

UGANDA STANDARD

Second Edition
2006-11-14

Fortified milled maize products — Specification



Reference number
US 509:2006

© UNBS 2006

Compliance with this standard does not, of itself confer immunity from legal obligations

A Uganda Standard does not purport to include all necessary provisions of a contract. Users are responsible for its correct application

© UNBS 2006

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilised in any form or by any means, electronic or mechanical, including photocopying and microfilm, without prior written permission from UNBS.

Requests for permission to reproduce this document should be addressed to

The Executive Director
Uganda National Bureau of Standards
P.O. Box 6329
Kampala
Uganda
Tel: +256 41 505 995
Fax: +256 41 286 123
E-mail: unbs@infocom.co.ug

Foreword

Uganda National Bureau of Standards (UNBS) is a parastatal under the Ministry of Tourism, Trade and Industry established, under Cap 327 of the Laws of Uganda. UNBS is mandated to co-ordinate 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/SPS Agreements 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 second edition cancels and replaces the first edition, US 509:2003, which has been technically revised.

This revision includes adapting the levels of fortification to provide reasonable levels of nutrients and to include standards for the fortificant to be used in the addition of nutrients to milled maize products.

Annex A is provided for information only. Annex B is an integral part of this standard.

Committee membership¹

This Uganda Standard US 509 was prepared by the Technical Committee on Food and agriculture standards (UNBS/TC 2) and the following organizations were represented:

- BIDCO Uganda Limited
- Child Health and Development Centre, Makerere University
- Department of Food Science and Technology, Makerere University
- Food Science and Technology Research Institute (FOSRI)
- Government Chemist and Analytical Laboratory
- Maganjo Grain Millers
- Masindi Milling Company
- Micronutrient Operational Strategies and Technologies (MOST) Project – Uganda
- Ministry of Agriculture Animal Industry and Fisheries (MAAIF)
- Ministry of Health (MOH)
- Ministry of Tourism Trade and Industry (MTTI)
- Mukwano Industries Limited
- National Drug Authority (NDA)
- Ntake Bakery Limited
- Sugar Corporation of Uganda Limited (SCOUL)
- Uganda Consumer Protection Association (UCPA)
- Uganda Industrial Research Institute (UIRI)
- Uganda Revenue Authority (URA)
- Unga 2000 Limited
- World Food Programme (WFP)

¹ Includes members who participated in the development of First edition 2003

Fortified milled maize products — Specification

1 Scope

This Uganda Standard specifies the requirements for fortified maize flour, fortified whole maize meal, and fortified de-germed maize meal all prepared from kernels of common maize, *Zea mays* L. and intended for human consumption. It does not apply to maize or other maize products for which other standards apply.

2 Normative references

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

US 7, *General standard for labelling of pre-packaged foods*

US 17/EAS 2, *Specification for maize grains*

US 28, *Code of practice for hygiene in the food and drink manufacturing industry*

US 98, *Cereals and cereal products — Determination of moisture content — Routine method*

US 97/ISO 13690, *Method for sampling of cereals*

US 217, *Methods for microbiological examinations of foods*

US 277, *General standard for the labelling of food additives when sold as such*

US 342/ ISO 2171, *Cereals, pulses, and derived products — Determination of ash*

US 343/ ISO 1871, *Agricultural food products — General directions for the determination of nitrogen by the Kjeldahl Method*

US 344/ ISO 5986, *Animal feedstuffs — Determination of diethyl ether extract*

US 345/ ISO 6541, *Agricultural food products — Determination of crude fibre content modified Scharrer Method*

US 354, *Milled cereal products — Determination of fat acidity*

US 367/EAS 82, *Milled cereal products — Methods of test (General methods)*

US 500, *General requirements for nutrition labelling of foods*

US 508, *General requirements for nutrition and health claims on foods*

US 566 *Use of nutrition claims — Requirements*

3 Terms and definitions

For the purpose of this standard, the following terms and definitions shall apply.

