

## **1 Scope**

This national standard sets a system of grading or classifying the cacao or cocoa beans derived from the harvested pods of cacao trees, *Theobroma cacao L.* Generally, cacao beans must be fermented and dried properly before marketing for various commercial uses and processing for various products.

## **2 References**

The titles of the standards publications and other references of this standard are listed on the inside back cover.

## **3 Definitions**

### **3.1 adulteration**

covers alteration of the composition of graded cacao by any means so that the resulting mixture or combination is either not of the grade prescribed, or its quality or flavour is injuriously affected or its bulk or mass is altered

### **3.2 bean count**

total number of cacao beans (excluding flat and broken beans) required to make a weight of 100 grams

### **3.3 cacao or cocoa beans**

refers to the whole seed which has been fermented and dried

### **3.4 dry cacao**

a commercial term designating cacao beans which have been evenly dried throughout and which the moisture content shall not to exceed 7.5%

### **3.5 defective beans**

cacao beans which are internally mouldy, slaty, insect-damaged, or insect-infested, or germinated

#### **3.5.1 bean cluster**

a bean clump which consists of three or more beans fused together

**3.5.2 broken bean**

cacao bean which has a missing fragment equivalent to less than half of the bean

**3.5.3 contaminated bean**

cacao bean which is contaminated by odours or flavours, or by dust from other products such as other foods, or by products such as oil, cement and tar

**3.5.4 double bean**

two beans fused together which can be separated by hand

**3.5.5 fermented bean**

cacao bean of which the color of the cotyledons should range from partly purple and partly brown to a fully brown color as shown by the cut test

**3.5.6 flat bean**

cacao or cocoa bean of which the cotyledons are too thin to be cut to give a full length of the cotyledon surface

**3.5.7 foreign matter**

means any substance other than cacao beans, broken beans, fragments and pieces of shell

**3.5.8 fragment**

a piece of cacao bean equal to or less than half the original bean

**3.5.9 germinated bean**

the shell of the cacao bean which have been pierced, slit or broken by the growth of the seed germ

**3.5.10 insect-damaged/infested bean**

cacao bean of which the internal parts are found to contain at any stage of development, or have been attacked by insects which have been inflicted damage visible to the naked eye

**3.5.11 mouldy bean**

mould present on the external parts of the cacao bean which is visible to the naked eye

**3.5.12 piece of shell**

part of the shell without adhering kernel or part of the kernel

**3.5.13 slaty bean**

cacao bean which shows a gray or purple colour on half or more of the surface exposed by the cut test

### **3.5.14 smoky bean**

cacao bean which has a smoky smell (obtained from “tapahan’/ copra drier) or taste or shows signs of smoke contamination

### **3.5.15 waste**

shall mean flat bean, fragments, pieces of shell, dried placenta and dried pulp

## **4 Preparation**

This refers to the primary processing of cacao beans which covers the breaking of cacao pods, sorting of good and damaged beans, fermentation and drying at 83 – 89 °C to moisture content 5 – 7.5 % before storage to avoid molds.

## **5 Quality Requirements**

- 5.1 Cacao beans shall be taken from ripe pods; adequately fermented and dried; free from smoky smell and other objectionable odor.
- 5.2 Cacao beans shall be reasonably uniform in size.
- 5.3 Cacao beans shall be free from any evidence of adulteration.
- 5.4 Cacao beans shall be reasonably free from broken beans, fragments and pieces of shell.
- 5.5 Cacao beans shall be virtually free from foreign matter.
- 5.6 Cacao beans shall be reasonably free from insect pests.
- 5.7 The moisture content of cacao beans in trade outside the producing country as determined at the first port of destination or subsequent points of delivery shall not exceed 7.5 %.
- 5.8 The consignment of bean shall contain not more than 2.5% waste by weight.

