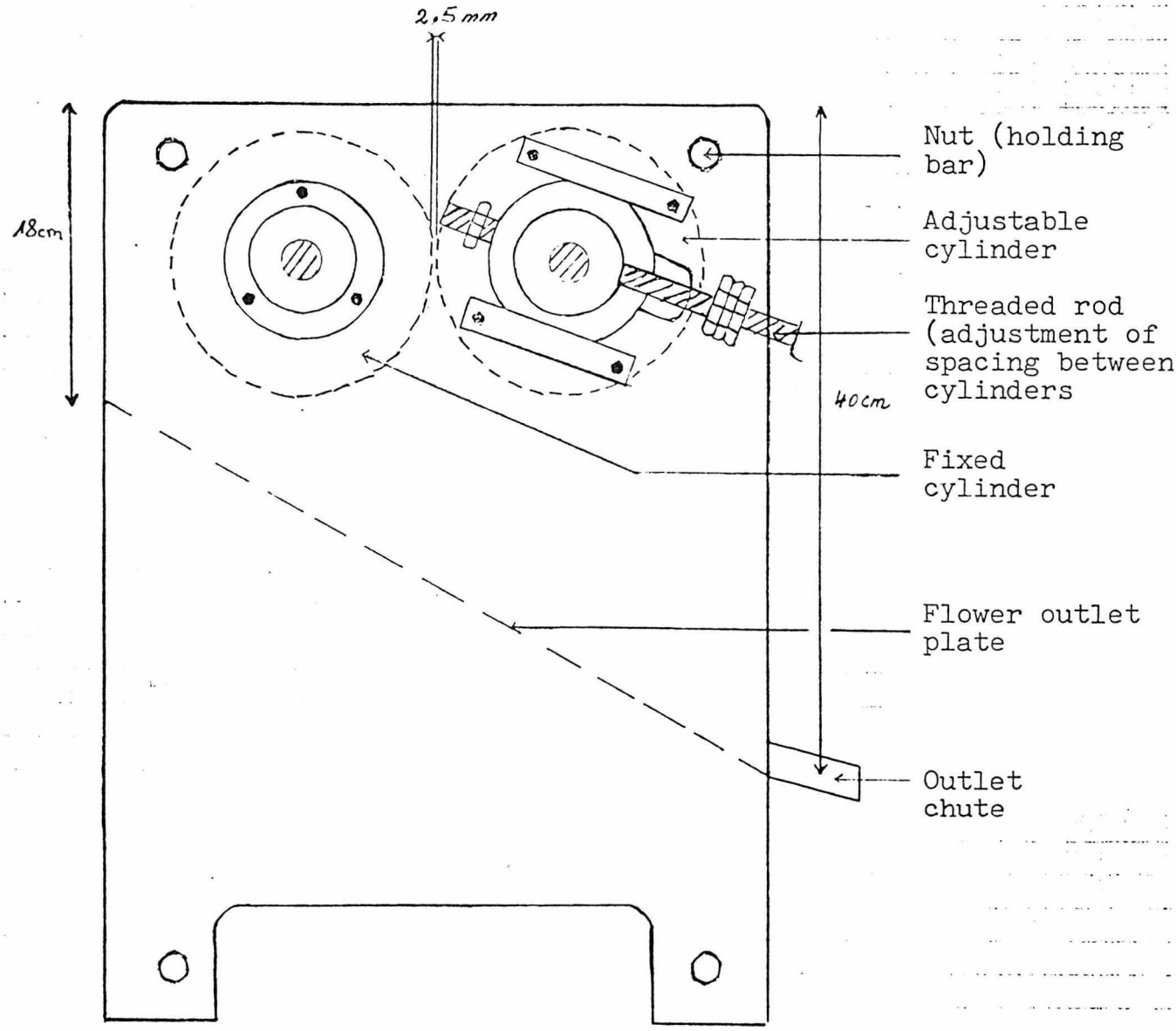
I.R.H.O.

COCONUT I.G.P. 7.8

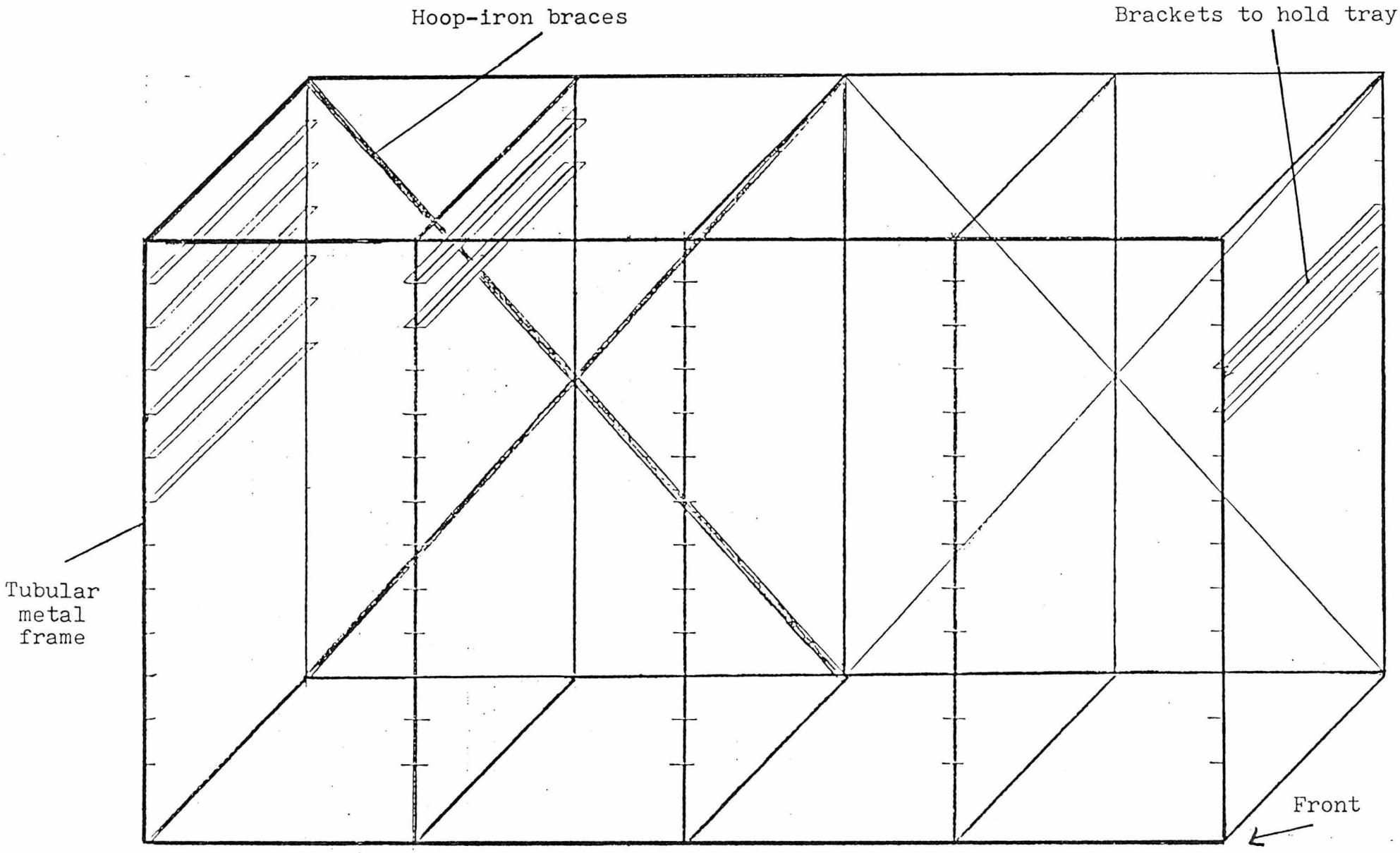
MALE FLOWER CRUSHER

(Left side)