3.1

degermed maize (corn) meal

food prepared by milling fully mature, sound, degermed kernels of maize (corn, *Zea mays* L.) in which the grain is cleaned, the germ and the bran removed before the remaining portion is comminuted to a suitable degree of fineness

3.2

maize flour

food prepared by milling fully mature, sound, un-germinated, whole kernels of maize, *Zea mays* L. in which the grain is cleaned, the germ and the bran removed before the remaining portion is comminuted to a suitable degree of fineness

3.3

whole maize (corn) meal

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

3.4

diluent

suitable, inert, food-grade carrier for micronutrients

3.5

fortificant

concentrate or premix of (a) vitamin(s) and/or mineral(s) which is used or intended for use to add vitamins or minerals to food

3.6

fortification mix

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

3.7

food fortification

addition to a food of significant quantities of a nutrient that was not originally present in that food or was present only in nutritionally insignificant amount

3.8

nutrient

any substance normally consumed as a constituent of food:

- a) which provides energy; or
- b) which is needed for growth, development and maintenance of life; or
- c) a deficit of which will cause undesirable health effects.

3.9

recommended dietary intakes (RDIs)

levels of intake of essential nutrients considered, in the judgement of the National Health Authority, on the basis of available scientific knowledge to be adequate to meet the known nutritional needs of practically all healthy people

3.10**reference quantity of a food**

a normal serving of the food or the quantity of that food which when prepared according to instructions produces a normal serving of that food

4 Symbols (and abbreviated terms)

- USP United States Pharmacopoeia
- BP British Pharmacopoeia
- Ph. Eur European Pharmacopoeia
- NF United States National Formulary
- MI Merck Index
- FAO/WHO General Principles for the Use of Food Additives, Codex Alimentarius Volume 1
- FCC Food Chemical Codex
- N/A Not Applicable

5 Description**5.1 Fortified whole maize (corn) meal**

This is the food prepared from fully mature, sound, un-germinated, whole kernels of maize, *Zea mays* L., cleaned from impurities, moulds, seeds of weeds and other cereals. In a grinding process the entire grain is comminuted to a suitable degree of fineness to comply with 6.4. In its preparation coarse particles of the ground maize kernel may be separated, reground and recombined with all of the material from which they were separated. Vitamins and/or minerals shall be added in accordance to this standard.

5.2 Fortified de-germed maize (corn) meal

This is the food prepared from fully mature, sound, degermed kernels of maize (corn, *Zea mays* L.), cleaned from impurities, moulds, seeds of weeds and other cereals. In a grinding process the grain is comminuted to a suitable degree of fineness to comply with 6.4. The bran and germ are removed. In its preparation, coarse particles of the ground maize kernel may be separated, reground and recombined with all of the material from which they were separated. Vitamins and/or minerals shall be added in accordance to this standard.

5.3 Fortified maize flour

This is the food prepared from fully mature, sound, un-germinated, whole kernels of maize, *Zea mays* L., cleaned from impurities, moulds, seeds of weeds and other cereals. In a grinding process the grains are de-hulled to remove part or all of the germ, husks and the bran and the remaining portion is comminuted to a suitable degree of fineness to comply with 6.4. The resulting mill stock is sieved into portions of different particle sizes, and may be blended to produce the final desired product. Vitamins and/or minerals shall be added in accordance to this standard.

6 Essential composition and quality factors

6.1 Raw material

The maize from which the product is made shall be clean, sound, mature and dry seeds essentially free from other seeds and foreign matter in accordance with US 17/EAS 2.

6.2 General quality factors

6.2.1 The product shall be safe and suitable for human consumption.

6.2.2 The product shall be free from objectionable mater.

6.2.3 The product shall be free from abnormal flavours, odours, and living insects.

6.2.4 The product shall be free from filth (impurities of animal origin, including dead insects) in amounts that may represent a hazard to human health.

6.2.5 All processing of the maize, including drying, milling and other treatment of the maize, intermediate milling products and final product shall be carried out in a manner that:

- (a) minimizes loss of nutritive value, particularly protein quality; and
- (b) avoids undesirable changes in technological properties of the maize flour.

6.3 Essential composition factors

The product shall conform to the compositional requirements in Table 1.

Table 1 — Compositional requirements for fortified milled maize products

Characteristic	Requirement		Method of test
	Whole maize meal	Degermed maize meal/ Maize flour	
Crude ash content, % by mass, max.	3.9	1.0	US 342
Protein content, % by mass, min. (N x 6.25)	8	7.0	US 343
Crude fat content, % by mass on a dry weight basis, min.	3.1	2.25	US 344
Crude fibre content, % by mass, max.	1.8	1.25	US 345
Fat acidity, mg potassium hydroxide (KOH) per 100 g of flour, on dry mass basis, max.	50	50	US 354
Acid insoluble ash, % by mass, max.	0.35	0.35	US 367
Moisture content, %, by mass, max.	14	14	US 98

6.4 Granularity

When tested in accordance with US 367, the product shall conform to the requirements in Table 2.