## **6 Grading**

**6.1** Cacao beans are graded, according to the proportion of defective beans determined by the method of test specified in ISO/R1114:

Percentage of beans				
Grade	Bean Count (per 100 g)	Mouldy	Slaty	Defects such as insect damaged, infested beans, and germinated beans
1 A	<= 100	3	3	2.5
1 B	101 - 120	3	3	2.5
2 A	<= 100	4	8	5.0
2 B	101 - 120	4	8	5.0
<b>Sub-Standard</b>	<b>&gt; 120</b>	> 4	> 8	> 5.0

**Note:** The percentages are maximum; the percentages given in the last column apply to all the defects mentioned therein, taken together. Code 1 – 2 denotes grade based on defective characteristics. Code A and B stands for bean counts.

## 6.2 Sub-Standard cacao

Cacao beans which exceed one of the limits accepted for Grade 2 shall be regarded as Sub-Standard and marked 'SS'. Sub-Standard cacao shall only be marketed under special contract.

## 7 Sampling

Sampling shall be carried out in accordance with the requirement of ISO 2292 (Annex A).

## 8 Methods of Test

Testing shall be carried out in accordance with the requirement of ISO/R1114 and ISO 2291 (Annexes A – E).

## **9 Packaging**

Cacao beans shall be packed in jute sacks which are clean, sound, sufficiently strong and properly sewn. The jute sacks shall be made of non-toxic materials. Other forms of packaging may be used as mutually agreed upon between participating parties.

## **10 Marking and Labeling**

Each bag of cacao beans shall be securely sealed, marked clearly and indelibly with the following information:

- a. Name of product, variety or commercial type
- b. Grade
- c. Net weight (kg)
- d. Name and address of producer, trader or exporter and relevant license number
- e. Location/place produced (town and province)
- f. Consignment or lot or contract number as applicable
- g. Product of the Philippines
- h. Year of harvest

## **11 Storage**

- a. Consignments of cacao beans shall be placed in a well constructed warehouse to keep their moisture content sufficiently low and consistent with local conditions.
- b. The cacao beans shall be stored for 6 – 7 months elevated on pallets with a clear space above ground of at least 7 cm for air circulation.
- c. Measures shall be taken to prevent infestation by insects, rodents and other animal pests.
- d. The bags of cacao beans shall be stacked in such a way that:
  1. Individual grades and lots shall be separated by a passage at least 60 cm wide, similar to that which shall be left between the bags and the walls of the warehouse.
  2. Disinfestation by approved fumigant may be carried out.

3. Contamination by odours or flavours, or by dust from other products such as other foods, or by products such as oil, cement and tar shall be prevented.
- e. During storage and immediately before shipment, the moisture content of each lot shall be periodically checked.

## 12 Fumigation

Fumigants (ethylene dibromide, methyl bromide, gastoxin (phosphine), propylene oxide, carbon oxide, and phostoxin (aluminum/magnesium phosphide) are used to control insects, rodents and other animal pests inside the warehouse. Care must be exercised in the choice and in the technique of their application to avoid incurring any risk of tainting or addition of toxic residues to the cacao. Any such residues should not exceed the tolerances prescribed by the FAO/WHO Codex Committee on Pesticide Residues, the FAO/WHO Expert Committee on Pesticide Residues and by the Government of the importing country.

## 13 Contaminants

### 13.1 Heavy metals

Cacao beans shall comply with those maximum residue levels for heavy metals established by the Codex Alimentarius Commission and/or authority for this commodity. These heavy metals are:

#### Maximum Residue Levels (mg/kg)

Arsenic	-	1.0
Copper	-	30.0
Lead	-	2.0

### 13.2 Pesticide residues

Cacao beans shall comply with those maximum residue limits established by the Codex Alimentarius Commission and/or authority for this commodity. These pesticides are:

#### Maximum Residue Limits (mg/kg)

Fenitrothion	0.10
Hydrogen phosphide	0.01
Lindane	1.00
Delthamethrin	0.05
Metalaxyl	0.20

## **14 Hygiene**

**14.1** It is recommended that the produce covered by the provisions of this standard be prepared and handled in accordance with appropriate sections of the Recommended International Code of Practice – General Principles of Food Hygiene (CAC/RCP 1 – 1969, Rev. 4 – 2003), and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.