Scale 1 : 4 cm



SHELVES FOR POLLEN DRYING



I.R.H.O.
COCONUT I.G.P. 7.9

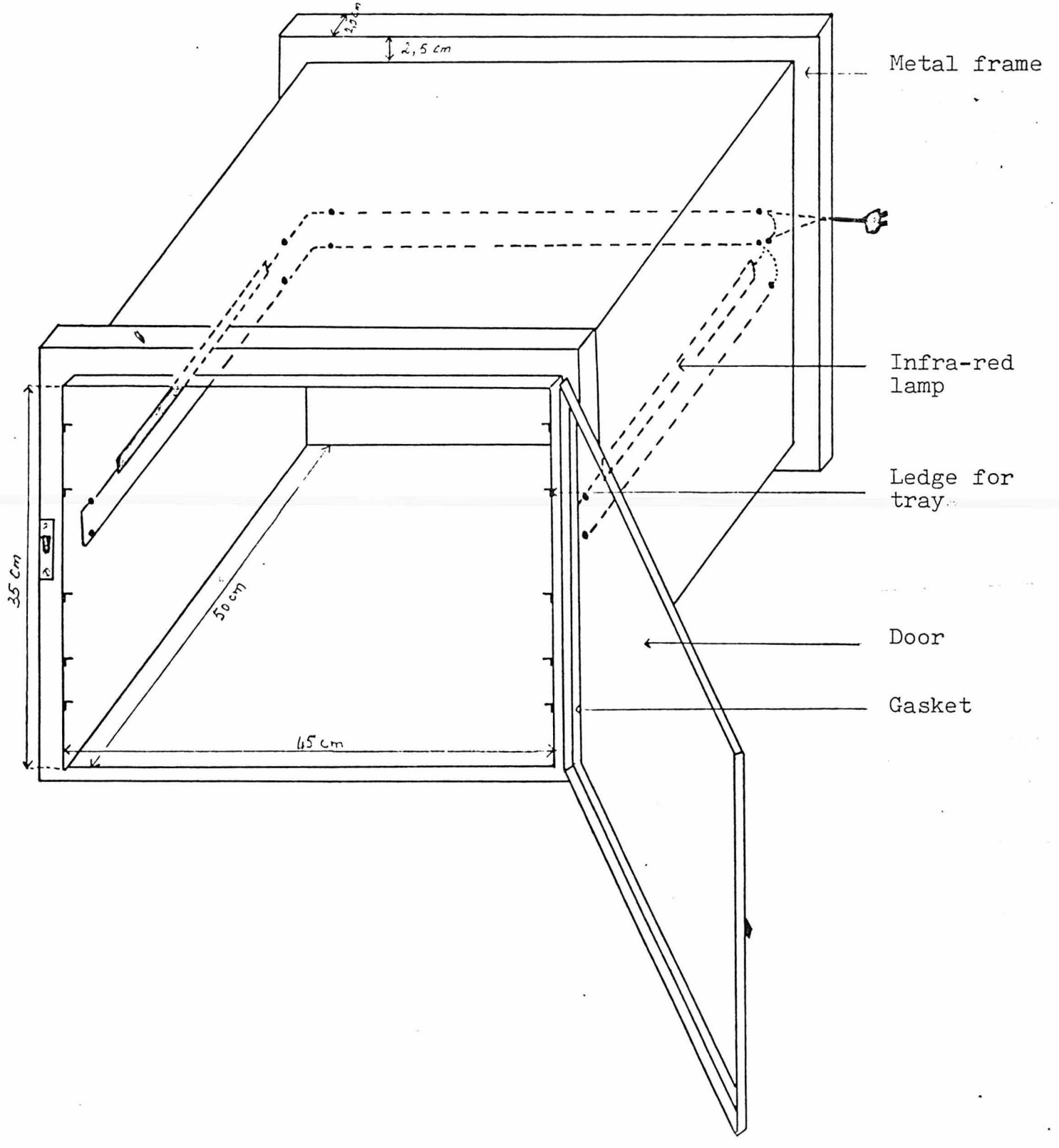
I.R.H.O.

