

# DRAFT UGANDA STANDARD

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## Fortified milled maize (corn) products — Specification

DRAFT FOR PUBLIC REVIEW



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DUS DEAS 768: 2017

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## National foreword

Uganda National Bureau of Standards (UNBS) is a parastatal under the Ministry of Trade, Industry and Cooperatives established under Cap 327, of the Laws of Uganda, as amended. UNBS is mandated to coordinate the elaboration of standards and is

- (a) a member of International Organisation for Standardisation (ISO) and
- (b) a contact point for the WHO/FAO Codex Alimentarius Commission on Food Standards, and
- (c) the National Enquiry Point on TBT Agreement of the World Trade Organisation (WTO).

The work of preparing Uganda Standards is carried out through Technical Committees. A Technical Committee is established to deliberate on standards in a given field or area and consists of representatives of consumers, traders, academicians, manufacturers, government and other stakeholders.

Draft Uganda Standards adopted by the Technical Committee are widely circulated to stakeholders and the general public for comments. The committee reviews the comments before recommending the draft standards for approval and declaration as Uganda Standards by the National Standards Council.

This Draft Uganda Standard, DUS DEAS 768:2017, *Fortified milled maize (corn) products — Specification*, is identical with and has been reproduced from an International Standard, ISO 768:2017, *Fortified milled maize (corn) products — Specification*, and is being proposed for adoption as a Uganda Standard.

This standard cancels and replaces the first edition US EAS 768: 2012, which has been technically revised.

This standard was developed by Food and agriculture Standards Technical Committee (UNBS/TC 2).

Wherever the words, "East African Standard" appear, they should be replaced by "Uganda Standard."



## **DRAFT EAST AFRICAN STANDARD**

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**Fortified milled maize (corn) products — Specification**

**EAST AFRICAN COMMUNITY**

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## Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 018, *Nutrition and Foods for Special Dietary Uses*.

This second edition cancels and replaces the first 2012 edition (EAS 768: 2012), which has been technically revised.



## Introduction

The Health Ministers of the East, Central and Southern Africa Health Community (ECSA-HC) passed a resolution in 2002 directing the Secretariat to work with the countries to fortify commonly consumed foods in the region after recognizing the high levels of malnutrition in the region. ECSA-HC is an intergovernmental organization that fosters cooperation in health among countries in the East, Central and Southern African Region. It has 10 active member states namely Kenya, Uganda, Tanzania, Malawi, Zambia, Zimbabwe, Lesotho, Swaziland, Mauritius and Seychelles. The mandate of the organization is to promote relevance and efficiency in health in the region.

Following initial promotion efforts, the countries identified staple foods suitable for fortification as oil, sugar, maize meal/ flour and wheat flour. These foods can be used as vehicles to deliver essential micronutrients to the populations. Based on scientific evidence and working with countries using country data, the Secretariat developed implementation focused guidelines on fortification of these foods to help countries start up programs and scale up the existing programs. These guidelines included fortification levels for addition of micronutrients at the factory, and levels for monitoring at commercial level.

Based on the guidelines and other available information, most of the countries in the East African Region and in the larger Africa have initiated national programs on oil fortification with vitamin A; and wheat and maize meal/ flour fortification with iron, zinc, folic acid, niacin, vitamin B-1, B-2, B6 and B-12 and vitamin A. Sugar fortification with vitamin A has also been considered as a way of supplementing other sources of the vitamin in order to prevent and reduce problems associated with the deficiency of this vitamin. Salt fortification with iodine continues to be implemented in all the countries.

With the increased trade of food commodities including these fortified foods within the region, it has become imperative to develop regional standards that over and above the other standards, stipulate minimum and maximum levels of the added nutrients, provide clauses on how to pack the fortified product and the use of health and nutrition claims. The guidelines developed through ECSA have now been incorporated into food standards to provide for specific fortified products.

It is envisaged that, the adoption of these standards and their utilization within the region will help countries adopt food fortification as a strategy to prevent, alleviate or eliminate micronutrient deficiency in the region. Standards will not only promote the health of the population but will also ensure safety of food products and enhance fair trade.

This standard was developed with support from the East, Central and Southern Africa Health Community (ECSA-HC) Secretariat. This was possible through a grant by the A2Z Project of the United States Agency for International Development (USAID). The financial and technical support was used in the process of formulation of fortification levels, development of the draft standards and mobilization of stakeholders to review the standard in national and regional fora. This support is hereby acknowledged.

