

PHILIPPINE NATIONAL STANDARD

PNS/BAFS 58:2019
ICS 67. 140. 30

Cacao or cocoa beans- specification and grading



BUREAU OF AGRICULTURE AND FISHERIES STANDARDS

BPI Compound Visayas Avenue, Diliman, Quezon City 1101 Philippines

Trunkline: (632) 928-8741 to 64 loc. 3301-3319

E-mail: info.dabafs@gmail.com

Website: www.bafs.da.gov.ph

Foreword

The updating of the Philippine National Standards for Cacao or cocoa beans was undertaken upon the request of the Philippine Cacao Industry Council and the Department of Trade and Industry in order to reflect current technology developments in the industry and the need for harmonization with international quality and food safety requirements.

The Bureau of Agriculture and Fisheries Standards reconstituted its Technical Working Group through Special Order No. 1092 series of 2018 and Special Order No. 322 series of 2019, composed of members from the public and private sectors.

This standard supersedes the existing Philippine National Standard for Cacao or cocoa beans - specification (PNS/BAFPS 58:2008). Modifications on this edition includes:

- Inclusion of “unfermented beans” in the scope of the standard;
- Addition of definition of “unfermented dried beans”;
- Addition of the term “detritus” as industry term for waste
- Adoption of Clause 5.9 from the ISO 2451:2017;
- Harmonization of grading for fermented cacao or cocoa beans with the ISO 2451:2017;
- Adoption of grading for unfermented cacao or cocoa beans from ISO 2451:2017;
- Deletion of maximum residue limits of pesticide residue and maximum levels of heavy metals;
- Updating of Annex A Common practices in cacao beans processing
- Inclusion of Annex F on Common defects of cacao or cocoa beans

The PNS for Cacao aims to provide common understanding on the scope, definition, quality requirements, grading, sampling, methods of tests, marking and labeling, storage, fumigation and contaminants.

This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2.

Table of Contents

1 Scope.....	1
2 Normative reference	1
3 Terms and definitions.....	1
4 Preparation	4
5 Quality requirements.....	4
6 Grading	4
7 Sampling.....	5
8 Method of test	5
9 Packaging	5
10 Marking or labeling.....	6
11 Storage	6
12 Fumigation	6
13 Contaminants.....	7
13.1 Heavy metals.....	7
13.2 Pesticide residues	7
14 Hygiene.....	7
Annex.....	8
Annex A Common practices in cacao beans processing	9
Annex B Procedures for determining bean count	10
Annex C Procedures in determining defects through the cut test.....	11
Annex D Procedures in determining the moisture content (oven method).....	12
Annex E Procedures in determining waste	13
Annex F Common defects of cacao or cocoa beans.....	14
Bibliography	18

1 Scope

This national standard sets a system of grading or classifying, sampling, test methods, packaging and marking for cacao or cocoa beans derived from the harvested ripe pods of cacao trees, *Theobroma cacao* L.

Generally, cacao or cocoa beans should be fermented or unfermented and shall be dried properly before marketing for various commercial uses and processing for various products.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Sampling for ascertaining the conformance should be in accordance with Cocoa beans—Sampling (ISO 2292)

ISO 2451:2017 Cocoa beans — Specification and quality requirements

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

adulteration

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

3.2

bean count

total number of cacao beans required per 100 grams

3.3

bean cluster

double bean

bean clump which consists of two or more beans fused together (see Annex F)

3.4

broken bean

fragmented bean

cacao or cocoa bean which has a missing fragment(s) and or cut(s) (see Annex F)

3.5

cacao beans¹

cocoa beans

seed of the cacao or cocoa tree (*Theobroma cacao* Linnaeus)

3.6

contaminated bean

cacao or cocoa bean which is contaminated by odors or flavors, or by dust from other products such as other foods, or by products such as oil, cement and tar, contaminants and toxins

3.7

contamination

introduction or transfer of a food safety hazard, whether it is physical, chemical or biological such as soil, water, chemicals, equipment, animals, and people to cacao beans or to the inputs that come in contact with the product

3.8

defective beans

cacao or cocoa beans which are moldy, slaty, insect-damaged, insect-infested, germinated, and broken (see Annex F)

3.9

dry cacao

commercial term designating cacao or cocoa beans which have been evenly dried throughout and which the moisture content shall not exceed 7.5% and not lower than 5.5%

3.10

fermented bean

cacao or cocoa bean which has undergone fermentation process of which the cotyledons are fissured with color ranging from fully brown, partially brown and partly purple color, as shown by the cut test.