COCONUT I.G.P. 7.10

POLLEN DRYING BOX

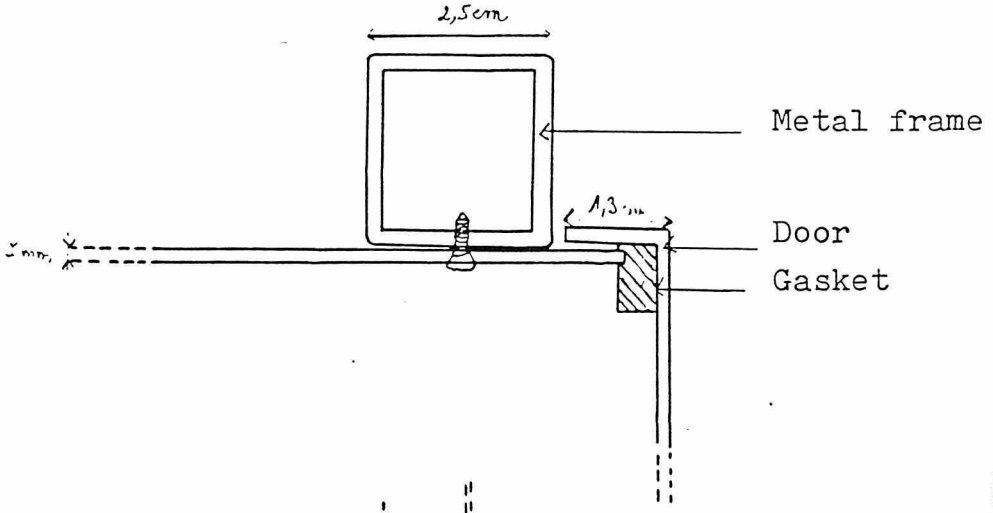
MATERIAL : 2 mm Aluminium sheet

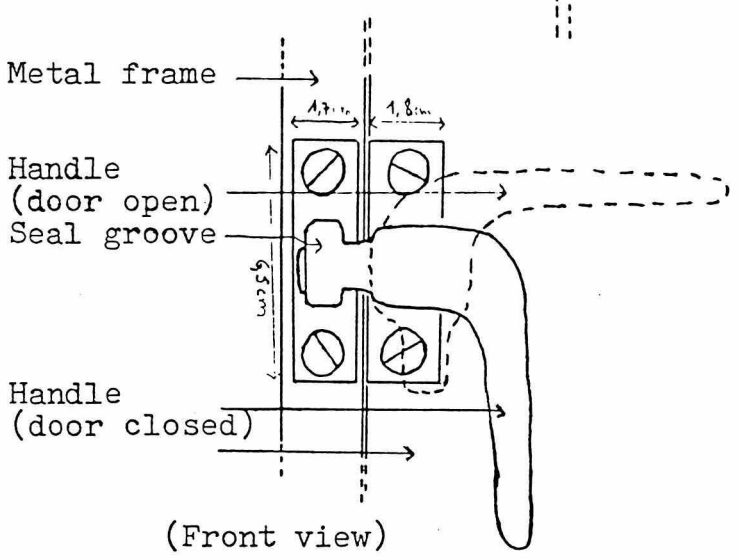
Movable trays not shown

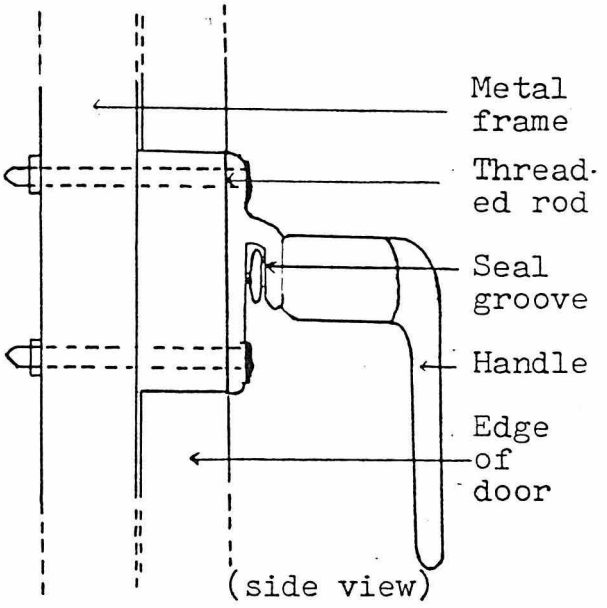


POLLEN DRYING BOX

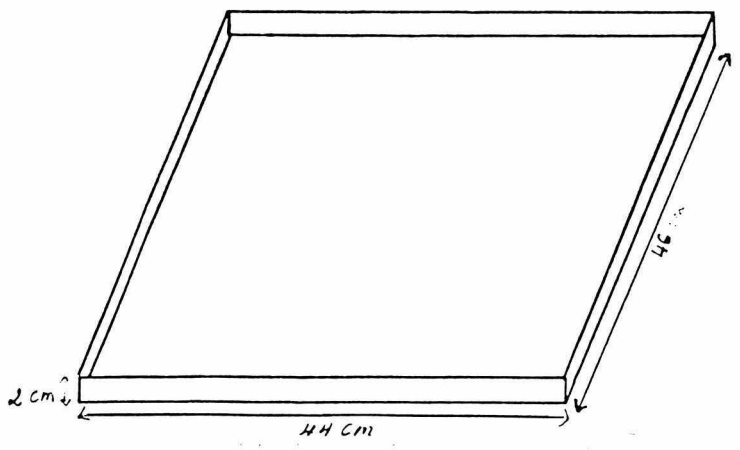
AIRTIGHT DOOR SYSTEM





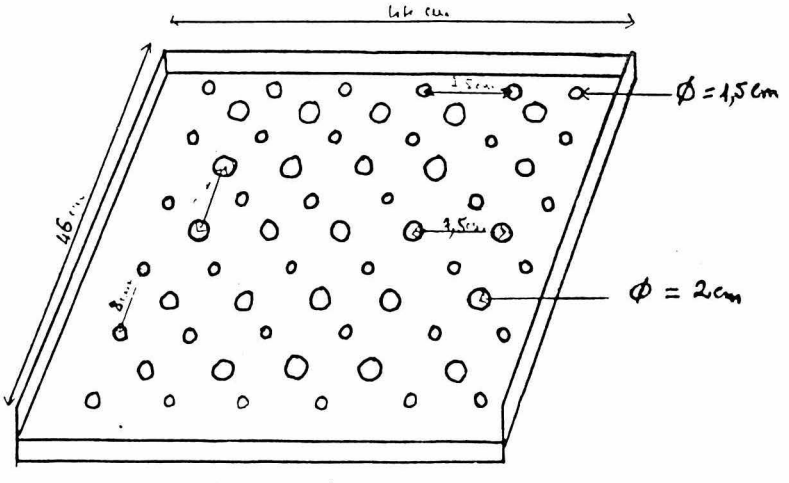


SYSTEM OF CLOSURE



SILICAGEL TRAY

(1 mm aluminium sheet, 4 raised edges)



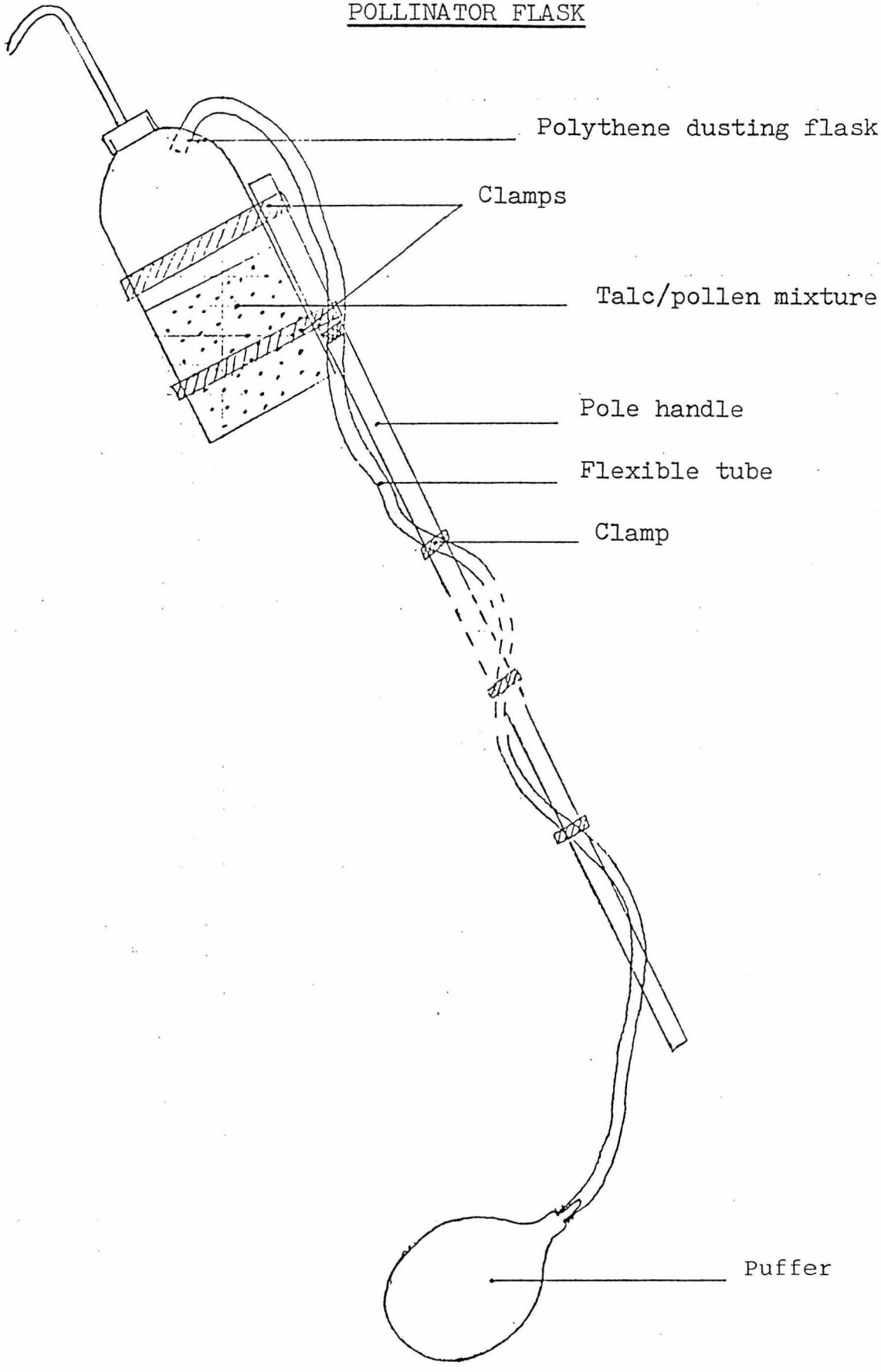
POLLEN TRAY

(1 mm aluminium sheet, 1 edge bent downwards to make it easier to remove pollen).

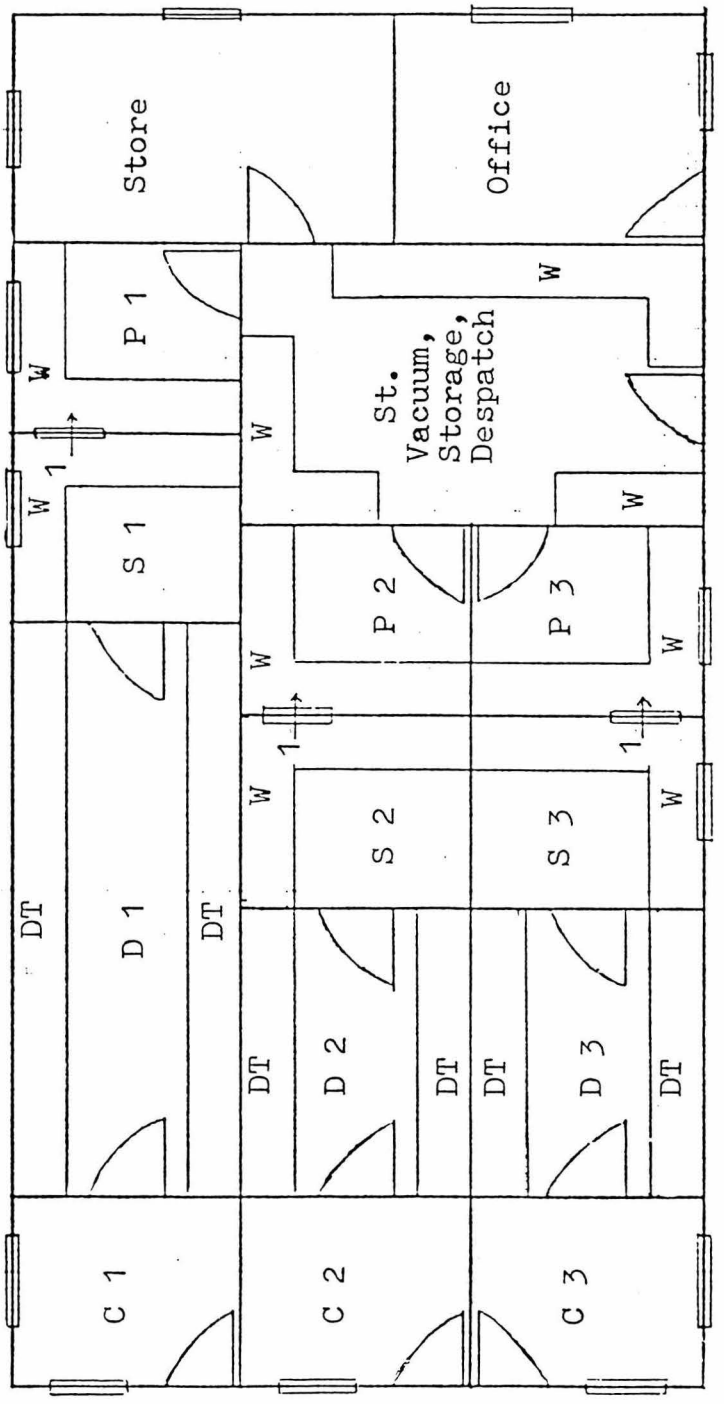
I.R.H.O.