**14.2** The produce should comply with any microbiological criteria established in accordance with the Principles for the Establishment and Application of Microbiological Criteria for Foods (CAC/GL 21-1997).

## **15 Legal requirement**

The cacao bean shall in all respect, comply with the current legislations enforced in the country of import and export.

## **16 Compliance with specification**

When found to conform to the Basic Requirement of Philippine National Standards for Cacao Beans, the lot, batch or consignment from which the samples have been drawn, shall be deemed to comply with this Standard Specification.

**References:**

Cocoa Association of Asia Quality Standard Specifications for Cocoa beans, 2003.

Cocoa Act of Papua New Guinea, 1982.

Codex Alimentarius Commission/ RCP 1 – 1969, Rev. 4 – 2003

Codex Alimentarius Commission/GL 21-1997

Codex Alimentarius Commission. Vol. 2B. 2000, p. 438

ISO/R 1114 Cocoa beans – Cut test

ISO 2291 Cocoa beans – Determination of moisture content (routine method)

ISO 2291 Cocoa beans – Sampling

Preparing Cacao for the Market. Cocoa Phil. Publication. 1999.

Standard Specification for Malaysian Cocoa. 1995.

## ANNEX A

### **Fermentation**

Fermentation is accomplished in heaps, baskets, boxes, or trays and requires 1,000 kg of beans. It involves keeping the mass of wet cacao beans well insulated so that heat is retained while air is allowed to pass through the mass. The beans are turned or mixed once or twice a day to ensure uniformity of fermentation. Criollo beans are fermented for 2 – 3 days while Forastero beans are fermented for 5 – 7 days or longer. Trinitario beans (hybrid of Criollo and Forastero) are fermented for 6 days. Under-fermentation produces beans with more purple pigments and the final products are more bitter and astringent. Over-fermentation will produce beans with a dull-colored nib and little chocolate flavor. Beans are adequately fermented when the exudate that comes out after removing the seedcoat becomes reddish brown and the cotyledon becomes paler in the center with a brownish ring outside.

### **Drying**

The fermented beans are immediately dried either artificially or by sun drying. At the end of fermentation the moisture content of cacao beans is about 55% and this must be reduced to 6 – 7 % for safe storage. Above 8%, there is danger of molds developing within the beans; below 5% the beans will be very brittle.

### **Sampling**

The sample shall be collected at random from minimum of 30% of the total quantity of bags in a lot or per B/L, using a sampling prop/spear. From each bag, a sample shall be taken from the top, the center and the bottom part of the bag. These samples shall be mixed thoroughly several times until a final sample of about 1,500 grams are obtained. The samples are then sealed and labeled in the area where the samples have been taken. After the samples have been taken out, the bags shall be sealed. The sampling official shall be a person with experience or training and employed by legal body.

## ANNEX B

### A. Procedures for Determining the Bean Count

Bean count is carried out by the determination of the number of cacao beans to make a weight of 100 g.

#### 1. Preparation of the sample

The sample is obtained by the method described in ISO/R 1114 (Cut tests) and shall be thoroughly mixed.

#### 2. Preparation of the test portion

The mixed samples shall be reduced by quartering or by means of a suitable dividing apparatus, to just over 300 beans per quarter. Then count the actual number of whole beans, after the removal of flat beans.

#### 3. Determination

The whole beans shall then be weighed to the nearest 0.05 g.

#### 4. Expression of Result

The bean count shall be expressed as the number of beans per 100 g.

$$\text{Thus, **bean count** = } \frac{\text{Number of whole beans}}{\text{Weight of whole beans (g)}} \times 100$$

## ANNEX C

### **B. Procedures in Determining Defects through the Cut Test**

The cut test is carried out primarily to determine the incidence of mouldy beans, slaty beans, insect damaged/infested beans and germinated beans.