Table 2 — Granularity of whole maize meal, degermed maize meal and maize flour

	Sieve size (mm)				
	0.2	0.5	0.71	0.85	1.70
Whole maize meal, percentage passing through the sieve	≤ 35	—	≥ 45	—	≥ 95
Degermed maize meal	≤ 35	—	≥ 45	≥ 95	—
Maize flour	≥ 95	100	—	—	—

NOTE 1 Not less than 95 % of the fortified whole maize meal should pass through a sieve of 1.70 mm aperture size, not less than 45 % through a sieve of 0.71 mm aperture size, but not more than 35 % through a sieve of 0.2 mm aperture size.

NOTE 2 Not less than 95 % of the fortified degermed maize meal should pass through a sieve of 0.85 mm aperture size, not less than 45 % through a sieve of 0.71 mm aperture size, but not more than 35 % through a sieve of 0.2 mm aperture size

NOTE 3 100 % of the fortified maize flour should pass through a sieve of 0.5-mm aperture size, not less than 95 % through a sieve of 0.2-mm aperture size.

6.5 Addition of nutrients

6.5.1 Required content of vitamins and minerals in fortified milled maize products

Fortified milled maize products shall contain the contents of vitamins and minerals that are specified in Table 3 for whole maize meal (high extraction) and Table 4 for maize flour (low extraction) and degermed maize meal during all the marketing life of the product.

NOTE The levels and labels should be used for the food control purposes to enforce the application of this standard in individual samples.

Table 3 – Required content of vitamins and minerals in fortified whole maize meal/flour (high extraction flour)

Micronutrient	Minimum content, (mg/100 g)	Tolerable maximum (mg/100 g)
Vitamin A	0.05	0.15
Vitamin B-1	0.3	N/A
Vitamin B-2	0.2	N/A
Niacin	3	N/A
Folate	0.05	0.15
Vitamin B-12	0.0003	N/A
Iron:		
Total	4	6
from NaFeEDTA	1	2
Zinc	3	5

Table 4 – Required content of vitamins and minerals in fortified degermed maize meal/flour (low extraction)

Micronutrient	Minimum content (mg/100 g)	Tolerable maximum (mg/100 g)
Vitamin A	0.05	0.15
Vitamin B-1	0.2	N/A
Vitamin B-2	0.2	N/A
Niacin	2	N/A
Folate	0.05	0.15
Vitamin B-12	0.0003	N/A
Iron:		
Total	2	3
NaFeEDTA	1	2
Zinc	2	4

6.5.2 Formulation of the fortification mix for addition of vitamins and minerals to milled maize products

The fortification mix shall be formulated in a way that 250 g per metric ton of maize milled products results in the average levels indicated in Table 3 or Table 4. Table 5 shows the composition of a fortification mix that fulfills the requirements.

All vitamins, minerals and diluents shall conform to USP, BP, Ph. Eur, NF, MI, FAO/WHO, or FFC.

Fortification mix shall be labelled in accordance with US 277. In addition the fortification mix shall be labelled with instructions for mixing in grams of mix per metric tonne of product.

NOTE 1 Producers may add fortification mix at a rate of 250 g per tonne of flour.

NOTE 2 Small mills may dilute the fortification mix to produce factory premix before adding to the flour. A proportional amount of premix should then be used to mix into the flour before packaging.

NOTE 3 The levels indicated in Table 5 should produce an average level of micronutrients in Table 6.