COCONUT I.G.P. 7.12

POLLINATOR FLASK



LABORATORY FOR POLLEN PREPARATION



1 = Passage of sieved pollen
Rooms D : Closed-circuit air conditioning
Rooms S, P & St. : Normal air conditioning

C = Crushing
D = Drying
S = Sieving
P = Packing in sachets or flasks
W = Workbench
DT - Drying trays

I.G.P. 8

DISINFECTION OF MATERIAL AND PREMISES

I. GENERAL RULES

The disinfection of material and premises used for seed production must be done with the greatest care :

- to avoid, when different varieties of pollen are being prepared, any contamination between them;
- to stop bacteria, moulds, etc. developing.

II. PREMISES

The various pollen preparation rooms must be disinfected every day. The floor and shelves are washed with a solution of Javel water (sodium hypochlorite) @ 10 %, then with a product for tiles and floors such as Teepol or Heliopol; finally they are rinsed with fresh water. On the oil-painted walls and ceiling, a 10 % solution of Javel water is sprayed with a Berthoud sprayer, followed by rinsing with fresh water (twice a week).

III. MATERIAL

The trays on which fresh male flowers are placed are soaked before each use in a solution of 5 % Javel water + Teepol, then rinsed in fresh water. When set in place, they are wiped with cotton wool soaked in surgical spirit @ 95°.

The crusher or rollers are washed with 10 % Javel water, then surgical spirit.

The sieves are also washed in a Javel water + Teepol solution, rinsed in fresh water, then disinfected with surgical spirit.

The drying boxes with the trays for pollen and silicagel are sterilized before each use by heating with infra-red tubes to 150°C for 15 minutes. About 30 minutes should be allowed for cooling before use. A disc placed on each box indicates whether it can be used or not; it is divided into four sections inscribed "To be disinfected", "Being disinfected", "Disinfected hot" and "Disinfected cold". A movable pointer is set to the corresponding position.

The flasks are sterilized for 6 hours in an oven set at 150°C, and the pierced stoppers are washed with surgical spirit.

If the pollen is dried in an oven, the latter will be disinfected by raising the temperature to 150°C for 6 hours. The pollen will only be put it when the oven, set to 39°C, has dropped to that temperature.

The synthetic bags for pollen and the tarpaulins are washed three times a week with Javel water + Teepol.

When the variety of pollen is changed, the bell flasks are disinfected with surgical spirit.

I.G.P. 9

HARVESTING OF MALE FLOWERS

I. CHOICE OF MALE PARENTS

As copra/nut is a heritable character, it is a criterion for the choice of trees, but nonetheless, the number of nuts and the resultant of the two characters, copra/tree and copra/year, must not be neglected.

The trees retained are usually those whose value is equal to or greater than the mean for the population + σ

That applies when a tree is being chosen in a population not initially selected. When the trees have been obtained by hand pollination between coconuts of value, most of the normal trees can be used.

II. HARVESTING OF SPIKELETS

The harvester cuts the spikelets at the top and in the middle 6 - 8 days after normal opening of the spathe, and the ones at the bottom between 10 and 14 days. It is also possible to harvest all the spikelets at once between the 8th. and 10th. days, but then the pollen yield is slightly less.

These values are given for WAT; they vary with the variety to be harvested.

III. OBTAINMENT OF MALE FLOWERS

Once the harvester has finished visiting and harvesting all the trees, he strips the spikelets in the field. For this, he lays them on a tarpaulin and strips off the male flowers by hand (usually protected by a glove). The flowers are put in a synthetic bag, the variety is marked on it, it is carefully closed and sent to the laboratory.

I.G.P. 10

OBTAINMENT OF POLLEN

I. CRUSHING

As soon as they arrive in the laboratory, the male flowers are crushed either mechanically or by hand (rollers). The object of this is to open the petals without damaging the stamens; this operation favours drying.

II. DRYING

In a room

The crushed flowers are spread in a thin layer on the trays at the rate of 1 - 1.5 kg fresh flowers/tray.

For rapid drying, conditions must be as close to ideal as possible, i.e. temperature 30°C and relative humidity of 45 - 50 %.

If the room is perfectly air-donditioned by a closed circuit system, drying lasts 24 hours; otherwise, 48 hours are required.

In the oven

The crushed male flowers are put in paper bags which are placed in a ventilated oven set to 39°C. Here, drying takes 24 hours.

III. SIEVING

The crushed, dried flowers are taken out of the room or oven to be sieved. The operator puts them in a sieve, which he shakes repeatedly to get the pollen out. The pollen yield is 2 - 2.5 % of the weight of fresh male flowers processed.

At this stage the pollen has a humidity of 10 - 12 %.

IT IS ESSENTIAL THAT DIFFERENT VARIETIES OF POLLEN SHOULD NOT BE PREPARED AT THE SAME TIME UNLESS THERE ARE SEVERAL COMPLETELY SEPARATE ROOMS.

I.G.P. 11

STORAGE OF POLLEN

There are two possibilities :

- the pollen is used on the spot within 15 days, or
- it has to be stored for longer, e.g. to build up a stock or collect pollen for shipment.

I. SHORT-TERM STORAGE

After sieving, the pollen is put immediately into plastic bags at the rate of one 5-g dose of use per bag, which is then sealed. The bags are kept in the freezer at - 20°C.

II. MEDIUM-LENGTH STORAGE

Drying

In this case, the pollen must be dried a second time. In the sterilized drying box, the preparer puts a filter paper on the pierced trays, then spreads the pollen on them in thin layers; he fills the other trays with silicagel. The trays are placed in the box, alternating silicagel-pollen-silicagel-pollen, etc.... The door of the box is shut, and drying goes on for 22 - 24 hours, the silicagel being changed after about 12 hours.

In a box of the type described in I.G.P. 6(d), 500 g of pollen and 2000 g of silicagel can be put on each tray; as there are three trays of each, the capacity is 1500 g of pollen and 6000 g of silicagel.

After use, the silicagel is regenerated in the oven at 105°C. In principle it keeps its properties for 5 or 6 regenerations, then it must be replaced.

Packing in flasks

The volume of the flasks depends on the amount of pollen to be stocked or shipped. In 38 ml flasks, 19 g of pollen can be put.

After drying, the operator removes the pollen, weighs the desired quantity, then transfers it to the flask by means of a wide-necked aluminium or glass funnel. The flask are then closed.

Vacuum packing

For this operation, the preparer puts the flasks in the bell flasks after raising their stoppers slightly to expose the grooves through which the vacuum will be made.