DRAFT FOR PUBLIC REVIEW

# Fortified milled maize (corn) products — Specification

## 1 Scope

This Draft East African Standard specifies the requirements, sampling and test methods for fortified milled maize (corn) products obtained from the grains of common maize (*Zea mays* L.) intended for human consumption.

## 2 Normative references

AOAC 2001.04, *Official methods of analysis for fumonisins B<sub>1</sub> and B<sub>2</sub> in corn and corn flakes*

AOAC 953.17, *Thiamine (vitamin B<sub>1</sub>) in grain products. Fluor*

AOAC 961.02, *Germicidal Spray Method*

AOAC 970.65, *Riboflavin (Vitamin B<sub>2</sub>) in Foods and Vitamin Pr*

AOAC 975.41, *Niacin and niacinamide in cereal products. Aut*

AOAC 2004.05, *Total Folates in Cereal*

AOAC 2011.14, *Calcium, Copper, Iron, Magnesium, Manganese, P*

CODEX STAN 192, *Codex general standard for food additives*

CODEXSTAN 193, *Codex general standards for contaminants and toxins in food and feed*

EAS 2, *Maize (grains) — Specification*

EAS 38, *Labelling of pre-packaged foods — Specification*

EAS 39, *Code of practice for hygiene in the food and drink manufacturing industry*

EAS 44, *Milled maize products — Specification*

EAS 803, *Nutrition labelling — Requirements*

EAS 804, *Claims on food — General requirements*

EAS 805, *Use of nutrition and health claims — Requirements*

ISO 711, *Cereals and cereal products — Determination of moisture content (Basic reference method)*

ISO 2171, *Cereals, pulses and by-products — Determination of ash yield by incineration*

ISO 4832, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coliforms — Colony-count technique*

ISO 5498, *Agricultural food products — Determination crude fibre content-General method*

ISO 5985, *Animal feeding stuffs -- Determination of ash insoluble in hydrochloric acid*

ISO 6540, *Maize — Determination of moisture content (on milled grains and on whole grains)*

ISO 6579, *Microbiology of food and animal feeding stuffs — Horizontal method for the detection of Salmonella spp.*

ISO 6888-1, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coagulase-positive staphylococci (Staphylococcus aureus and other species) — Part 1: Technique using Baird-Parker agar medium*

ISO 7251, *Microbiology of food and animal feeding stuffs — Horizontal method for the detection and enumeration of presumptive Escherichia coli — Most probable number technique*

ISO 7305, *Milled cereal products – Determination of fat acidity*

ISO 7954, *Microbiology — General guidance for enumeration of yeasts and moulds — Colony count technique at 25 °C*

ISO 11085, *Cereals, cereals-based products and animal feeding stuffs -- Determination of crude fat and total fat content by the Randall extraction method*

ISO 16050, *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*

ISO 16649-1, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of  $\beta$ -glucuronidase-positive Escherichia coli — Part 1: Colony-count technique at 44 °C using membranes and 5-bromo-4-chloro-3-indolyl  $\beta$ -D-glucuronide*

ISO 20483, *Cereals and pulses — Determination of the nitrogen content and calculation of the crude protein content — Kjeldahl method*

ISO 20633, *Infant formula and adult nutritionals -- Determination of vitamin E and vitamin A by normal phase high performance liquid chromatography*

ISO 21527-2, *Microbiology of food and animal feedstuffs — Horizontal method for the enumeration of yeasts and moulds — Part 2: Colony count technique in products with water activity less than or equal to 0.95*

ISO 24333, *Cereals and cereal products — Sampling*

### **3 Terms and definitions**

#### **3.1**

##### **diluent**

suitable, inert, edible food-grade carrier for micronutrients

#### **3.2**

##### **premix**

blend of fortificants and diluents formulated to provide specified and determinable amounts of micronutrients

#### **3.3**

##### **fortified milled maize products**

maize meal, maize flour or sifted maize meal to which micronutrients have been added in accordance with this standard

### 3.4

#### **fortificant**

compound which contains the specified micronutrient intended to be added to a food vehicle

### 3.5

#### **food fortification**

practice of deliberately adding essential micronutrients in a food so as to improve the nutritional quality of the food and to provide a public health benefit with minimal risk to health

### 3.6

#### **granulated maize meal**

coarse product obtained from milling and sifting of clean shelled maize

### 3.7

#### **sifted maize meal**

form of granulated maize meal that has been reduced to a certain degree of fineness

### 3.8

#### **whole maize meal**

food prepared from fully mature, sound, un-germinated, whole kernels of maize, *Zea mays L.*, by a grinding process in which the entire grain is comminuted to a suitable degree of fineness

### 3.9

#### **maize flour**

product obtained by removing the germ and bran followed by grinding, clean maize kernels using roller mills or other methods and sifting the resulting product to suitable degree of fineness

## 4 Quality requirements

### 4.1 Raw materials

Fortified milled maize products shall be produced from milled maize conforming to EAS 44 or maize grains conforming to EAS 2.

