SURVEY TO ASSESS THE QUALITY OF PROCESSED COCOA BEANS

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ABSTRACT

The processed cocoa beans of monsoon and summer collected from the various processing centres in Karnataka and Kerala states were used to assess the quality. Bean acidity (pH and titrable acidity of the nibs), moisture content, shell per cent, bean weight and fat content were assessed. The pH of the samples ranged from 4.90 to 6.05 and the average bean weight varied from 0.62 to 1.20 gm. Smaller beans were more in monsoon crop, as compared to summer indicating the seasonal variation. The moisture content of the beans in different samples varied between 4.50 and 8.75 per cent. The shell and fat content of the processed beans ranged from 14-20 and 40.5-50.0 per cent respectively.

Cut test was carried out to evaluate the extent of fermentation of the beans (brown, brown/purple and purple beans). The percentage of defective beans such as germinated, flat, slaty, broken, moldy and insect-infested beans was recorded.

INTRODUCTION

Cocoa is mainly grown as a mixed crop in coconut and arecanut plantations covering an area of 28,000 hectares. The production is increasing in our country and the anticipated production is about 20,000 tonnes by 1985. After meeting the internal demand, the surplus produce has to be exported. Therefore, the quality of the beans should meet the international standards to fetch a good price. The prime interest of chocolate manufacturers in respect of quality of the cocoa beans lies in the flavour it develops after processing and roasting. Cocoa of marketable quality is required to be free from insects and broken beans. Grading in cocoa is done on the basis of limits to its content of particular defects, viz. moldy, slaty, flat and germinated beans. The manufacturer's needs with respect to quality of cocoa beans are outlined by Wood (1979). Mold is detectable in very small quantities (4 per cent) in the finished

chocolate. So far no studies have been carried out to assess the quality of the processed beans, although there was a report on the inferior quality of the beans (Balasimha *et al.* 1980). In the present investigation the author reports on the survey conducted to assess the quality of the processed beans.

Materials and Methods

Collection of beans: The processed cocoa beans were collected from the various processing units in Karnataka and Kerala states. The details regarding the fermentation and drying methods are given in Table 1. The samples included the processed beans of monsoon and summer season for comparison.

Table 1. Fermentation method, duration and drying of Cocoa at various processing units in Karnataka and Kerala States

Place	Method of fermentation	Mixing schedule	Duration of fermentation (days)	Drying
Puttur	box	1st, 2nd and 4th day	6	Samoan type (72-96 hrs)
Vittal	tray*/heap	2nd and 4th	6	Electric oven (72 hrs)
Kottayam	box/heap	2nd, 3rd and 5th day, or 2nd and 4th day	6	Electric oven (72 hrs) or Sundrying (96 to 144 hrs)
Tamarassery	heap	2nd and 4th day	6	Sun drying (96 to 144 hrs)
Wynad	box/tray*	2nd and 4th day	5/6	Samoan type/ Sun drying

*No mixing, and fermentation period is 5 days.

pH and moisture content: Ten gm of cocoa beans were ground to powder using pestle and mortar, transferred to 150 ml beaker, and 100 ml boiling water added to it. After cooling to room temperature, the pH was measured using digital pH meter. Another ten gm of beans were roughly crushed with the help of a cutter. The samples were kept in an oven regulated at 103±2°C for 16 hrs to

determine the moisture content (per cent) of the beans (Anon. 1967). The 100–bean weight and shell content (per cent) were recorded.

Titratable acidity: Five ml extract, was made upto 100 ml with water, and titrated against 0.1N NaOH solution using phenolphthalein indicator. The amount of alkali used times 0.15 equals the titratable acidity.

Fat estimation: Twenty beans were powdered after removing the shell and 3 gm powder used for fat estimation using solvent petroleum ether (40-60°C grade) in a soxhlet extraction apparatus for 6 hrs. Tne solvent was evaporated in an oven to get a constant weight. The increased weight of the flask is the butter fat and percentage fat was calculated.

Visual method of assessment of processed cocoa (cut test): Cut test was carried out to evaluate the beans for the extent of fermentation (brown, brown/purple and purple beans). The moldy and insect infested beans were also recorded. For each sample, 25 beans were used for the cut test and 100 beans to record the defective beans. The percentage occurrence of germinated, flat, slaty and broken beans were recorded.

Results and Discussion

The observations revealed that different methods of fermentation (box, tray and heap) and drying (artificial and sun drying) were followed at the various processing units (Table 1). Further, there was variation in the mixing schedule adopted during the fermentation. However, the duration of fermentation remained same (6 days). No mixing was done in tray fermentation for a period of 5 days. The artificial driers include Samoan driers or electric ovens. Sun drying was given preference because of low cost and also results in superior quality beans.

The quality of processed beans in summer and monsoon season at different centres are presented in Table 2. Seasonal variation was observed in bean weight, indicating that bigger beans occurred in summer crop. The average bean weight varied from 0.62 to 1.20 g. The international standard requires a bean weight

of one gram and above (maximum of 110 counts for 100 gm). Therefore, grading is required for the monsoon beans.