The rubber discs are placed on the bells and the pump started up. When the vacuum is complete, there is a 3-minute pause, then the flasks are closed; for this, the stoppers are pushed in by pressing on the rubber disc with a stick.

The flasks under vacuum are taken out of the bell flasks and capsuled with the sealing pliers.

Storage

The flasks are kept in the freezer at - 20°C. For shipment, they are packed in isothermal polystyrene boxes and put in a freezer on arrival.

Preparation of doses

Before use, the content of the flasks is divided into 5 g doses and put in sealed plastic bags.

N.B. :

1. To avoid remoistening of the pollen during the various manipulations, the laboratory will be air-conditioned.

2. When working on several varieties, the variety code of the pollen concerned will be written on the flasks and bags.

3. The flasks or bags are regrouped by date of packing.

I.G.P. 12

CHECKING POLLEN QUALITY

I. TAKING POLLEN SAMPLES

Samples are taken at the following stages of preparation :

- after sieving;
- after the pollen has been put in plastic bags or, in the case of the flasks, after the vacuum has been made;
- at the moment of use, a sample is taken for each packing date; if the results are bad, a second sample is taken, and if the first check is confirmed, the whole lot is eliminated.

For shipments, one control flask is kept for each packing date; it is checked after being kept for 2 months at surrounding temperature.

II. VACUUM QUALITY

The vacuum in the flasks is checked by means of a hypothermic syringe, measuring the retraction of the piston.

III. POLLEN VITALITY

The vitality of the pollen is measured by culturing on a gelose-saccharose-distilled water medium.

1. Preparation of the medium

Put 1.2 g gelose flakes in an Erlenmeyer flask.

Add 100 cm^3 distilled water with a dropping bottle.

Heat on a bunsen burner over a low flame until all the gelose is dissolved, stirring continuously. Once the gelose is dissolved, allow to stand for 1 or 2 minutes, then add 11 g sugar (saccharose) to the Erlenmeyer. Stir to dissolve. Make up to 110 cm^3. Pour into petri dishes and cover.

When the gelose has set, open the dishes and wipe the surface of the medium with slightly moist filter paper to remove droplets of water due to condensation. Wipe the covers of the dishes.

Note : The petri dishes are washed and kept in an oven at 105°C before use.

2. Seeding

Place the tubes or flasks containing the pollen in a humidor at surrounding temperature for 1 hour. Take a little pollen on a paint-brush, shake it so as to form a cloud of pollen grains, and pass a petri dish through the cloud once. See if sufficient grains have been deposited on the gelose, otherwise pass the dish through the cloud again (if necessary check under the microscope that there are 10 - 20 grains in the field).

Close the dish. Mark the number of the pollen on it with a glass pencil and place in an oven at 35°C for 2 hours.

3. Counting

On removal from the oven, use a microscope to count the grains.

Count all the grains seen in one field and note :

- the normal grains which have germinated,
- the normal grains which have not germinated,
- the abnormal grains.

Repeat the counts several times until about 100 grains have been counted (if there is an average of 20 grains on one field, 5 fields should be observed).

Choose different fields at random - move the petri dish around without looking in the microscope.

Example :

		Normal grains germinated	Normal grains ungerminated	Abnormal grains
1st. position of dish	Field 1	10	8	3
2nd. position	Field 2	11	7	1
3rd. position	Field 3	13	5	1
4th. position	Field 4	8	10	4
5th. position	Field 5	9	14	1
		51	44	10

Abnormal grains : $\frac{10}{105} = 9.5\ \%$

Vitality : $\frac{51}{105} = 48.6\ \%$

IV. POLLEN HUMIDITY

1. Method

Before putting the tubes or flasks in the humidor, part of the pollen is transferred to a weighing bottle. The checker determines the fresh weight, then the dry weight after 24 hours in the oven at 105°C. The weighing bottle is open in the oven and closed for weighing.

2. Calculation

W 1 = Weight of weighing bottle

W 2 = Weight of weighing bottle + fresh pollen

W 3 = Weight of weighing bottle + dry pollen

$$\% \text{ humidity} = \frac{W3 - W1}{W2 - W1} \times 100$$

V. QUALITY NORMS

1. % germination : 30

2. % humidity :

   - stored in bags (short term) : 13
   - stored in flasks (medium length of storage) : between 4 and 8.

3. Vacuum in flasks : depends on size of flasks and amount of pollen packed in them. With 38-ml flasks containing 19 g of pollen, retraction of the syringe piston should be 20 ml.

I.G.P. 13

DISPATCH OF POLLEN

I. PACKING

The pollen tubes or flasks are placed in a polystyrene box specially designed to receive them.

II. DISPATCH

Pollen is always sent from one country to another by air freight.

A quarantine certificate is enclosed with the parcel if required.

III. DISPATCH ADVICE NOTE

A dispatch advice note, the same as for H.P. pollen (model overleaf) is enclosed with each parcel. It specifies :

- the variety,
- the date of harvesting,
- the number of flasks or tubes,
- the % germination and humidity after preparation of the pollen.

The parent's registration number is not mentioned in the case of assisted pollination.

IV. RECEIPT

On receipt, the consignee checks that the contents of the parcel conform to the dispatch advice note.

I.R.H.O.

COCONUT I.G.P. 13.2

I.R.H.O.

A.P. No. .....

DISPATCH ADVICE NOTE FOR POLLEN No. ..... of .....

Unit of ...th. consignment of pollen to :

Consignor :

Addressee :

Pollen sent :

Unit :

Parent No.	Variety	Date of harvest	Number of units (1) (2)	% germination	% humidity

(1) Unit of

(2) Unit of

Plant Breeding Service

Director

I.G.P. 14

EMASCULATION OF INFLORESCENCES ON MOTHER TREES

I. TIME OF EMASCULATION

Whether the variety of coconut concerned is self- or cross-pollinating, pollen is emitted as soon as the spathe opens naturally, and then there is a risk of contamination of the seed garden and production of illegitimate nuts.

Consequently, the spathe must be opened by hand about 24 to 48 hours before the presumed date of natural opening, and emasculation practised immediately.

II. ELIMINATION OF MALE FLOWERS : EMASCULATION

After opening the spathe if it is still closed, the emasculator cuts it at the basewith shears. Then he sections all the male spikelets 5 or 6 cm above the highest female flower, then removes all male flowers on the uncut part of the spikelets by hand, not forgetting those which flank each female flower.

Note : When the spathe is opened by hand, care must be taken not to damage the inflorescence, particularly the tender tissues of the female flowers. It is also necessary to make sure that the spathe is not opened too soon because the inflorescence will be too fragile at that time; the right moment is when the central 'seam' of the spather sinks to form a clearly visible furrow.

I.G.P. 15

QUANTITY OF POLLEN

Normally, one 5-gram unit of pollen is mixed with 100 g of talcum (or lycopodium) before assisted pollination is carried out.

This quantity of mixture will be enough to pollinate about 150 inflorescences.

I.G.P. 16

CARRYING OUT ASSISTED POLLINATION

I. TIME AND FREQUENCY OF POLLINATION

Pollination starts as soon as the first flower on the inflorescence has its stigmata open and secretes nectar. It goes on daily until the stigmata on the last flower are withered. Receptivity is judged from the ground.

The number of applications depends on the length of the female cycle :

- In Talls, flowering lasts 3 or 4 days,
- in Dwarfs, it lasts about 10 to 14 days,

so many more applications must be made to Dwarfs.

II. PREPARING THE MIXTURE

Each morning, 5-g units of pollen and 100-g units of talcum packed in sealed plastic sachets are distributed to the pollinators, each of whom waits in his plot.

He puts one unit each of talcum and pollen into his dusting flask. To make sure it is thoroughly mixed, he pours in small quantities of talcum and pollen alternately, shaking well each time. In principle, the whole quantity is transferred in five instalments.

The mixture ready for pollination, he fixes the flask to the pole handle and connects it to the bulb with the flexible tube.

III. POLLINATION

The pollinator goes up and down his plot row by row and dusts the talcum-pollen mixture on all the inflorescences with receptive flowers (secreting nectar).

He holds the spout of the flaskclose to the inflorescence and presses the bulb two or three times, expelling a cloud of powder; this application should be sufficient.