Table 5 — Formulation of fortification mix for addition of vitamins and minerals to milled maize products

Micronutrient required	Fortificant compound	Minimum micronutrient level (g/kg)	Approximate fortificant Amount (g/kg)
Vitamin A	Vitamin A ^a , spray dried or equivalent	4	53.3
Vitamin B-1	Thiamin Mononitrate, (Activity 81% min.)	8	9.9
Vitamin B-2	Riboflavin	10	10.0
Niacin	Niacinamide, (Activity 99 % min.)	100	101.0
Folic Acid	Folic acid (Activity 90 % min.)	4	4.4
Vitamin B-12	Vitamin B12 (Activity 0. 1% min.)	0.02	20.0
Iron	NaFeEDTA (Activity 13 % min.)	60	461.5
Zinc	Zinc oxide, (Activity 80 % min.)	100	53.3
Diluents			To complete 1000 g

^a Vitamin A shall be added in form of stabilized vitamin A palmitate in spray dried form or equivalent, containing 75 000 mcg RE activity² per gram (0.075% min). The vitamin A palmitate shall have storage stability such that no more than 20 percent of its original activity will be lost when stored for 21 days at 45°C in a well closed container at a level 1.0 mg per kg in maize milled products having moisture content of 14 %.

6.5.3 Target levels at production

Producers should aim as target level values of the micronutrient content indicated in Table 6 for whole maize meal (high extraction), and Table 7 for maize flour and degermed maize flour (low extraction) in their internal and external quality control procedures.

NOTE The average levels of micronutrients in the product should appear in the label of the corresponding product.

² Retinol equivalents (RE) = 1 mcg retinol = 3.33 IU

Table 6 – Total quantity of vitamins and minerals in fortified whole maize meal/flour (high extraction) at the moment of production

Micronutrient	Minimum (mg/100 g)	Average (mg/100 g)	Maximum (mg/100 g)
Vitamin A	0.05	0.10	0.15
Vitamin B-1	0.3	0.5	0.7
Vitamin B-2	0.2	0.4	0.6
Niacin	3	4	5
Folate	0.05	0.10	0.15
Vitamin B-12	0.0003	0.0005	0.0007
Iron:			
Total	4	5	6
NaFeEDTA	1.2	1.5	1.8
Zinc	3	4	5

Table 7 – Total quantity of vitamins and minerals in fortified degermed maize meal/flour (low extraction) at the moment of production

Micronutrient	Minimum (mg/100 g)	Average (mg/100 g)	Maximum (mg/100 g)
Vitamin A	0.05	0.10	0.15
Vitamin B-1	0.2	0.4	0.6
Vitamin B-2	0.20	0.35	0.50
Niacin	2.5	3.0	3.5
Folate	0.05	0.10	0.15
Vitamin B-12	0.0003	0.0005	0.0007
Iron:			
Total	2.0	2.5	3.0
NaFeEDTA	1.2	1.5	1.8
Zinc	2	3	4

6.5.4 Application of fortification mix

The fortification mix should be used at an addition rate as recommended by the fortification mix manufacturer.

NOTE Fortification mix manufactured in accordance with Table 5 should be used at a rate of 250 g per metric tonne of meal or flour.

7 Contaminants

7.1 Heavy metals

The product shall conform to those maximum limits for heavy metals established by the Codex Alimentarius Commission for this commodity.

7.2 Pesticide residues

The product shall conform to those maximum residue limits established by the Codex Alimentarius Commission for this commodity.

7.3 Mycotoxins

The product shall conform to those maximum mycotoxin limits established by the Codex Alimentarius Commission for this commodity.

8 Hygiene

8.1 The product covered by the provisions of this standard shall be prepared and handled in accordance with US 28.

8.2 When tested in accordance with US 217 or other appropriate methods of test, the product shall:

- a) be free from microorganisms in amounts which may present a hazard to health and shall conform to the limits in Table 4;
- b) be free from parasites which may represent a hazard to health; and
- c) not contain any substance originating from microorganisms in amounts which may represent a hazard to health.

Table 4 — Microbiological limits for milled maize products

Micro-organisms	Maximum limit
Total aerobic count, CFU/g, max.	10 ⁵
<i>E. coli</i> , in 10 g	<1
<i>Salmonella</i> in 25 g	Absent
Yeast and mould, CFU/g, max.	10 ⁴

9 Packaging

Fortified milled maize products shall be packaged in new containers that will safeguard the:

- a) safety and hygiene, that is, minimise contamination of the products;
- b) nutritional value, that is, minimise the loss of the nutrients;
- c) technological qualities of the products; and
- d) aesthetic qualities of the food.

