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**Cereals — Whole and dehulled sorghum grains for  
human consumption — Specification**

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**BOTSWANA BUREAU OF STANDARDS**





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## Foreword

This Botswana Standard was approved by the Technical Advisory Committee of the Standard Council on 20XX-XX-X.

The Botswana Bureau of Standards (BOBS) was established under the Standard Act No. 16 of 1995 with a primary responsibility of preparing Botswana Standards.

During the preparation of this standard, assistance was derived from ARS 462:2016, Sorghum — Specification and Codex Alimentarius CXS 172-1989, Standard for Sorghum grains.

This Botswana Standard is a revision of, cancels and replaces BOS 26:2009.

During the preparation of this standard the following organizations were directly represented in the Cereals and Pulses Technical Committee:

Botswana University of Agriculture and Natural Resources – Department of Crop and Soil Sciences	Mr	G	Legwaila (Chairperson)
Botswana Bureau of Standards	Mr	O J	Moje (Technical Secretary)
Bokomo	Mr	J	Venter
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# **Cereals — Whole and dehulled sorghum grains for human consumption — Specification**

## **1 Scope**

This Botswana Standard applies to whole and dehulled/dehulled sorghum grains obtained from *Sorghum bicolor* (L). Moench.

## **2 Normative References**

The following normative documents contain provisions which, through reference in this text, constitute provisions of this Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. BOBS maintain registers of currently valid Standards.

AOAC Official Method 2001.04, *Determination of Fumonisin B1 and B2 in corn and corn flakes — Liquid chromatography with immunoaffinity column clean up.*

BOS 63, *Classification and grading and classification of sorghum grains for sale in Botswana – Specification.*

BOS CAC/RCP1 – 1969, *Recommended International code of practice – General principles of food hygiene.*

BOS ISO 13690, *Cereals, pulses and milled products – Sampling of static batches Codex Alimentarius, Volume 1, Cereals, pulses, legumes, and derived products and vegetable proteins.*

Codex Alimentarius, *Pesticides residues in food – Maximum residue limits; extraneous maximum residue limits.*

ISO 605:1991 *Pulses — Determination of impurities, size, foreign odours, insects, and species and variety — Test methods*

ISO 712: 1998, *Cereals and cereal products – Determination of moisture content – Routine reference method.*

ISO 5223:1995 *Test sieves for cereals.*

ISO 5983: 1997, *Animal feeding stuffs – Determination of nitrogen content and calculation of crude protein content-Kjeldahl method.*

ISO 6561-1, *Fruits, vegetables and derived products — Determination of cadmium content — Part 1: Method using graphite furnace atomic absorption spectrometry*

ISO 6561-2, *Fruits, vegetables and derived products — Determination of cadmium content — Part 2: Method using flame atomic absorption spectrometry*

ISO 6633, *Fruits, vegetables and derived products — Determination of lead content — Flameless atomic absorption spectrometric method*

ISO 9648:1988, *Sorghum – Determination of tannin content.*

ISO 16050:2003 *Foodstuffs — Determination of aflatoxin B1, and the total content of aflatoxins B1, B2, G1 and G2 in cereals, nuts and derived products — High-performance liquid chromatographic method*



### **3 Definitions**

For the purpose of this Botswana Standard the following definitions shall apply

**3.1 Sorghum grains:** whole grains obtained from species of *Sorghum bicolor* (L) Moench, after a complete threshing without any further treatment.

**3.2 Dehulled/decorticated sorghum grain:** grains of sorghum from which all or part of the bran and germ have been removed.

**3.3 defective grain:** pieces of grain or grains of sorghum which :

- a) is broken, rotten, mouldy, smutty, or otherwise diseased;
- b) the embryo skin is cracked;
- c) grain is immature;
- d) has been damaged by insects, heat, or any other means, but does not include weather stained sorghum; and,
- e) passes through a 1.8 mm slotted sieve.

**3.4 weather-stained grains:** means sorghum grains of which more than one-third of the surface of the pericarp is distinctly discoloured by the weather, but does not include sorghum kernels with purple anthocyanic blotches in or on the pericarp.

**3.5 foreign matter:** all organic or inorganic materials other than sorghum grains such as sticks, stones, clods, dung, chaff, other portions of the sorghum plant, other plants and seeds of other plants.

**3.6 technological qualities:** refers to physico-chemical properties of the product.

### **4 Requirements**

#### **4.1 Quality factors - General**

The product shall meet the following quality factors:

- a) safe and suitable for human consumption;
- b) free from abnormal flavours and odours/aroma;
- c) shall not have filth (impurities of animal origin, including insects) and impurities of plants in amounts which may constitute a hazard to human health; and,
- d) shall not have noxious and toxic seeds, or their components including but not limited to crotonia (*Crotalaria* spp.), corn cockle (*Agrostemma githago* L.), castor bean (*Ricinus communis* L.) and jimson weed (*Datura* spp.) in amounts that may constitute a hazard to human health.

#### **4.2 Quality factors – Specific**

##### **4.2.1 Colour**

Sorghum grains may be white, pink, red, brown, orange, or yellow in colour, or a mixture of these colours.

##### **4.2.2 Moisture content**

The moisture content of lots of sorghum grains shall not exceed 13 % by mass as determined according to ISO 712.

#### 4.2.3 Protein content

The protein content (N x 6.25) shall not be less than 7 % on a dry matter basis as determined according to ISO 5983.

#### 4.2.4 Test weight

When tested in accordance with ISO 605, density of grade 1 sorghum grains shall not exceed 71 kg/hl of which grade 2 sorghum grains shall not exceed 62kg/hl.