### 4.2 General requirements

Fortified milled maize products shall be:

- a) be characteristic of the colour of milled maize or maize grains from which they were prepared;
- b) not contain any foreign matter such as insects, fungi or dirt;
- c) be free from fermented musty or other objectionable odour and colours; and
- d) be wholesome and fit for human consumption in all aspects.

### 4.3 Specific requirements

Fortified milled maize products shall comply with the quality requirements specified in Table 1 when tested in accordance with tested method therein.

**Table 1 — Specific quality requirements for fortified milled maize products**

S/N	Characteristic	Type				Test method
		Sifted maize meal	Granulated maize meal	Whole maize meal	Maize flour	
i.	Crude fibre, % by m/m, max.	0.7	1.0	3.0	0.7	ISO 5498
ii.	Crude fat on moisture free basis, % by m/m, max.	3.0	3.0	3.1*	3.0	ISO 11085
iii.	Moisture content, % by m/m, max.	14	14	14	14	ISO 6540
iv.	Total ash, % by m/m, max.	1.0	1.0	3.0	1.0	ISO 2171
v.	Acid insoluble ash, % by m/m, max.	0.15	0.35	0.40	0.15	ISO 5985
vi.	Fat acidity, mg KOH per 100 g of product, on dry mass basis, max.	80	80	80	80	ISO 7305

\* Minimum crude fat on moisture free basis for whole maize meal

## 5 Fortification requirements

### 5.1 Levels of micronutrients

The fortified milled maize products shall conform to the requirements and the levels of micronutrients provided in Table 2. These levels include the intrinsic amount of micronutrients in the unfortified milled maize products.

**Table 2 — Requirements for micronutrients in fortified milled maize products**

S/N	Nutrient	Fortificant compound	Limits, mg/kg		Test methods
			Min.	Max.	
i.	Vitamin A*	Vitamin A (Retinyl) palmitate	0.5	1.4	ISO 20633 AOAC 2001.13
ii.	Vitamin B <sub>1</sub> *	Thiamin Mononitrate	3.0	N/A	AOAC 953.17
iii.	Vitamin B <sub>2</sub> *	Riboflavin	2	N/A	AOAC 970.65
iv.	Niacin*	Niacinamide	14.9	N/A	AOAC 975.41
v.	Vitamin B <sub>6</sub> *	Pyridoxine	2	N/A	AOAC 961
vi.	Folate	Folic acid	0.6	1.7	AOAC 2004.05
vii.	Vitamin B <sub>12</sub>	Vitamin B <sub>12</sub> , WS, 0.1%	0.007	N/A	ISO 20634:2015
viii.	Zinc	Zinc oxide	33	65	AOAC 2011.14
ix.	Total iron	Total iron	21	41	AOAC 2011.14
x.	Added Iron	NaFeEDTA**	10	30	
		ferrous fumarate	10	30	

N/A – Not applicable. Setting the maximum level for these nutrients is not necessary because the upper tolerable limit for these nutrients is very high.

- \* The addition of these micronutrients is optional in Tanzania.
- \*\* Either NaFeEDTA or ferrous fumarate can be used

## 5.2 Stability of fortificants and premixes

The fortificants and premixes shall have storage stability such that no more than 20 % of their original activity will be lost when stored for 21 days at 45 °C in a well closed container at a level of 2.5 g per kg in fortified milled maize products having the moisture content in the range of 13.5 % - 14 % for testing stability.

The supplier of the premix shall provide the stability data for the fortificants and premixes.

NOTE For stability of fortificants, manufacturers may refer to Annex A for detailed information.

## 5.3 Premix

The fortificants shall be mixed with diluents or carriers as appropriate to form a premix. Diluents or carriers shall conform to USP, BP, Ph Eur, NF, MI, FAO/WHO, or FCC.

The premix shall be made in such a way that at a given rate of addition to the product, the product shall conform to the requirements in Table 2.

The premix may be formulated to conform to the provisions given in Table A.2 and Table A.3 using NaFeEDTA and ferrous fumarate compound respectively.