10 Labelling, nutrition labelling and claims

10.1 Labelling of pre-packaged products

In addition to the requirements of US 7, US 500, US 508 and US 566, the following specific provisions shall apply:

- a) the name of the food to be shown on the label shall be 'Fortified whole maize meal' or 'Fortified degermed maize meal' or 'fortified maize flour' in accordance with Clause 5;
- b) storage instructions with the statement 'Store in cool and dry place', shall be included in close proximity to the date marking;
- c) the statement 'Human food', shall be included on the label; and
- d) the product label shall include the following information:
 - (i) the names of the vitamins and minerals which have been added to the product; and
 - (ii) the average quantity of each vitamin and mineral in mg per 100 g of the product.

10.2 Non-retail containers

In the case of the product in non-retail containers the labelling information shall either be given on the container or in accompanying documents except that the name of the product and the name and address of the manufacturer or packer shall appear on the container.

11 Storage and transportation

Fortified food products shall be stored and/or transported in such a way as to avoid:

- (a) adverse effect of the natural environment;
- (b) contamination;
- (c) loss of the nutrients; and
- (d) any other type of deterioration.

12 Methods of analysis and sampling

Sampling shall be done in accordance with US 97 (ISO 13690). Testing should be done in accordance with appropriate methods of test. Recommended methods of test for vitamins and minerals are given in Annex A.

Annex A (informative)

Recommended methods of test for vitamins and minerals in fortified milled maize products

Determination of Vitamin A; According to AOAC *Methods of analysis of Vitamin A in foods*, 974.29 of 1990.

Determination of Vitamin B₁; According to AOAC *Methods of analysis of Vitamin B₁ in foods*, 953.17 of 1990.

Determination of Vitamin B₂; According to AOAC *Methods of analysis of Vitamin B₂ in foods*, 981.15 or 970.65 of 1990.

Determination of Niacin; According to AOAC *Methods of analysis of Niacin in foods*, 961.14, 975.41, or 981.16 of 1990.

Determination of Iron; According to AOAC *Methods of analysis of iron in foods*, 944.02 of 1990.

Determination of Zinc; According to AOAC *Methods of analysis of zinc in foods*, 944.09, or 969.32 of 1990.

Annex B (normative)

Recommended daily intake (Nutrient Reference Values) of nutrients

Protein	(g)	50
Vitamin A	(μ g)	800
Vitamin D	(μ g)	5
Vitamin C	(mg)	60
Thiamin	(mg)	1.4
Riboflavin	(mg)	1.6
Niacin	(mg)	18
Vitamin B6	(mg)	2
Folic acid	(μ g)	200
Vitamin B12	(μ g)	1
Calcium	(mg)	800
Magnesium	(mg)	300
Iron	(mg)	14
Zinc	(mg)	15
Iodine	(μ g)	150
Copper	Value to be established	
Selenium	Value to be established	

Bibliography

- [1] British Pharmacopoeia, 1993, Volume I and II
- [2] CAC/GL 10-1979, Advisory list of mineral salts and vitamin compounds for use in foods for infants and children
- [3] CAC/MISC 1-1972, *General principles for the use of food additives*
- [4] CODEX STAN 212: 1999(Amd.1-2001), *Codex standards for sugars*
- [5] US 12:2002, *Specification for whole maize meal*
- [7] US 13:2002, *Specification for de-germed maize meal and maize grits*
- [8] US 370:2002, *Specification for maize flour*

Certification marking

Products that conform to Uganda standards may be marked with Uganda National Bureau of Standards (UNBS) Certification Mark shown in the figure below.

The use of the UNBS Certification Mark is governed by the Standards Act, and the Regulations made thereunder. This mark can be used only by those licensed under the certification mark scheme operated by the Uganda National Bureau of Standards and in conjunction with the relevant Uganda Standard. The presence of this mark on a product or in relation to a product is an assurance that the goods comply with the requirements of that standard under a system of supervision, control and testing in accordance with the certification mark scheme of the Uganda National Bureau of Standards. UNBS marked products are continually checked by UNBS for conformity to that standard.

Further particulars of the terms and conditions of licensing may be obtained from the Director, Uganda National Bureau of Standards.



Food Fortification Logo

Products that conform to Uganda Standards for fortified food products may be marked National food fortification logo shown in the figure below.

The use of the food fortification logo is governed by the Food Fortification Regulations. Further particulars of the terms and conditions of use of the logo may be obtained from Uganda National Bureau of Standards.