3.11

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 (see Annex F)

3.12

foreign matter

any substance or material other than cacao or cocoa beans, broken beans, fragments and pieces of shell

¹ Seed of the cacao or cocoa tree composed of episperm, embryo and cotyledon

3.13

germinated bean

shell of the cacao or cocoa bean which have been pierced, slit or broken by a growth of the seed germ or presence of radicle (see Annex F)

3.14

grading

classification of cacao beans according to bean size and the proportion of defective beans to good beans

3.15

insect-damaged bean

infested bean

cacao or cocoa bean of which its parts are found to contain insects or have been damaged by insects (see Annex F)

3.16

lot

quantity of cacao or cocoa beans in bags or in bulk established at any point in the cocoa supply chain and from which primary samples and/or incremental samples are to be drawn for quality analysis purposes

3.17

moldy bean

mold present on parts of the cacao or cocoa bean which is visible to the naked eye (see Annex F)

3.18

piece of shell

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

3.19

slaty bean

cacao or cocoa bean which is unfissured and shows a purple-gray color on half or more of the surface exposed by the cut test (see Annex F)

3.20

smoky bean

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

3.21

unfermented dried beans

cacao or cocoa beans which have not undergone fermentation process

3.22

waste

detritus

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

4 Preparation

This refers to the postharvest processing of cacao or cocoa beans which covers the breaking of cacao pods, fermentation, as applicable, drying and sorting of good beans and waste (detritus).

5 Quality requirements

The quality requirements prescribed under this section apply for both fermented and unfermented cacao or cocoa beans.

- 5.1 Cacao or cocoa beans shall be taken from ripe pods, adequately dried, free from smoky smell and other objectionable odor.
- 5.2 Cacao or cocoa beans shall be sorted and graded to meet uniformity in size.
- 5.3 Cacao or cocoa beans shall be free from any evidence of adulteration.
- 5.4 Cacao or cocoa beans shall be virtually free from foreign matter.
- 5.5 Cacao or cocoa beans shall be reasonably free from pest and pest damage.
- 5.6 The moisture content of cacao or cocoa 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 % and not below 5.5%.
- 5.7 The consignment of bean shall contain no more than 2% waste (detritus) by weight.
- 5.8 Cacao or cocoa beans shall be within the allowed range for violet or purple beans, if specified, typical for the grade or origin.

6 Grading

Cacao or cocoa beans are graded as shown in Table 1 and 2, according to the proportion of defective beans determined by the method of test specified in **ISO 2451:2017 Cocoa beans — Specification and quality requirements**.

Table 1. Grading percentage of fermented cacao or cocoa beans

Grade	Bean size (count per 100g)	Percentage (%) of beans		
		Moldy	Slaty	Insect-damaged and/or germinated
1A	≤100	3	3	3
1B	101-110			
1C	111-120			

2A	≤100	4	8	6
2B	101-110			
2C	111-120			
NOTE 1: The percentage are the maximum NOTE 2: The percentages given in the last column apply to the combined total of all the defects specified in the column header NOTE 3: Codes 1-2 denote grade based on defective beans. Codes A-C denote grade based on bean size.				

Table 2- Grading percentage of unfermented cacao or cocoa beans

Grade	Bean size (count per 100g)	Percentage (%) of beans		
		Moldy	Slaty	Insect-damaged and/or germinated
1A	≤100	3	>20	3
1B	101-110			
1C	111-120			
2A	≤100	4	>20	6
2B	101-110			
2C	111-120			
NOTE 1: The percentage are the maximum NOTE 2: The percentages given in the last column apply to the combined total of all the defects specified in the column header NOTE 3: Codes 1-2 denote grade based on defective beans. Codes A-C denote grade based on bean size.				

Bean size is defined by the bean count and is usually expressed by the number of beans per 100g.

7 Sampling

Sampling should be in accordance with *Cocoa beans—Sampling (ISO 2292)*.

8 Methods of test

Testing shall be carried out in accordance with the requirement of *Cocoa beans — Specification and quality requirements (ISO 2451:2017)*.

9 Packaging

Cacao or cocoa bean shall be properly packed in such a way to protect the produce. The materials used for the package shall be new, clean, and of good quality such as to avoid causing any external or internal damage and contamination to the cacao or cocoa beans.

10 Marking or labeling

10.1 Name of product (fermented or unfermented);

10.2 Grade and bean size (e.g. Grade 1A);

10.3 Net weight (kg);

10.4 Origin of produce (country);

10.5 Lot identification code or number;

10.6 Official Inspection Mark (optional).

11 Storage

11.1 Consignments of cacao or cocoa beans shall be placed in a well-constructed warehouse to keep their moisture content sufficiently low and consistent with local conditions.

11.2 The cacao or cocoa beans shall be stored elevated on pallets with a clear space above ground of at least 7cm for air circulation.