NOTE This premix formulation is designed with minimum nutrient composition and does not take into consideration factory overages in the preparations of the premix.

The premix shall be labelled with the addition rate (that is, the amount of premix to be added to the milled maize product) in grams of premix per metric tonne of maize product and dilution factor.

Where the premix is made in accordance with Table A.2 and Table A.3, the addition rate shall be 500 g of premix per metric tonne of maize flour.

## 6 Food additives

The product shall contain food additives in accordance with CODEX STAN 192.

## 7 Hygiene

7.1 Fortified milled maize products shall be produced, prepared and handled in accordance with the provisions of appropriate sections of EAS 39.

7.2 The product shall be free from pathogenic micro-organisms and shall comply with microbiological limits in Table 3.

**Table 3 — Microbiological limits for milled maize products**

S/N	Micro-organism	Maximum limit	Test method
i.	Total aerobic count, per g	10 <sup>5</sup>	ISO 4832
ii.	<i>Escherichia coli</i> , per 1 g	Absent	ISO 16649-1
iii.	<i>Salmonella</i> , per 25 g	Absent	ISO 6579

S/N	Micro-organism	Maximum limit	Test method
iv.	Yeast and moulds, cfu/g	10 <sup>4</sup>	ISO 7954
v.	<i>Staphylococcus aureus</i> , per 25 g	10 <sup>2</sup>	ISO 6888-1

## 8 Contaminants

### 8.1 Heavy metals

Fortified milled maize products shall conform to those maximum limits for heavy metals established in CODEX STAN 193.

### 8.2 Pesticide residues

Fortified milled maize products shall conform to those maximum residue limits established by the Codex Alimentarius Commission for these products.

NOTE Where the use of certain pesticides is prohibited by some Partner States, it should be notified to all Partner States accordingly.

### 8.3 Mycotoxins

Fortified milled maize (corn) products shall comply with mycotoxin limits specified in Table 4 when tested in accordance with test methods specified therein.

**Table 4 — Mycotoxins limits for fortified milled maize (corn) products**

S/N	Mycotoxin	Maximum limit µg/kg	Test method
i.	Total aflatoxins	10	ISO 16050
ii.	Aflatoxins B <sub>1</sub>	5	
iii.	Fumonisin	2 000	AOAC 2001.04

## 9 Weights and measures

Wheat flour shall be packaged in accordance with the weights and measures regulations of the destination country.

NOTE EAC Partner States are signatory to the International Labour Organizations (ILO) for maximum package weight of 50 kg where human loading and offloading is involved.

## 10 Packaging

Fortified milled maize (corn) products shall be packaged in food grade packaging materials. When the product is packaged in sacks, these must be clean, sturdy and strongly sewn or sealed.



## **11 Labelling**

### **11.1 General labelling**

In addition to the requirements in EAS 38, each package shall be legibly and indelibly marked with the following:

- a) name of product such as "Fortified Whole Maize Meal, Fortified Sifted Maize meal, Fortified Maize flour or Fortified Granulated Maize meal";
- b) name and address of the manufacturer/packer/importer;
- c) brand name/registered trade mark, if any;
- d) lot or batch number in code or in clear format;
- e) net weight in metric units;
- f) the statement "Store in a cool dry place and away from contaminants";
- g) the statement "for human consumption";
- h) Country of origin;
- i) date of manufacture;
- j) best before date; and
- k) instructions for disposal of used package.

NOTE Each product unit may also be marked with the national food fortification logo, where the industry qualifies to use the mark.

### **11.2 Nutrition labelling**

The amount of micronutrients in the maize flour shall be declared on the label in accordance with EAS 803.

### **11.3 Nutrition and health claims**

Fortified milled maize products may have claims on the importance of the micronutrients in nutrition and health. Such claims when declared shall be consistent with EAS 804 and EAS 805.

## **12 Sampling**

Sampling shall be done in accordance with ISO 24333.

## Annex A (informative)

### Fortificants compound

A.1 For fortificants compounds, the recommended factory levels should be as detailed in Table A.1.