#### 4.2.5 Tannin Content

The tannin content shall not exceed 0.5 % for whole sorghum grains, 0.3 % on dehulled/dehulled grains on a dry matter basis, as determined according to ISO 9648.

#### 4.2.6 Mycotoxins

Sorghum grain shall comply with the mycotoxin limits established by the Codex Alimentarius Commission as given in Table 2 when tested in accordance with the test methods specified therein.

**Table 2 — Mycotoxins limits for Sorghum grains**

<b>Mycotoxin</b>	<b>limit</b>	<b>Test method</b>
Total Aflatoxin (AFB1+AFB2+AFG1+AFG2), ppb, max	10	ISO 16050
Aflatoxin B <sub>1</sub> ppb, max	5	
Fumonisin ppm, max	2	AOAC Official Method 2001.04

#### 4.2.7 Heavy metals

Sorghum grains shall comply with those maximum limits for heavy metal contaminants specified in CXS 193 and in particular those listed in Table 1.

**Table 1 —Heavy metal contaminants**

<b>Parameter</b>	<b>Limit (ppm max)</b>	<b>Test method</b>
Lead (Pb)	0.1	ISO 6633
Cadmium (Cd)	0.02	ISO 6561-1 or ISO 6561-2

#### 4.2.8 Pesticide Residues

Sorghum grains shall comply with those maximum residue limits established by the Codex Alimentarius Committee on Pesticide Residues for this commodity as spelt out in Pesticide Residues in food – Maximum Residue limits.

#### 4.2.9 Hygiene

The product covered by the provision of this standard shall be handled, prepared, packed, transported and distributed under hygienic conditions. When tested by appropriate methods of sampling and examination, the product shall be free from microorganisms and substances originating from microorganisms or other poisonous or deleterious substances in amounts, which may constitute a hazard to human health.

It is also recommended that the products covered by the provisions of this standard be prepared and handled in accordance with the appropriate sections of the BOS CAC/RCP 1.

## 4.3 Grading and classification

### 4.3.1 Food class sorghum (FOC)

Food class sorghum shall comprise three sub-classes:

- a) Food class sorghum - White (FOCW);
- b) Food class sorghum - Red (FOCR);
- c) Food class sorghum - Other colour (FOCO);

### 4.3.2 Characteristics of class FOC

A consignment of sorghum shall be classified as class FOC sorghum if it has the following characteristics:

- a) consists of sorghum that does not have a dark testa;
- b) the grains are of intermediate to hard endosperm texture;
- c) consists of either white grains (sub-class FOCW); red grains (sub-class FOCR); or is of grain colour other than white or red, or a mixture of grain colours (sub-class FOCCO);
- d) is of a FOC cultivar, as specified by the Department of Agricultural Research of the Ministry of Agriculture;
- e) complies with the requirements for one of the grades of class FOC sorghum as set out in Table 1.

**Table 1 — Permissible purity characteristics in sorghum**

Nature of deviation	Maximum extent to which defects are permissible in %		Methods of analysis
	Grade FOC		
	GR 1	GR 2	
Foreign matter *	1.5	2.0	Visual examination
Unthreshed sorghum	4.0	6.0	Visual examination
Defective sorghum **	3.0	6.0	BOS 63 -Annex G
Small kernel	4.0	8.0	ISO 5223
Sorghum of other classes	2.0	4.0	Visual examination
Sorghum of another colour	2.0	4.0	BOS 63 -Annex D
Total of the above defects	8.0	10.0	BOS 63 -Annex G
Weather stained sorghum	25.0	50.0	Visual examination
* of which inorganic matter should not exceed 0.5 %, and filth should not exceed 0.1 %.			
** of which rotten, smutty, or diseased grain should not exceed 0.5 %.			

#### **4.3.3 Class FOC**

This class consists of the following subclasses and grades:

- a) Sub-class FOCW;
  - (1) Grade FOCW 1;
  - (2) Grade FOCW 2;
- b) Sub-class FO CR;
  - (1) Grade FO CR 1;
  - (2) Grade FO CR 2;
- c) Sub-class FO CO;
  - (1) Grade FO CO 1;
  - (2) Grade FO CO 2.

### **5 Test methods**

Testing shall be done in accordance with the methods referred to in this standard.

### **6 Sampling**

Sampling shall be done in accordance with BOS ISO 13690.

## **7 Labelling and packaging**

In addition to the requirements of the relevant regulation<sup>1</sup>, the following requirements shall be met:

- a) The specific name of the product to be declared on the label shall be either 'Whole sorghum grains' or 'Dehulled/ Decorticated sorghum grains';
- b) Sorghum grains shall be packaged in containers which will safeguard the hygienic, nutritional, technological and organoleptic qualities of the product;
- c) The containers, including packaging material, shall be made of substances, which are safe and suitable for their intended use. They shall not impart any toxic substance or undesirable odour or flavour to the product; and,
- d) When the product is packaged in bags, these shall be clean, sturdy and strongly sewn or sealed.
- e) Net volume in accordance with relevant regulations<sup>2</sup>

Information for non-retail or bulk containers shall either be given on the container or in accompanying documents, except that the name of the product, lot identification and name and address of the processor or packer shall appear on the container. However, lot identification, the name and address of the processor or packer may be replaced by an identification mark, provided that such mark is clearly identifiable with the source and accompanying documents.

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<sup>1</sup> For Botswana: Labelling of pre-packaged foods regulations Cap 65:05

<sup>2</sup> For Botswana: Weights and Measures Act, Chapter 43:0

## **Bibliography**

- 1) For Botswana Food Control Act 1993, Labelling of prepackaged foods regulations Cap 65:05
- 2) For Botswana, Weights and Measures Act, 2006, Chapter 43:06.