

STUDIES ON THE METHODS OF CURING FOR SMALL QUANTITIES OF COCOA BEANS

K. KUMARAN, P. C. SIVARAMAN NAIR AND R. VIKRAMAN NAIR,

College of Horticulture, Vellanikkara—680 654

Cocoa beans after extraction from pods should be fermented following any one of the conventional methods of fermentation like heap, box, basket, tray method etc. which are in vogue in the major cocoa growing countries. All these methods of curing require substantial quantities of wet beans at a time for satisfactory results. The minimum quantity required in the basket method of fermentation followed in Nigeria is about 25 to 30 kg. (Are and Gwynne-Jones, 1974) while that for the 'Heap method' widely adopted by the farmers in Ghana is about 50 kg. (Adomako, 1978). The 'Tray-fermentation' recommended in Kerala (Anon, 1978) also requires a minimum quantity of 40 kg. of wet beans and four trays. Fermentation of small batches of cocoa in the range from 5 to 25 kg. has always been difficult (Quesnel and Lopez, 1975). This study was, therefore undertaken at the College of Horticulture to investigate the feasibility of developing some methods of fermentation with smaller quantities of beans which would suit to the many small cocoa gardens in the State.

MATERIALS AND METHODS

Three methods of fermentation viz. 'Mini Basket' 'Mini Box' and 'Mini Tray' were tested with two quantities of wet beans (1.5 kg and 3 kg). One set each of wooden boxes and trays of sizes 17 × 10 × 12 cm and 25 × 15 × 12 cm to contain 1.5 kg and 3 kg respectively of wet beans were used. They were made of hard wood planks of 1.5 cm thick. The two boxes had their tops open and were provided on all sides with holes of about 0.5 cm dia. to facilitate aeration and drainage of sweatings. The bottom of the two trays were provided with wooden reapers of 1.5 cm width which were closely fixed to permit aeration and drainage of sweatings during fermentation. Two small bamboo baskets of 15 cm dia. and 15 cm and 25 cm height to contain 1.5 kg and 3 kg respectively of wet beans were used. The

bamboo baskets were sufficiently strong and were closely woven. They were lined with two layers of banana leaves and were provided with proper conditions for drainage of sweatings.

Cocoa beans extracted from healthy pods collected and stored for two days were filled with slight jerkings twice or thrice in the baskets, boxes and trays. The surface of the beans was given a levelling by passing the palm over them. Afterwards, the surface was covered with one layer of banana leaf and a small weight was placed on it in all treatments. They were then placed on bricks for 24 hours to permit drainage of sweatings. On the second day, all the containers were covered with a thick layer of gunny sacking which was weighted down by a piece of brick. The beans in the boxes and baskets were taken out, thoroughly mixed, reset and placed over bricks as before, once alternate daily after starting i.e. 48 hours and 96 hours after initial setting. Beans were finally taken out for drying on the 7th day. Beans in the trays were kept only for four days without turning and mixing out covered with gunny sacking and were taken out for drying on the 5th day. The beans from the three methods of fermentation were sundried on bamboo mats by spreading them to about 3 cm thickness and keeping for 5-6 days until they were properly dried. Drying was judged by the peculiar crackling noise of the well-dried beans when a sample was pressed in the palm.

Reading on the temperature in the three methods of fermentation were recorded twice daily at two levels of the fermenting beans. Acidity of the cotyledons after proper drying was estimated for all of the three methods.

Properly dried beans were subjected to cut test for assessing the efficiency of the three methods of fermentation based on the colour of cotyledons (Wood, 1975, Anon. 1979).

PLATE III

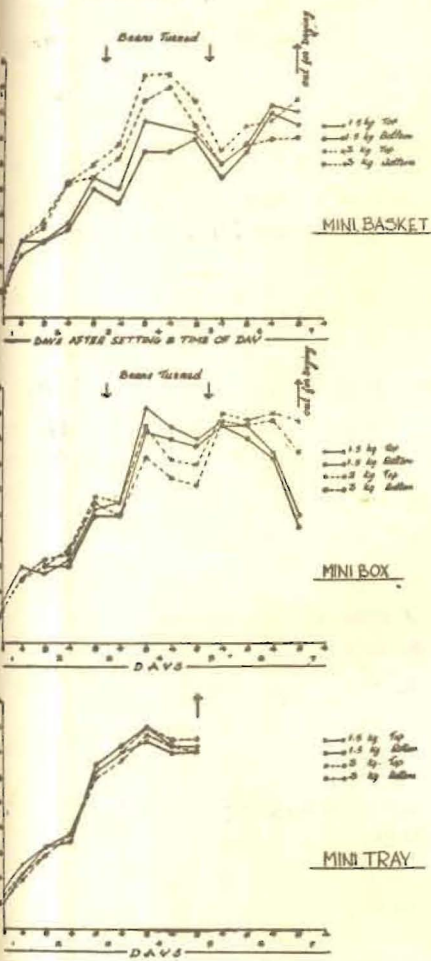


FIG. 1. VARIATIONS IN TEMPERATURE OF BEANS IN THREE METHODS OF SMALL SCALE FERMENTATION - COCOA BEANS.

