

PROCESSING OF COCOA

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Cocoa cultivation is of a recent origin in India. The major cocoa growing countries are Ghana, Nigeria and Brazil. Its total production in the world is estimated to be about 15 lakh tonnes. The post-war period witnessed an increased interest in cocoa production. It promoted for establishing estates and small gardens both as a mono crop and as a mixed crop. Intensive efforts are being made to increase the production of cocoa in India particularly by mixed planting in the arecanut and coconut gardens. Eventhough accurate statistics are not available, the present production of cocoa in India is estimated to be around 400 tonnes from an area of more than 10000 hectares.

There are two main varieties of cocoa, Criollo and Forestero, the latter being chosen for cultivation in India. Cocoa is a common ingredient in confectionary and bakery delicacy and in beverages. Amongst its main products, cocoa powder and chocolates are the most popular.

Most of the cultivators in our country are not fully aware of the scientific method of processing of cocoa beans. Cocoa products will have delicious taste, characteristic odour and chocolate colour only if the beans are processed properly. Well processed beans therefore fetches premium price in the markets. For this, special care is taken from the harvesting of pods to fermenting, drying and storing of the beans.

Harvesting:

It takes about 170 days from opening of the flowers to the ripening of fruits. Green Forestero pods on ripening attain a yellow colour. For harvesting the fruits, extreme care should be taken to see that the cushion like projections on the bark are not damaged as flowers are produced only at such places. A sharp knife can be used for separating the fruits from the tree without making any injury to the projections on the bark. After

harvesting, the pods are opened by hitting them against a stone or hard surface. Sharp knife should not be used for this purpose, since it will cut the beans inside and adversely affect the quality of fermented beans. After opening the pods, the beans are scooped out with the help of fingers. It is estimated that on an average a man can harvest 1500 pods or can open the same number and take out the beans per day.

The fleshy rind of the pods is a good cattle feed. Therefore, immediately after removing the beans, the rind may be cut into small pieces and given to cattle and pigs. The rind can also be evenly distributed over the planted area and the nutrients they contain are returned to the soil for reabsorption by the trees.

Fermentation

Fresh cocoa beans are covered with mucilage or pulp which largely disappears during fermentation. The main object of fermentation is, however, to produce cocoa beans which on manufacture will produce good chocolate. Chocolate flavour is developed by the two processes of fermentation by the grower and of roasting by the manufacturer and it cannot be obtained by one of these processes alone.

The basic requirements for satisfactory fermentation of beans which should commence within 24 hours after break opening the pods demand maintenance of heat, drawing off of sweating and provision of adequate access to air. Heat is produced during fermentation and must be conserved so that chemical changes inside the beans are completed. The process lasts upto 6 to 7 days for Forestero variety and is followed immediately by drying. The term fermentation normally means the conversion of sugar contained in the pulp to alcohol and from alcohol to acetic acid, but there are many other quite different changes

which take place inside the bean. It is evident that the fermentation and drying of cocoa beans, while involving relatively simple principles, are quite complex in the inter-play of their controlling factors and hence proper attention is to be given at each stage for the production of high quality cocoa beans.

Changes occurring during fermentation:

The pulp covering the fresh beans is sterile initially, but the presence of sugars and the high acidity provide excellent conditions for the development of micro-organisms. A wide range of them infect the mass of beans. In the first stage yeasts proliferate and they convert sugars in the pulp to alcohol. The cells of the pulp start to break down on the onset of fermentation either through an enzyme reaction or by simple mechanical pressure. The activity of the yeasts leads to the production of a large amount of carbon dioxide and at this stage of fermentation relatively anaerobic conditions prevail. This condition allows the development of lactic acid bacteria which assist in the further break down of sugars. During this process the liquid portion of the pulp runs off as "Sweating".