IV. AVERAGE QUANTITY OF POLLEN PER INFLORESCENCE

The dilution of pollen in talcum enables it to be seen whether the inflorescence has received enough pollen or not.

For Dwarfs, the average quantity per inflorescence is 0.4-0.5 g pollen split into 12-14 applications, or a daily dusting of 0.7-0.8 g mixture.

For Talls, there are only 4 or 5 applications per inflorescence of the same daily quantity of mixture (0.7-0.8g), which means that each inflorescence gets about 0.15-0.20 g of pollen.

I.G.P. 17

RECORDING OF THE VARIOUS OPERATIONS

Form A

Number of emasculations per day, per plot and per variety, with monthly totals per field.

Ex. : A-1 ASSINIE S.G. 1
A-2 Block S.G. 5, 7 and 9

These Forms A are filled in from the manifold books of the emasculators (I.G.P. 6).

Form B

This gives details of the quality of pollen used or despatched, per variety and per month.

Ex. : B-1 - Pollen used on the seed gardens of the Station. It includes :

- date of use,
- % humidity,
- % germination,
- date of packing,
- % humidity,
- % germination,
- use : Site
  No. of doses

B-2 - Pollen despatched. This includes :

- Packing : date
  % humidity
  % germination
  vacuum
- Despatch: date
  destination
- Check : date
  % humidity
  % germination
  vacuum

The Forms B are filled in from the pollen quality checker's manifold book (I.G.P. 12).

Form C

The quantity of pollen used, in number of doses/day per variety are noted, with monthly totals per field.

Ex. : C-1 - ASSINIE S.G. 1
C-2 - Block S.G. 5, 7 and 9

If the pollen is not of the usual type (WAT), it is indicated by a figure corresponding to the variety in accordance to an agreed code :

Ex. : (1) = PYT (2) = RLT.

Form D

Check of fruit set

According to the size of the plot concerned, one, two or more sheets will be used. The form is filled in in the field by the pollinators, who enter each month the serial number of the tree observed and the number of nuts set on the 3-month-old bunch(es).

If the tree is dead, the 'nuts' column is marked 'D'. The forms are then sent to the Plant Breeding office, where the columns are added up and the overall totals of living trees, number of nuts and average number of nuts/bunch are worked out.

Form E

Seed production

Form E is filled in by the person responsible for harvesting, after sorting and counting.

Each month, the number of good nuts, the number eliminated and the total per plot and per variety are entered.

Ex. : E-1 - ASSINIE
E-2 - Block

Form F

This is filled in by the person responsible for the seed-bed at the rate of one sheet per control. The following information is noted :

- no. of sowing,
- date of harvesting,
- date placed in seed-bed,
- consignee,
- no. of plot from which the nuts came,
- variety,
- no. of nuts sown.

Then, for the date of each check (every 2 weeks) :

- no. of sprouted nuts,
- no. of sprouted nuts which are : normal
  abnormal
  illegitimate
  legitimate

To avoid counting the same nuts several times, a ring is painted in red on the sprouted nuts at the time of the check.

When the seed-bed is wound up, the % germinated/sown, abnormal/sown and legitimate/sprouted are calculated.

Form G

Here, the errors made each month by each seed garden employee are grouped :

G-1 : Emasculator
G-2 : Foreman emasculator
G-3 : Pollinator
G-4 : Foreman pollinator

Form H

These are drawn up on the basis of Forms G, and count for any errors which enter into the calculation of monthly bonuses.

H-1 : Emasculator
H-2 : Foreman emasculator
H-3 : Pollinator
H-4 : Foreman pollinator

FORM A-1

Month ..... 19...

PLACE :

S.G. No.:

NUMBER OF EMASCULATIONS

Day \ Plot / Variety										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
TOTAL										

MONTHLY TOTAL:

FORM A-2

Month ..... 19....

Place:

S.G. No.:

NUMBER OF EMASCULATIONS

Seed Garden No.													
Plot													
Variety													
Day 1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
TOTAL													

FORM B-1

Month ..... 19 ...

Place:
S.G. No.:
Variety:

POLLEN QUALITY

Date used	% Humidity	% Germination	Date packed	% Humidity	% Germination	Use	
						Place	Number of doses
MEAN							

FORM B-2

Place: Month .... 19....

S.C. No. :

Variety :

POLLEN QUALITY

- DISPATCH -

DATE	PACKING			DISPATCH		CHECKS			
	% Humidity	% Germination	Vacuum	Date	Consignee	Date	% Humidity	% Germination	Vacuum

FORM C-1

Month .....19 ....

Place:

S.G. No.:

QUANTITY OF POLLENS USED

- Number of doses -

Plot										
Variety										
Date										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
TOTAL										

For pollens other than WAT, mention in brackets (1) PYI; (2) RLT

FORM C- 2

Month ..... 19 ...

Place:
S.G. No.:

QUANTITY OF POLLEN USED

- Number of doses -

S.G. No.										
Plot										
Variety										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
TOTAL										

For pollens other than WAT, mention in brackets (1) PYT; (2) RLT

FORM D

FRUITSET INSPECTION

Month ....19 ....

Place:
Plot :

Tree	Nuts	Tree	Nuts	Tree	Nuts	Tree	Nuts	Tree	Nuts
TOTAL									

OVERALL TOTAL :

Number of trees :)
Number of nuts :) % Fruitset

IRHO COCONUT I.G.P. 17

FORM E-1

Month ..... 19 ....

Place:
S.G. No.:

SEED PRODUCTION

PLOT	VARIETY	NUMBER OF NUTS			REMARKS
		GOOD	ELIMINATED	TOTAL	

FORM E-2

Month ..... 19 ....

Place :
S.G. No.:

SEED PRODUCTION

S.G. No.	Plot No.	Variety	Number of nuts			REMARKS
			GOOD	ELIMINATED	TOTAL	

Place

FORM F

GERMINATION AND LEGITIMACY
- CONTROL -

Sowing No. :
Harvest date :
Date placed in seed bed :
Consignee :

Family No. :
Plot No. :
Variety :
Number of nuts sowed (S):

DATE	NUMBER				
	G/ Germinated Nuts	Normal	A Abnormal	Illegitimate	Legitimate
TOTAL					

% Germinated / Sowed =

% Abnormal / Sowed =

% Legitimate / Germinated =

IRHO COCONUT I,G.P. 17

FORM G1

PLACE:

S.G. No.:..... CASTRATOR ..... 19 .....

MONTH	ABSENCE	♂ flowers missed	Recording errors	Broken spikelets	Late	Non-castrated inflorescences	Early departure	Discipline	Remarks
January									
February									
March									
April									
May									
June									
July									
August									
September									
October									
November									
December									
TOTAL									

APPOINTED: .....

APPOINTED AS CASTRATOR ON .....

REMARKS :

FORM G2

PLACE

S.G. No. ..... CASTRATOR SUPERVISOR ..... 19 .....

MONTH	ABSENCE	LATE	EARLY DEPARTURE	UNCHECKED INFLORESCENCES	DISCIPLINE	REMARKS
JANUARY						
FEBRUARY						
MARCH						
APRIL						
MAY						
JUNE						
JULY						
AUGUST						
SEPTEMBER						
OCTOBER						
NOVEMBER						
DECEMBER						
T O T A L						

APPOINTED ON:

APPOINTED AS CASTRATOR ON :

REMARKS:

FORM G3

PLACE ..... POLLINATOR ..... 19 .....

S.G. No. .....

Plot No. .....

MONTH	ABSENCE	0 inflores-cences not pollinated	Reporting errors or missing from book	Pollen exposed to sunlight	Pollen mix-ture poorly prepared	Too much or too little pollen used	Lateness or early departure	Discipline	Equipment	Remarks
JANUARY										
FEBRUARY										
MARCH										
APRIL										
MAY										
JUNE										
JULY										
AUGUST										
SEPTEMBER										
OCTOBER										
NOVEMBER										
DECEMBER										
T O T A L										

APPOINTED ON: .....

APPOINTED AS CASTRATOR ON .....

REMARKS:

FORM G4

PLACE:
S.G. No.
Plot No.

POLLINATOR SUPERVISOR ..... 19 .....