11.3 Measures shall be taken to prevent infestation by insects, rodents and other storage pests.

11.4 The bags of cacao or cocoa beans shall be stacked in such a way that:

11.4.1 Rows of stacks of bags of cacao or cocoa beans shall be separated by a passage at least 60cm wide, similar to that which shall be left between the bags and the walls of the warehouse.

11.4.2 Disinfestation by registered fumigant and application protocol by competent authority may be carried out.

11.4.3 Contamination by odors or flavors, or by dust from other products such as other foods, or by-products such as oil, cement and tar shall be prevented.

11.4.4 During storage and immediately before shipment, the moisture content of each lot shall be periodically checked.

12 Fumigation

Fumigants [e.g. ethylene dibromide, methyl bromide, gastoxin (phosphine), propylene oxide, carbon oxide, and phostoxin (aluminum/magnesium phosphide)] are used to control insects, rodents and other storage 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 or cocoa beans. Any such residues should not exceed the tolerances prescribed by the Codex Alimentarius Commission and/or authority for this commodity.

13 Contaminants

13.1 Heavy Metals

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

13.2 Pesticide residues

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

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).

Annex A (informative)

Common practices in cacao beans processing

A.1 Fermentation

Fermentation is accomplished in heaps, baskets, boxes, or trays and requires a minimum of 30 kg of beans. It involves keeping the mass of wet cacao beans well insulated under anaerobic condition for 48 hours. The beans are mixed and turned after 48 hours to proceed aerobic condition until the end of fermentation process. Cacao or cocoa beans are fermented for 4-7 days depending on the variety, weather condition and target flavor profile.

A.2 Drying

Cocoa beans are dried after fermentation in order to reduce the moisture from about 60% to about 7.5% but not lower than 5.5%. Drying should be carried out carefully by mixing and turning the beans regularly. Drying should be done through sun drying and/or mechanical drying methods, which shall not exceed 60°C drying temperature.

A.3 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 (normative)

Procedures for determining the bean count

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

B.1 Preparation of the sample

The bean count determines the average number of whole cocoa beans that weigh 100 g. After sieving in accordance with ISO 2292:2017 and removing cocoa related matter, flat beans and foreign matter, empty the remainder of the reference sample onto a clean, dry, flat surface and thoroughly mix. Take a test sample of not less than 600 g cocoa beans from the reference sample using a flat -bottomed shovel drawn across the middle of the remainder of the reference sample.

B.3 Determination

Remove any cocoa related matter, flat beans and foreign matter still remaining following the procedure set out in ISO 2292:2017 from the test sample, and then weigh and replace by an equivalent mass of whole beans taken randomly from the remainder of the reference sample. Then count the total number of beans in the test sample. The resulting number is known as the bean count.

B.4 Expression of result

The bean count, n_{BEAN} , shall be expressed as the number of beans per 100 g

$$n_{\text{BEAN}} = \frac{n_{\text{WHOLE}} \times 100}{m_{\text{WHOLE}}}$$

where

n_{WHOLE} is the number of whole beans

m_{WHOLE} is the mass of whole beans, in g.

Annex C

(normative)

Procedures in determining defects through the cut test

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

C.1 Preparation of the sample

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

C.2 Preparation of the test portion

The sample of the cacao or cocoa 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.

C.3 Determination

C.3.1 All the beans shall be cut lengthwise through the middle, so as to expose the maximum cut surface of the cotyledons.

C.3.2 Both halves of each bean shall be examined visually in full daylight or equivalent artificial light.

C.3.3 Separate counts shall be made on the number of beans which are defective in that they are internally moldy, 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 of gravity:

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

C.4 Expression of result

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

Annex D (normative)

Procedures in determining the moisture content (oven method)

D.1 Principle

After grinding, weighing and drying of cacao or cocoa beans for 16 hours in a ventilated oven controlled at $103^{\circ}\text{C} \pm 2^{\circ}\text{C}$, determine the moisture content by calculating the difference in mass.

D.2 Apparatus

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

D.2.1 Grinder, which permit the beans to be ground without heating.

D.2.2 Ventilated oven, preferably fitted with a fan, capable of being maintained at $103^{\circ}\text{C} \pm 2^{\circ}\text{C}$.

D.2.3 Dishes with lids, of corrosion-resistant metal or glass, with at least 35cm^2 effective surface (for examples minimum diameter 70 mm) and 20 mm to 25 mm deep.

D.2.4 Desiccator, containing an effective desiccant.

D.2.5 Analytical balance, capable of weighing to 1 mg.

D.3 Procedure

D.3.1 Preparation of sample

- a. Take one of the sample quarters obtained by the method described in ISO 2292.
- b. By successive reductions of the one quarter draw approximately 50g of beans.
- c. Grind the beans roughly so that the greatest dimension of the particles does not exceed 5mm, while avoiding the formation of a paste.