Table 2. Quality of the cocoa beans processed at different centres in Karnataka and Kerala states during summer and monsoon

Place	Season	100 bean wt. (gm)	Shell per cent	Moisture content (%)	pH	Titratable acidity (mg)	Butter fat (%)
Puttur	Summer	120.2	14.6	5.8	1.2	210	46.5
	Monsoon	80.4	15.4	4.5	5.2	210	40.5
Vittal	Summer	108.0	15.8	5.5	5.4	210	43.5
	Monsoon	85.0	18.9	6.0	5.4	225	48.0
Kottayam	Summer	104.5	14.2	6.2	5.4	225	42.6
	Monsoon	93.8	15.5	5.5	5.1	240	46.3
Tamarassery	Summer	109.1	14.7	5.6	5.6	210	48.9
	Monsoon	62.0	20.9	5.8	6.0	150	45.5
Wynad	Summer	110.7	15.8	6.0	5.6	225	44.5
	Monsoon	93.4	16.1	8.8	5.6	225	46.5
Nedumangad (Trivandrum)	Monsoon	75.3	18.5	7.2	4.8	285	42.6
Palghat	Monsoon	87.2	18.5	6.8	5.0	270	44.5
Trivandrum	Monsoon	83.3	16.5	6.2	5.2	195	45.5
Kottayam	Monsoon	73.3	17.8	5.9	5.2	210	48.0

The important parameters in the assessment of quality of the beans were pH and titratable acidity. The pH of the cocoa bean samples collected from different centres ranged from 4.80 to 6.05. Several samples collected from Central Arecanut Processing and Marketing Cooperatives Limited (CAMPCO) Cocoa Processing Unit, Puttur at different intervals showed a pH range of 4.90 to 5.35 (Table 3). Therefore, it indicates that standardization

Table 3. Variation in bean weight, shell per cent and pH of the processed bean at CAMPCO, Puttur, and CPCRI, Vittal

Place	100 bean weight (gms)	Shell per cent	pH
CAMPCO 1	80.4	15.4	4.9
CAMPCO 2	120.2	14.6	5.2
CAMPCO 3	70.3	19.2	5.3
CAMPCO 4	70.5	16.2	5.1
CAMPCO 5	110.4	15.5	5.1
CPCRI 1	108.0	15.8	6.1
CPCRI 2	89.9	15.9	5.4

is required in fermentation process. The survey indicated that many samples were in the limit of international standard (pH 5.3-5.5). The titratable acidity was in the range of 150 to 240 mg. The bean acidity is important in the preparation of chocolate, as it affects the quality by imparting acid taste.

The moisture percentage of the processed beans ranged from 4.5 to 8.8 (Table 2). The moisture content should be less than 7.5 per cent, as above 8 per cent moisture it encourages mold development during storage, thus affecting the quality (Wilbaux, 1965). The butter fat content of the processed beans varied from 40.5 to 49.0 per cent. The manufacturers are interested in bean size, shell per cent and butter fat content, but these factors are largely outside the control of growers.

Table 4 presents the results of cut test carried out to record the extent of fermentation, and moldy beans. The percentage occurrence of brown (fully fermented), brown/purple (partially fermented) and purple (unfermented) beans were recorded. The purple (violet beans are most undesirable with respect to quality. The partially fermented beans varied from 8-36 per cent. It has been shown that a certain proportion of fully fermented and partially fermented beans are required for the ideal flavour and aroma development in the products. Moldy beans were not observed in most of the samples. At the present time, in the absence of any other available objective method of assessing the degree of fermentation, the commonly used cut test for quality in relation to fermentation is recom-

Table 4. Cut Test—Extent of fermentation and moldy beans (per cent)

Place	Season	Brown	Brown/ purple	Purple	Moldy
Puttur	Summer	64	32	4	..
	Monsoon	60	30	4	..
Vittal	Summer	68	32	4	..
	Monsoon	60	32	8	..
Kottayam	Summer	64	32	4	..
	Monsoon	68	24	8	..
Tamarassery	Summer	60	28	12	..
	Monsoon	88	8	4	2
Wynad	Summer	56	32	12	..
	Monsoon	64	28	8	1

Table 5. Percentage of defective beans in processed cocoa at various units

Place & Season	Germinated beans	Flat beans	Slaty beans	Broken beans
Puttur				
Summer	..	2	2	3
Monsoon	..	3	3	1
Vittal				
Summer	1	1	3	..
Monsoon	..	2	3	2
Kottayam				
Summer	1	5	2	1
Monsoon	2	8	2	1
Tamarassery				
Summer	..	1	3	2
Monsoon	1	2	1	..
Wynad				
Summer	..	1	..	2
Monsoon	..	1	1	2

mended. The quality assessment is incomplete without the organoleptic evaluation by the expert taste panel either by paired comparison or triangular test (Rohan, 1963).

The percentage occurrence of germinated, flat, slaty and broken beans (defective beans) in processed cocoa at various centres is given in Table 5. Kottayam samples showed more number of flat

beans. The flat, slaty and broken beans could be removed while grading the beans. Report of the Food and Agriculture Organisation's (FAO) Cocoa Study Group published in 1961 on cocoa has made some recommendations on quality and grading (Rohan, 1963). In conclusion, it may be said that the quality of the processed cocoa beans in our country is on par with that of Ghana or Nigerian beans. The slight bean acidity reported in a few samples could be easily overcome by manipulating the fermentation method.

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