MONTH	ABSENCE	LATENESS OR EARLY DEPARTURE	WRONG POLLEN DOSE USED	0 inflores-censes not pollinated	Discipline	Remarks
JANUARY						
FEBRUARY						
MARCH						
APRIL						
MAY						
JUNE						
JULY						
AUGUST						
SEPTEMBER						
OCTOBER						
NOVEMBER						
DECEMBER						
TOTAL						

APPOINTED ON .....
APPOINTED AS CASTRATOR ON .....
REMARKS

FORM H1

CASTRATOR MONTHLY BONUS SHEET

PLACE :

DATE	NUMBER OF FAULTS IN THE MONTH								BONUSES				
	Absence	Lateness or early departure	Reporting error or absence from book	♂ flowers missed	Broken spikelets or damaged ♀	Broken leaves	Inflo. not castrated	Equipment	Discipline or negligence	EXPECTED OUTPUT	FAULT TO BE DEDUCTED	ACTUAL OUTPUT	PRESENCE	TOTAL

SANCTIONS AND FAULTS FROM THE 20TH OF THE PREVIOUS MONTH
TO THE 19TH OF THE CURRENT MONTH

FORM H2

PLACE:

MONTHLY BONUS SHEET FOR CASTRATOR TEAM LEADERS

DATE	NUMBER OF FAULTS PER MONTH						BONUSES				
	Absence	Lateness or early departure	Report keeping	Opened inflorescences	Inflorescences not checked	Discipline or negligence	EXPECTED OUTPUT	FAULT TO BE DEDUCTED	ACTUAL OUTPUT	PRESENCE	TOTAL

SANCTIONS AND FAULTS FROM THE 20TH OF THE PREVIOUS MONTH
TO THE 19TH OF THE CURRENT MONTH

IRHO COCONUT I.G.P. 17

FORM H3

PLACE:

MONTHLY BONUS SHEET
POLLINATORS

DATE	NUMBER OF FAULTS IN THE MONTH										BONUSES					
	ABSENCE	LATENESS OR EARLY DEPARTURE	REPORTING ERROR OR ABSENCE FROM BOOK	♀ INFLORESCENCES NOT POLLINATED	POLLEN EXPOSED TO SUNLIGHT	POLLEN MIXTURE POORLY PREPARED	TOO MUCH OR TOO LITTLE POLLEN USED ON INFLORESCENCE	EQUIPMENT	DISCIPLINE OR NEGLIGENCE	EXPECTED OUTPUT	FAULT TO BE DEDUCTED	ACTUAL OUTPUT	PRESENCE	TOTAL

SANCTIONS AND FAULTS FROM THE 20TH OF THE PREVIOUS MONTH
TO THE 19TH OF THE CURRENT MONTH

IRHO COCONUT I.G.P. 17

FORM H4

PLACE:

MONTHLY BONUS SHEET FOR POLLINATOR TEAM LEADERS

DATE	NUMBER OF FAULTS FOR THE MONTH					BONUSES				
	ABSENCE	LATENESS OR EARLY DEPARTURE	WRONG AMOUNT OF POLLEN USED	INFLORESCENCES NOT POLLINATED	DISCIPLINE OR NEGLIGENCE	EXPECTED OUTPUT	FAULTS TO BE DEDUCTED	ACTUAL OUTPUT	PRESENCE	TOTAL

SANCTIONS AND FAULTS FROM THE 20TH OF THE PREVIOUS MONTH
TO THE 19TH OF THE CURRENT MONTH

IRHO
COCONUT I.G.P. 18

I.G.P. 18

MONTHLY REPORT

The purpose of this report is to make it possible to monitor, month by month, the progress and quality of work, and to check production forecasts and their achievement in the seed gardens.

There are five tables, divided into plots and hybrid types:

Table V:	Number of emasculations.
Table VI/1	Yield (% germination, abnormals and legitimacy).
Table VI/2	Yield (% germination, abnormals and legitimacy of controls - cf I.G.P. 20)
Table VII	Assisted pollination: number and quantity of pollens used.
Table VIII	Fruitset and production forecasts.
Table IX	Pollen dispatches per consignee.
Table X/1	Development of production programme and hybrid seed sales for the current year.
Table X/2	Production and delivery forecasts for hybrid seeds over two years.
Table XI	Number of nuts produced.

The other tables are for keeping track of pollen deliveries, harvesting forecasts and seed deliveries.

MONTHLY BREEDING REPORT

TABLE V

SEED PRODUCTION - EMASCULATION

PLACE: MONTH ..... 19....

S.G. No.	PLOT	TYPE OF CROSS	NUMBER OF EMASCULATIONS	
			THIS MONTH	CUMULATED
TOTAL S.G.				

PLACE:

MONTH .... 19 ....

MONTHLY BREEDING REPORT

TABLE VI

HYBRID PRODUCTION - YIELDS

					Number of nuts				Percentage		
C.S. No.	Variety	Plot	Harvest date	Sowing date	Sowed S	Germinated G	Hybrid H	Abnormal	% $\frac{G}{S}$	% $\frac{A}{S}$	% $\frac{H}{G}$

PLACE:

MONTH ..... 19 .....

MONTHLY BREEDING REPORT

TABLE VI/2

DISPATCH RECORD SHEET - SEEDBED RESULTS

CONSIGNEE	VARIETY	HARVESTING DATE	SOWING DATE	TREATMENT	NUMBER OF NUTS				PERCENTAGE				
					SOWED S	GERMINATED G	LEGITIMATE L	ABNORMAL A	% G/S	% A/S	% L/G		

PLACE: MONTH .....19.....

MONTHLY BREEDING REPORT
TABLE VII
ASSISTED POLLINATION

S.G. No.	PLOT	NUMBER OF INFLORESCENCES POLLINATED	AMOUNT OF POLLEN USED		MEAN QUANTITY PER INFLORESCENCE	MEAN VIABILITY
			NUMBER OF DOSES	NUMBER OF GRAMMES		
TOTAL S.G.s						
TOTAL SINCE JANUARY						

PLACE:

MONTH .... 19 ....

MONTHLY BREEDING REPORT

TABLE VIII

FRUITSET RATES FOR THE POLLINATIONS THIS MONTH: ....

S.G. No.	PLOT	BUNCHES	NUTS	NUTS/BUNCH PLOT	PLOT PRODUCTION FORECAST
TOTAL S.G.s					
TOTAL SINCE JANUARY					

MONTH ..... 19 .....

PLACE:

MONTHLY BREEDING REPORT

TABLE IX

POLLEN DISPATCH PER CONSIGNEE

DISPATCH ADVICE NO.	CONTRACT No.	CONSIGNEE	VARIETY	QUANTITY	
				THIS MONTH	CUMULATED
TOTAL					
TOTAL SINCE JANUARY					

PLACE: MONTH ..... 19 .....

MONTHLY BREEDING REPORT
TABLE X/1
1980 - DEVELOPMENT OF THE PRODUCTION PROGRAMME AND HYBRID SEED SALES

MONTH	NUMBER OF NUTS					REMARKS
	PRODUCTION		SALES			
	FORECASTS START OF 1980	ACTUALLY PRODUCED	LOCAL	EXPORT	STOCK	

PLACE:

MONTH ..... 19.....

MONTHLY BREEDING REPORT
TABLE X/2

HYBRID SEED PRODUCTION AND DELIVERY FORECASTS

MONTH	NUMBER OF NUTS			
	PRODUCTION FORECAST	EXPECTED DELIVERIES		
		LOCAL	EXPORT	AVAILABLE

FIRM ORDERS

PROBABLE ORDERS

PLACE: MONTH ..... 19 .....

MONTHLY BREEDING REPORT

TABLE XI

SEED GARDEN MONTHLY STATISTICS AND YIELDS

- NUMBER OF NUTS PRODUCED -

S.G. No.	PLOT	VARIETY	THIS MONTH	CUMULATED	
				YEAR	PREVIOUS YEAR
TOTAL Seeds					
TOTAL LF					

(*) LF

I. G. P. 19

WORK CHECKS

All the assisted pollination operations must be checked daily by the supervisors and foremen.

This is absolutely indispensable if good legitimacy of the seed and and excellent yield are to be assured.

I. CHECKING THE WORKERS

1. Emasculators

Once an inflorescence it must be emasculated within two hours, especially during the hottest hours of the day. Not a single male flower should remain on it after emasculation.