D.3.2 Test portion

- a. Weigh the empty dish and its lid when dry, place in it quickly about 10 g of ground beans prepared as described in Section D.3.1.
- b. Cover the dish with its lid and weigh to the nearest 1 mg.

D.3.3 Determination

Place the dish containing the test portion in the oven at $103^{\circ}\text{C} \pm 2^{\circ}\text{C}$, on its lid. Keep it there for 16 ± 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 minutes to 40 minutes 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.3.4 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 grams, of the empty dish and its lid;

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

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

Annex E
(normative)

Procedures in determining waste

E.1 Preparation of the sample

The sample obtained by the method described in ISO 2292 shall be thoroughly mixed.

E.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.

E.3 Determining the waste

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

E.4 Expression of result

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

Annex F
(informative)

Common defects of cacao or cocoa beans



Figure F.1 Clustered or clumped bean



Figure F.2 Broken or cut bean



Figure F.3 Germinated bean



Figure F.4 Moldy Bean



Figure F.5 Slaty bean



Figure F.6 Flat beans



Figure F.7 Insect infested bean

Bibliography

Agus, Baizura Aya Putri & Nadzirah Mohamad, Nurul & Hussain, Norhayati. (2018). Composition of unfermented, unroasted, roasted cocoa beans and cocoa shells from Peninsular Malaysia. *Journal of Food Measurement and Characterization*. 10.1007/s11694-018-9875-4. Preparing Cacao for the Market. Cocoa Phil. Publication. 1999.

Cocoa Association of Asia Quality Standard Specifications for Cocoa beans, 2016.

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

Codex Alimentarius Commission/GL 21-1997

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

Figure F.1 Clustered or clumped bean, 2019, Davao City: Filipinas Oro De Cacao

Figure F.2 Broken or cut bean, 2019, Davao City: Filipinas Oro De Cacao

Figure F.3 Germinated bean, 2019, Davao City: Filipinas Oro De Cacao

Figure F.4 Moldy bean, 2019, Davao City: Filipinas Oro De Cacao

Figure F.5 Slaty bean, 2019, Davao City: Filipinas Oro De Cacao

Figure F.6 Flat beans, 2019, Davao City: Filipinas Oro De Cacao

Figure F.7 Insect infested bean, 2019, Davao City: Filipinas Oro De Cacao

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

ISO 2292 Cocoa beans – Sampling

ISO 2451:2017 Cocoa beans- Specification and quality requirements

Specification for Grading Malaysian Cocoa Beans. MS 293:2005 - ICS:67.140.30

PNS/ ISO 874 Fresh Fruits and Vegetables—Sampling.

PNS/ISO 7563:2014 Fresh fruits and vegetables- Vocabulary

Recommended International Code of Practice – General Principles of Food Hygiene (CAC/RCP 1 – 1969, Rev. 4 – 2003)

**Department of Agriculture
Bureau of Agriculture and Fisheries Standards**

**Technical Working Group (TWG) for the Revision of the Philippine National
Standard (PNS) for Cacao or cocoa beans- specifications**

Chairperson

Luisito D. Cena
Filipinas Oro De Cacao

Members

1	Edwin O. Banquerigo Department of Trade and Industry- Davao City	10	Philo Chua Theo and Philo Artisan Chocolates
2	Valente D. Turtur Philippine Cacao Industry Council	11	Marlo Deblois Fertilizer and Pesticide Authority Department of Agriculture
3	Mary Grace Belviz Cacao Industry Development Association of Mindanao Inc	12	John Paolo Tatlonghari High Value Crops Development Program Department of Agriculture
5	Bernardo Karaan Fort Justine Farm		
6	Ernesto Pantua Jr. Kablon Farms	13	Charisa Miral Agricultural Training Institute Department of Agriculture
7	Caerel Shane Orosio		
8	Rex Puentespina Malagos Agri-Ventures Corporation	14	Josephine Ramos Philippine Council for Agriculture and Fisheries- Cacao Industry Development Sub-committee
9	Patricia Limpe Antonio Pueo Incorporada	15	Virgilio Loquias Bureau of Plant Industry

Project Manager

John Gregory V. Aquino
Krisha Marie L. Mecija
Bureau of Agriculture and Fisheries
Standards
Department of Agriculture

Adviser

Vivencio R. Mamaril
Bureau of Agriculture and Fisheries
Standards
Department of Agriculture



BUREAU OF AGRICULTURE AND FISHERIES STANDARDS

**BPI Compound Visayas Avenue, Diliman, Quezon City 1101 Philippines
T/ (632) 928-8741 to 64 loc. 3301-3319
E-mail: info.dabafs@gmail.com
Website: www.bafs.da.gov.ph**