#### 1. Preparation of the sample

The sample of whole beans used for the bean count shall be used for the entire cut test.

#### 2. Preparation of the test portion

The sample of the cacao beans shall be thoroughly mixed, and then quartered, or divided into four (4) heaps, until reaching a heap of slightly more than 300 beans. The first 300 beans shall be counted off, irrespective of size, shape and condition.

### **3. Determination**

1. All the beans shall be cut lengthwise through the middle, so as to expose the maximum cut surface of the cotyledons.
2. Both halves of each bean shall be examined visually in full daylight or equivalent artificial light.
3. Separate counts shall be made on the number of beans which are defective in that they are internally mouldy, slaty, insect-damaged/infested and germinated.

*Where a batch of beans is defective in more than one respect, only defect shall be counted, and the defect to be counted shall be the defect which occurs first in the following list of defects presented in a decreasing order or gravity:*

- (a) mouldy beans;*
- (b) slaty beans;*
- (c) insect damaged/infested beans and germinated beans.*

### **4. Expression of result**

The results for each kind of defect shall be expressed as a percentage of the number of beans examined.

## C. Procedures in Determining the Moisture Content

### 1. Principle

The determination of moisture content is carried out by the oven method. However, for quick certification purposes, the moisture content may be determined by the infra-red moisture meter or its equivalent.

### 2. Apparatus

Usual laboratory equipment not otherwise specified, and the following items:

- i. Grinder, which permit the beans to be ground without heating.
- ii. Ventilated oven, preferably fitted with a fan, capable of being maintained at  $103 \pm 2$  °C.
- iii. Dishes with lids, of corrosion-resistant metal or glass, with at least 35 cm<sup>2</sup> effective surface (for examples minimum diameter 70 mm) and 20 mm to 25 mm deep.
- iv. Desiccator, containing an effective desiccant.
- v. Analytical balance, capable of weighing to 1 mg.

### 3. Procedure

#### a. Preparation of sample

- a. Take one of the sample quarters obtained by the method described in sub-section 4.2.2.
- b. By successive reductions of the one quarter draw approximately 50 g of beans.
- c. Grind the beans roughly so that the greatest dimension of the particles does not exceed 5 mm, while avoiding the formation of a paste.

#### b. Test portion

- a. Weigh the empty dish and its lid when dry, place in it quickly about 10 grams of ground beans prepared as described in No. 1

b. Cover the dish with its lid and weigh to the nearest 1 mg.

**c. Determination**

Place the dish containing the test portion in the oven at  $103 \pm 2^{\circ}\text{C}$ , *on its lid*. Keep it there for  $16 \pm 1$  hour, taking care not to open the oven.

At the end of this period, remove the dish, cover it immediately with its lid and place it in the desiccator. After cooling to ambient temperature (30 min to 40 min approximately after placing in the desiccator), weigh it, still covered, to within 5 mg.

**Note on procedure**

The grinding and weighing operations for each determination should be carried out as rapidly as possible, and in any event within 5 min.

**d. Calculation of results**

The moisture content of the sample, expressed as percentage by mass, is equal to :

$$(m_1 - m_2) \times \frac{100}{m_1 - m_0}$$

where,

$m_0$  is the mass, in grammes, of the empty dish and its lid;

$m_1$  is the mass, in grammes, of the dish and its lid and the test portion before oven drying;

$m_2$  is the mass, in grammes, of the dish and its lid and the test portion after oven drying.

**D. Procedures in Determining Waste**

**1. Preparation of the sample**

The sample obtained by the method described in sub-section 4.2.2. shall be thoroughly mixed.

**2. Preparation of the test portion**

The thoroughly mixed sample shall be reduced by quartering or by means of a suitable dividing apparatus to about 1500 g per quarter.

**3. Determining the waste**

- a. Weigh the quartered sample.
- b. Separate the waste and weigh it.

**4. Expression of result**

$$\text{Waste (\%)} = \frac{\text{Weight of the waste}}{\text{Total weight of sample}} \times 100$$