To achieve this, extremely close supervision is essential. The fore-man emasculator has the duty :

- to keep an overall check on the workers for whom he is responsible;
- to make a thorough check of a certain number of inflorescences per emasculator.

The number of inflorescences/emasculator is as follows :

(a) normal working days : 5 per emasculator.

(b) Saturday, Sunday and public holidays : 3 per emasculator.

(c) Leave, days off, etc. : when assuring the interim, the supervisor may have his task doubled, checking not only his own workers but those of the absent foreman; in this case, the number of inflorescences/emasculator is reduced to 3.

N.B. (1) When the trees are very young and a ladder is not required to check them, the number of inflorescences is increased to 7 in case (a) and 4 in cases (b) and (c).

(2) To be sure that the check has been made by him, the foreman signs and dates the rachis of the frond subtending the inflorescence observed with a felt pen.

The foreman enters in a manifold notebook any faults noted with name of the person responsible, as well as the field numbers of the trees on which he has checked the inflorescences and his comments

2. Pollinators

The foreman-pollinator has several things to check :

- the variety of pollen, which must conform to the type of hybrid to be produced;
- the quality of the mixture and the actual pollination;
- the quantity of pollen applied to the inflorescence, not too much, not too little, just the right amount; the monthly table, No. VII (IGP 18) will show the average monthly dose per inflorescence used and allow the quantity to be adjusted accordingly;
- no inflorescences must be forgotten.

He also has to make sure that the day's pollen units are not exposed to the sun while waiting to be used.

All anomalies are noted in a manifold notebook with the name of the person responsible.

3. Foremen

These checks are ensured by the head supervisor, aided by one or more assistants depending on the size of the seed garden staff.

As well as generally controlling all the personnel and the quality of the work, the head supervisor also checks 3 inflorescences per foreman-pollinator on ordinary working days and 2 on Saturdays, Sundays and public holidays, noting any anomalies and verifying that the foreman has indeed signed and dated the rachis.

It is he who, each day, gives the foremen-emasculators the field numbers of the trees to be checked.

4. Monthly statements of checks

The manifold notebooks of the foremen-emasculators serve them for filling in the Forms G-1 in which errors made by each emasculators during the current month are recorded.

Forms G-3 are filled in by the foremen-pollinators from their manifolds, and record errors made by the pollinators during the current month.

As for the head supervisor, he fills in Forms G-2 (foreman-emasculator) and G-4 (foreman-pollinator), noting the errors made by both during the month.

These forms make it possible to follow up the quality of the work done by the emasculators, pollinators and foremen and judge their aptitude for their tasks.

Monthly bonuses for the different categories are worked out by the Head of the Plant Breeding Service, responsible for seed production, and his assistant, in the presence of the head supervisor and on the basis of Forms G-1, G-2, G-3 and G-4. These bonuses figure in Forms H-1 (emasculator), H-2 (foreman-emasculator), H-3 (pollinator) and H-4 (foreman-pollinator). Any faults committed entail reductions in the bonuses, according to an agreed scale.

If a member of the seed garden staff is unfit for the work entrusted to him because of numerous and repeated errors, he is replaced.

5. Marking of work sites

To make checks by foremen and supervisors easier, the following system of marking is used :

- Emasculator : Signboard with the name in black on a white ground.
- Pollinator : Signboard with the name in black on a red ground.
- Harvest : Board marked "Harvest" in white on a blue ground.

Each type of board is placed in the return interrow.

I.G.P. 20

YIELD CHECKS

I - FRUITSET CHECK

The castrators check the number of set fruits per bunch, watched over by the castrator-supervisor and the general supervisor. This is done on three-month old bunches, i.e. when they are about the size of a fist. Counting is carried out on 10% of the trees, i.e. every fifth row and every other tree, as a rule. The trees to be observed are chosen once and for all.

The data are recorded on D forms (I.G.P. 16). The monthly means per plot and type of hybrid are recorded in table VIII of the monthly report (I.G.P. 18).

II - PRODUCTION FORECASTING

Monthly production forecasts are calculated from the fruitset figures and the number of emasculations carried out three months beforehand (I.G.P. 18, table VII), indicated in Table VIII (I.G.P. 18).

To allow for sampling discrepancies, counting errors, and abortions which may still occur, along with rat attacks (except in the case of extreme infestation) and harvest culling (nuts too small, no water, excessive *Aceria guerreronis* damage, or wounded), only 80% of the calculated figure is taken into account.

III - LEGITIMACY CHECKS

Germination is observed on sample batches taken from each harvest (100 nuts taken at random per plot and per hybrid type). Checks are made of the germination, abnormality and legitimacy percentages. A good legitimacy percentage would be between 95 and 98%. 93% legitimacy in germinated seeds is taken to be borderline, and under this figure the cause must be investigated (poor workmanship, contamination by coconut palms located too close to the seed garden) and the necessary steps must be taken (staff replacement, bonus reductions, felling of surrounding coconuts likely to contaminate the seed garden). Illegitimates caused by poor emasculation are easy to recognize if the mother-trees are Yellow or Red Dwarfs - they have yellow or red sprouts, whereas hybrid sprouts are green, brown or brownish-red. If the mother-trees are Talls or Green

Dwarfs, it is much more difficult to make a distinction; each is a case on its own. Sometimes the difference in germination rate of the two parents can be taken into account.

Selection according to colour

Cross	Legitimate sprout colour
Yellow Dwarf x Tall	Brown or green
Red Dwarf x Tall	Brown, brownish-orange, or brownish-brown
Green Dwarf x Tall	Brown or green

I.G.P. 21

HARVESTING - COUNTING - CONTROL

I - HARVEST

Harvesting takes place every month (Dwarf type mother-trees with rapid germination), or every 2 months (mother-trees with slow germination, such as certain Talls).

The bunches are cut when they contain at least one nut with a brown epidermis. Detached bunches or nuts are grouped together in the circle, around the stem, to simplify collection.

The nuts are harvested and collected per plot and hybrid type and unloaded in a storage area.

II - COUNTING AND SORTING

Nuts are counted and sorted at the same time, per plot and hybrid type.

The following nuts should be eliminated:

- Nuts that are too small compared to the mean for the variety in question,
- Nuts without water,
- Immature nuts,
- Damaged nuts,
- Nuts with severe malformations.

Generally speaking, good nuts are stacked in piles of 3,000, which facilitates loading for deliveries. A noticeboard indicates the plot, type of hybrid and number of nuts.

III - CONTROL SAMPLING

A sample of 100 nuts is taken at random per plot and per type of hybrid, and is placed in the seedbed to check legitimacy (see I.G.P. 20).

I.G.P. 22

SEED DISPATCHES

I - IDENTIFICATION

The nuts are separated according to hybrid type. The consignee can identify them from the numbers written on the bags.

II - TREATMENT

The conventional treatment consists in dehusking the nuts and soaking them for 3 minutes in a solution containing:

- a fungicide = Organyl 66 - 500 g CP/hl
- an insecticide-acaricide = Monocrotophos = Nuvacron 33 g/hl

III - DISPATCH

1) Packing

- By ship : jute bags
- By air : synthetic bags

2) Dispatch Advice Notes

Every shipment is accompanied by a dispatch advice note (see specimen copy). Bag numbering enables separation of the different hybrids.

A phytosanitary certificate is issued for each shipment.

3) Shipment Method

Shipments are by air or sea freight, in line with clients' wishes.

IV - DISPATCH CHECK

A random sample is taken after treatment for each type of hybrid. The number of nuts in the control sample corresponds to 1% of the seeds dispatched, with a minimum of 100 and a maximum of 1,000. The germination rate, the number of abnormal sprouts and legitimacy rate are determined (see I.G.P. 20).

The results are given in Table VI of the monthly report.

SENDER:

DISPATCH ADVICE NOTE

ADVICE NOTE No.: .....
CONTRACT No.: .....

Dispatched on: ..... 19.....

CLIENT:

BAG MARKINGS

Family Number where applicable	CROSS	NUMBER OF NUTS	NUMBER OF BAGS	BAG No.

SIGNED IN: on: ..... 19 .....
(date)

BREEDING SERVICE :

DIRECTOR
(signature)