(1) *Temperature*: Data on temperature are given in Table I. Temperature rose from 27-29°C to a peak of 44-45°C on the fourth day in the boxes and mini-baskets. The 'mini tray' method showed a slightly lower peak (42°C) as compared to the other two methods. Temperature then dropped slightly on the 5th day followed by a rise on the 6th day and it was retained till the 7th day. Temperature dropped considerably on the 7th day in the mini box with 1.5 kg of beans indicating completion of the fermentation process. In the mini tray, however, temperature did not show much fluctuations after reaching the peak but it remained stationary on the 5th day also when the beans were taken out for drying. The trend of temperature change in all the methods in general, agrees with those observed in large scale method of fermentation as reported by others (Hardy 1960, Wood 1975 and Adomak *et al* 1979). The maximum temperature, however, was found to range between 48 to 50°C in these cases and the peak was reached on the 3rd or 4th day after setting. The slightly lower peak temperature observed in the present study can be explained as due to the small quantities of the beans set for fermentation and the consequent poorer insulation. Quesnel and Lopez (loc cit) experimenting with a Styrotex sweat box for fermenting small quantities of cocoa (10 to 18 kg) observed slightly lower temperature as compared to those obtained in the common sweat boxes. The maximum temperature was recorded on the 6th day, and it dropped little on the 6th day.

As regards the effect of the containers and the quantity of the beans on the retention of temperature, wooden containers appeared to be better than the baskets. Though uniform insulation was provided for the two quantities of beans in baskets, higher temperature was observed in the basket with the larger quantity. On the other hand, temperature was almost identical in both the lots using wooden containers. It can be suggested that with small quantities of the ferment as used in the present study, development and retention of temperature are almost identical in the wooden containers if sufficient insulation is provided. The mini baskets, however, revealed a direct relationship between the quantity of the wet beans and the extent of temperature developed.

(2) Grading:

Data on the cut test of the dried beans are given in Table 1. The mean percentage of brown beans ranged from 41 to 49 in the 'mini box' and 'mini basket' methods which is on par with the generally accepted maximum for commercial curing (Anon, 1968). Mini tray showed low mean percentages of brown beans. This evidently was due to inadequate fermentation under a slightly lower peak temperature and a far too aerated condition as against a favourable temperature range prevailing for a longer period (4th to the 7th day after setting) and less aeration in the other two methods. A temperature range of 40-50°C is necessary for most of the biochemical activities to proceed in the fermenting cocoa beans (Hardey, 1960). The beans in the boxes and baskets, having kept for six days, could undergo various biochemical changes under a more favourable condition than in the tray.

(3) Bean pH:

Samples of beans from the box method and basket method gave a mean pH value ranging from 5.3 and 5.7 while that for the mini tray ranged between 4.8 and 5.1. A low pH in the latter could be attributed to the incomplete oxidation of the acid(s) during the oxidation phase of the fermentation probably due to the low temperature and the insufficient time given (Hardey 1960).

SUMMARY AND CONCLUSION

Attempts to identify suitable methods of fermentation for small quantities of cocoa beans were made in the KAU. Three methods viz. 'mini box' 'mini basket' and 'mini tray' using two quantities each of wet beans (1.5 kg and 3.0 kg) were compared. The beans were set for fermentation for varying periods: 4 days for 'mini tray' and 6 days for box and basket

methods. They were given extra insulation from the second day onwards by fully covering with gunny sacking. Results revealed that the 'mini box' and 'mini basket' methods which involve keeping the means for 6 days and turning them once in alternate days were suitable for properly fermenting small quantities of cocoa beans. Variations in temperature in the methods tested followed more or less the same trend as in the conventional methods using larger quantities of the beans. Among the containers, those

made of wood were better than baskets as far as temperature retention and extent of aeration are concerned. The quality of the beans as judged by cut test and acidity value was satisfactory in the first two methods of curing.

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TABLE 1 : Effect of Three methods of Small Scale Fermentation on the Quality of the Beans (based on Cut Test)

Fermentation		Percentage of colour classes*			
Method	Quantity Kg.	BR	PP	DP	SL
I. Mini box	1.5	49	31	20	..
	3.0	46	36	18	..
II. Mini basket	1.5	41	40	19	..
	3.0	44	35	21	..
III. Mini tray	1.5	24	30	46	..
	3.0	23	36	41	..

*BR=Brown, PP=Pale purple
DP=Deep purple, SL=Slaty bean