When the sweatings run off, the condition becomes more aerobic and the acidity is also reduced. The presence of oxygen allows acetic acid bacteria to take over from yeasts and convert alcohol to acetic acid. These reactions produce much heat which results in the death of beans. This is followed by the break down of the external cell structure and various enzyme reactions. The polyphenols undergo chemical changes which help to reduce bitterness and astringency. The proteins undergo hydrolysis by reactions with the polyphenols and these changes have much influence on the chocolate flavour produced after roasting.

Methods of fermentation:

The beans are fermented by two methods basically; the box and the heap. Fermentation in boxes involves the use of strong wooden boxes holding 60 kg. to 1.5 tonnes of wet beans. There is provision for drainage of sweatings which also allows air to enter and pass up through the beans which are covered with banana leaves or sacking. The beans are turned every day or every other day for six to eight days.

In the heap method beans are laid on banana leaves and covered with more leaves when the

heap is complete, the leaves are normally held in place by pieces of wood. Fermentation lasts four to six days during which period the heap may be turned once or twice.

Basket fermentation is another method followed in some countries like Nigeria. The baskets are of no definite size and are lined with leaves. The method is usually adopted by small holders.

Method suitable for Foresterio Cocoa beans:

A method using the wooden trays is the most appropriate particularly for the variety "Foresterio" which is recommended for cultivation in India. This is a relatively new method of fermentation or rather an improvement over the box method.

The tray used for this purpose is of the size 90 cm. × 60 cm. × 12 cm. which holds upto 40 kg. wet beans. In order to drain out the sweatings formed at the time of fermentation there should be small holes at the bottom of these trays. This also helps for the entry of air. For this, the bottom of the tray is made of canes or bamboo sheets or wooden planks with small holes. A single tray of beans will not ferment properly and a minimum of 4 trays are needed for successful fermentation. In order to improve aeration and drainage of sweatings cocoa beans should not be placed at the lower-most layer.

These trays are covered by jute bags after 24 hours of filling up with beans. Polythene covers should not be used since aeration is essential for fermentation. The trays are not moved until the end of fermentation. Like this, the trays are kept for 5 days and thereafter the beans are taken out and dried.

Fermentation in trays has been found to be advantageous over the traditional methods in the following ways:—

- (i) The fermentation period is comparatively shorter.
- (ii) As the beans are not turned during fermentation there is a saving in labour.

When the beans to be processed are small in quantity, the basket method can be adopted by small growers for fermentation. In this method, baskets are lined with banana leaves. About 60

cm. length of the leaves will be projecting out of the basket. Cocoa beans are filled in the basket and covered by folding the projected portion of leaves. The basket is kept on three stones for facilitating the drainage of sweatings during fermentation. Afterwards the basket is covered by jute bags. The beans are turned after every two days. Turning or mixing is said to be essential to prevent surface mould growth and for uniformity in fermentation. After 6 days the beans are taken out and dried.

Factors affecting fermentation:

1. Ripeness of pods:

Unripe pods give only low recovery of dry beans and produce more purple beans. Overripe pods may contain germinated beans but from the point of view of quality, there is no objection.

2. Type of Cocoa:

There is a basic difference between Criollo and Forestero types in the way they are fermented. Criollo cocoa is fermented for a relatively short period of two to three days while Forestero is fermented for five to seven days. As a result of this difference mixed fermentation of these two types should be avoided.

3. Quantity of Cocoa:

The heat generated during fermentation is retained by insulation. But it is difficult to achieve with small quantities of beans as their surface area is great in relation to their mass. There is therefore a minimum quantity of beans which will ferment satisfactorily. The quantity varies according to the method adopted for fermentation.

4. Duration:

Under-fermentation will produce beans with more purple pigment, and greater bitterness and astringency can be expected in the final product. Over-fermentation will produce beans with a dull dark coloured nib and little chocolate flavour.

5. Turning:

The purpose of turning the beans during fermentation is to ensure uniformity. The commonest practice is turning every day or every other day. But this is not required in the tray-method.

Drying:

At the end of fermentation, the moisture content of cocoa beans is about 55% and this must be reduced to 6 to 7% for safe storage.