**Table A.1 Recommended levels for fortificants compounds**

S/N	Nutrient	Fortificant compound	Factory limits, mg/kg
i.	Vitamin A	Vitamin A (Retinyl) palmitate	1 ± 0.4
ii.	Vitamin B <sub>1</sub>	Thiamin Mononitrate	6.5 ± 2.9
iii.	Vitamin B <sub>2</sub>	Riboflavin	4 ± 1.8
iv.	Niacin	Niacinamide	30 ± 13.4
v.	Vitamin B <sub>6</sub>	Pyridoxine	5 ± 2.5
vi.	Folate	Folic acid	1.2 ± 0.5
vii.	Vitamin B <sub>12</sub>	Vitamin B <sub>12</sub> , WS, 0.1%	0.015 ± 0.007
viii.	Zinc	Zinc oxide	49 ± 16
ix.	Total iron	Total iron	31 ± 10
x.	Added Iron	NaFeEDTA **	20 ± 10
		ferrous fumarate	20 ± 10

**Table A.2 – Formulation of premix for addition of micronutrients to milled maize products**

If using NaFeEDTA as a source of iron

Micronutrient	Fortificant compound	Amount of micronutrient to be added to food, mg/kg	Amount of fortificant to be added to food, mg/kg	Amount of fortificant in premix, g/kg	Amount of nutrient in premix, g/kg
Vitamin A	Retinyl palmitate, spraydried or equivalent, 7.5 % retinol, min.	1.0	13.3	26.7	2
Vitamin B <sub>1</sub>	Thiamin mononitrate, 81 %, min.	4.5	5.6	11.1	9
Vitamin (Riboflavin) B <sub>2</sub>	Riboflavin, 100 %, min.	3.0	3.0	6.0	6
Vitamin (Niacin) B <sub>3</sub>	Niacinamide, 99 %, min	25.0	25.3	50.5	50

Vitamin B <sub>6</sub> (Pyridoxine)	Pyridoxine, 82 %, min.	5.0	6.1	12.2	10
Vitamin B <sub>9</sub> (Folate)	Folic Acid, 100 %, min.	1.0	1.1	2.2	2
Vitamin B <sub>12</sub>	Vitamin B <sub>12</sub> , water-soluble form 0.1 %)	0.015	15.0	30.0	0.03
Iron	NaFeEDTA, 12.5 % Fe, min.	20	160	320	40
Zinc	Zinc oxide, 80 %, min.	40	50.0	100.0	80
	Filling material (at least 25 %)	-	220.6	441.2	-
		<b>TOTAL</b>	<b>500</b>	<b>1000.0</b>	

**Table A.3 – Formulation of premix for addition of micronutrients to milled maize products**

**If using ferrous fumarate as a source of iron**

<b>Micronutrient</b>	<b>Fortificant compound</b>	<b>Amount of micronutrient to be added to food, mg/kg</b>	<b>Amount of fortificant to be added to food, mg/kg</b>	<b>Amount of fortificant in premix, g/kg</b>	<b>Amount of nutrient in premix, g/kg</b>
Vitamin A	Retinyl palmitate, spraydried or equivalent, 7.5 % retinol, min.	1.0	13.3	26.7	2
Vitamin B <sub>1</sub>	Thiamin mononitrate, 81 %, min.	4.5	5.6	11.1	9
Vitamin B <sub>2</sub> (Riboflavin)	Riboflavin, 100 %, min.	3.0	3.0	6.0	6
Vitamin B <sub>3</sub> (Niacin)	Niacinamide, 99 %, min	25.0	25.3	50.5	50
Vitamin B <sub>6</sub> (Pyridoxine)	Pyridoxine, 82 %, min.	5.0	6.1	12.2	10
Vitamin B <sub>9</sub> (Folate)	Folic Acid, 100 %, min.	1.0	1.1	2.2	2
Vitamin B <sub>12</sub>	Vitamin B <sub>12</sub> , water-soluble form 0.1 %)	0.015	15.0	30.0	0.03
Iron	Ferrous fumarate, 32 % activity	20	62.5	125	40
Zinc	Zinc oxide, 80 %, min.	40	50.0	100.0	80
	Filling material (at least 25 %)	-	318.1	636.3	-
	<b>TOTAL</b>		<b>500</b>	<b>1000.0</b>	

NOTE The following documents may help in formulation of compound:

- a) British Pharmacopoeia (BP);
- b) Food Chemical Codex (FCC);
- c) Merck Index (MI);
- d) United States National Formulary (NF);
- e) European Pharmacopoeia (Ph Eur);
- f) United States Pharmacopoeia (USP); and
- g) FAO/WHO Codex Alimentarius Commission (CAC)

## Bibliography

- [1] CODEX STANDARD 154, *Codex Standard for Whole Maize (Corn) Meal*
- [2] CODEX STANDARD 155, *Codex Standard for Degermed Maize (Corn) Meal and Maize (Corn) Grits*
- [3] ECSA-HC, *Guidelines of fortification levels for staples.*

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