Sun drying:

For drying under sun, the beans are to be spread at 3 to 4 cm. thickness on wooden floors or bamboo mats. Sun drying requires constant attention not only to ensure uniform drying but also to put the beans under cover when it rains. Well dried beans will break with a crackling sound, when pressed between two fingers.

Artificial drying:

On large estates and plantations, drying in the sun may be more costly than mechanical drying. The drying period is longer particularly in sun drying and the area required for drying is much more extensive. Further, the labour required to handle large quantities becomes considerable. To avoid these difficulties mechanical driers can be used in big plantations.

Cleaning, grading and bagging:

After drying, the beans are filled in jute bages or in polythene bags, after they are allowed to cool. At this stage, the quality of the sample is improved by removing flat and broken beans. An examination of the sample will tell whether any cleaning or grading is necessary. Where grading is required sieving is adopted. The cleared beans will be free from dust and small pieces of shell.

Grading according to size is not considered to be worthwhile as there is no demand for beans of different sizes, nor at present is there any strong emphasis on uniformity of bean size.

Storage:

Cocoa beans can be stored indefinitely in temperate countries. If it is to be stored in the tropics, special precautions must be taken to ensure that quality does not deteriorate from either pest attack or mould development. Cocoa beans are hygroscopic and will therefore absorb moisture under very humid conditions. The relative humidity in cocoa stores should not exceed 80% for any length of time. To prevent infestation, the building should have a cement floor and wall made of bricks.

The beans fermented, dried and cleaned properly will have the following characteristics:—

- (1) 100 beans will weigh about 115 grms. and will be uniform in shape and boldness.
- (2) The outer cover of the beans will not break easily but if pressed between two fingers it will be broken into pieces.
- (3) The beans will have a characteristic smell, but the chocolate smell will develop only after roasting.
- (4) There will no fungus inside or outside the beans.

At present, the following companies are purchasing cocoa beans from cultivators.

- (1) M/s. Cadbury Fry India Private Limited. Bombay.
- (2) M/s. Kaira Milk Producers Co-op. Union, Anand.

(3) M/s. Sathe Biscuits & Chocolate Co., Poona

(4) M/s. Dr. Writer's Chocolate and Canning Co., Bombay.

(5) M/s. F. D. Metha & Company, Standard Buildings, Dr. Dadabai Naoroji Road, Fort, Bombay.

(6) M/s. Cocoa Products & Beverages Limited, Manapakkam, Mount—Poonamalli High Road, Madras-680089.

(7) M/s. Weikfield Products (India) Private Limited, Weikfield Estate, Nagar Road, Post Box 25, Poona-411014.

They have opened purchasing depots in different areas of cocoa cultivation.

The present price of dry beans is around Rs. 40/- per kg. It is very attractive and hence its cultivation in India deserves encouragement.

DARKNESS IS GOOD FOR POULTRY FARMS

Poultry farmers in Canada will now be able to save a lot of money: on energy bills, animal feed and on the costs of cutting the birds' beaks. Researchers at the Agricultural Research Station at Kentville, Nova Scotia, have found that chickens raised in the dark grow faster on low-protein diets: they are also less aggressive and do not fight each other. By trying out different lighting levels and manipulating the protein content of the chicken feed, they found that a 15—20 per cent protein cut did not affect the birds' growth if kept at the lowest illumination levels—1/10 of a foot-candle. The low protein diet will save \$36 per tonne compared to the normal fattening diet which is given to the birds after the first four weeks of life. And, of course, there will be savings on lighting.

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DANGERS OF LONG REST IN BED

If one stays in bed too long for too many days at a stretch it is dangerous, according to Dr. B. Saltin of the Copenhagen University, Denmark. In an upright position, the heart has to pump blood to the brain. It requires a certain amount of force because it is done against the force of gravity. If a person is bedridden for long, the heart gets used to making lesser effort in blood pumping. Even a week of physical inactivity and bedrest can result in reduction of oxidative enzymes of the leg muscles producing the same effect as during weightlessness, pointed out Dr. Saltin.

(*Caravan—May, 1978*)