Islamic Republic of Iran
Institute of Standards and Industrial Research of Iran

Corn - Specifications and test methods

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In the name of God
Introduction to Iran National Standards Organization

According to Article 3 of the Law on Amending the Rules and Regulations of the Institute of Standards and Industrial Research of Iran (approved in February 1993), the Institute of Standards and Industrial Research of Iran is the only official body in the country responsible for determining, organising and publishing national (official) standards of Iran.

The name of the Institute of Standards and Industrial Research of Iran has been changed to Iran National Standards Organization according to the 152nd meeting of the High Administrative Council on 20 Sept. 2011 and has been notified for implementation in letter No. 206/35838 dated 16 Oc. 2011.

The development of standards in various fields is carried out under the supervision of technical commissions composed of organisation experts, educated experts from scientific, research, production and economic institutes. It is an effort in line with national interests and in accordance with the conditions of production, technology and trade. All these are achieved through the informed and fair participation of the holders of rights and interests, including producers, consumers, exporters and importers, scientific and specialized centres, institutions, governmental and non-governmental organisations. The draft national standards of Iran are sent to the concerned authorities and members of the relevant technical commissions for further evaluation. After receiving comments and suggestions in the National Committee related to the specific field, and if it is approved as a national (official) standard of Iran, it will be printed and published.

Draft standards prepared by interested and competent institutions and organisations in accordance with the established criteria are reviewed by the National Committee and, if approved, are published as Iranian national standards. Accordingly, the standards prepared on the basis of the provisions written in the Iranian National Standard No. 5 and approved by the National Standards Committee of the Iranian National Standards Organisation are considered as national standards.

The Iranian National Standards Organization is a key member of the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC) and the Organisation Internationale de Metrologie Legale (OIML), and serves as the sole point of contact for the Codex Alimentarius Commission (CAC) in the country. The latest scientific, technical and industrial developments in the world as well as international standards are used in the preparation of Iranian national standards, while taking into account the general conditions and specific needs of the country.

With the approval of the High Council of Standards, the National Iranian Standards Organisation can enforce some of Iran's national standards for domestic products and/or imported items in order to protect consumers and maintain personal and public health and safety, and to ensure the quality of products, as well as environmental and economic considerations, in accordance with the principles set forth in the law. In order to maintain

international markets for the country's products, the Organisation may make the implementation of standards for exported goods and their gradation mandatory.

Technical Commission for Corn Standards

Technical Commission for Corn Standards
"Characteristics and Test Methods"

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Foreword

The standard entitled “Corn - Characteristics and Test Methods”, which has been drafted in the relevant commissions and has been prepared and compiled by the Iran Institute of Standards and Industrial Research in the 719th meeting of the National Committee for the Standardization of Feed and Agricultural Products and was approved on 10 March 2008, Now, it is published as the national standard of Iran, based on paragraph 1 of article 3 of the law amending the rules and regulations of the Iran Institute of Standards and Industrial Research, that was approved in February 1993. To maintain synchronization and coordination with national and global developments and progresses in the field of industries, sciences and services, Iran’s national standards will be revised as necessary. Any proposal for changes or additions to these standards will be evaluated while being reviewed by the relevant technical commission. Thus, the latest revision of national standards should always be used.

The sources used to prepare this standard are as follow:

1. National standard of Iran1445: 1376 [1998] corn seeds for feeding livestock, poultry and aquatic animals
2. National Standard of Iran 8152: 1384 [2006] Corn semolina flour with no sprout-specifications and test methods
3. Codex Standards for Maize (corn), Codex stan 153-1985 (Rev.1-1995)
4. United Standards for corn, 1996.
5. Commission Regulation (EC) 1881- 2006 , Setting Maximum Levels for Certain Contamination in Food stuffs.
6. Herman T.J and Reed C. Corn Grading Procedures, Kansas state University Agricultural Experiment station and cooperative Extension service.

Corn- characteristics and test methods

1 Purpose

The purpose of this standard is to determine the characteristics, grading, sampling and testing methods, packaging and marking of maize seed.

2 Scope of Application

This standard applies to whole maize seeds used directly or indirectly (food industry) for human consumption, whether or not packaged.

Note: This standard does not apply to processed maize.

3 Required References

The following mandatory documents contain the provisions referred to in the context of this Iranian National Standard. Therefore, these provisions are part of this Iranian National Standard.

If a document is referred while mentioning the date of publication, any subsequent amendments and revisions will not be considered by the national standard of Iran. In case of documents referred to without mentioning the date of publication, the last revision and subsequent amendments are always considered.

3-1 Iranian National Standard No. 7437, Corn, determination of moisture of complete and crushed seeds, test method

3-2 Iranian National Standard No. 2087, determination of grain sampling methods

3-3 Iranian National Standard No. 7310, cereals and its products, test sieves for cereals seeds, characteristics

3-4 Iranian National Standard No. 2863, method of measuring crude protein of cereals and its products

3-5 Iranian National Standard No. 2862, the method of measuring the fat of cereals and its products

3-6 Iranian National Standard No. 103, wheat flour - characteristics and test methods

4 Terms and Definitions

In this Standard, the following terms and definitions are used:

4-1

Corn

Corn is a one-year-old plant of the cereal family, Zea mays L. Although all types of corn come from the same species, they differ greatly in the texture, shape, size and colour of the seeds. Maize is divided into the following types:

4-1-1 Dent corn. This is Zea mays indentata L., also known as dent corn. It is the best type of maize for producing seed for human and animal consumption. It is the most common type of maize used to produce seed for human consumption. The sides of the seed are hard endosperm. The inner part of the crown of the seed is soft endosperm, which causes a hollow in the crown of the seed.

4-1-2 Corn flour (soft). Zea mays amilacia L., also known as flour corn. It is the oldest type of maize. The endosperm of maize flour consists almost entirely of very soft starch. The seeds tend to shrink evenly when dried, so they do not become jagged or the amount of jagging is very small.

4-1-3 Waxy corn. Zea mays Ceratina L., which is a type of dent corn, is called waxy corn. It owes its name to the waxy appearance of the endosperm, i.e. the surface of the seed is covered with a layer of wax. This phenomenon is due to the lack of glassy starch in the outer layer of the endosperm. The seeds of this type of maize are small.

4-1-4 Flint corn. Zea mays indurate L., also known as flint corn. This maize often has a layer of thick, hard and glassy endosperm. This layer covers most of the seed. The grain has a smooth and shiny surface.

4-1-5 Sweet corn. Zea mays Saccharata L., also known as sweet corn. This type of maize has glassy and sweet starch. Its seeds are semi-transparent and glassy. When it is ripe, the surface has wrinkles. This type of corn is harvested unripe with 70% humidity.

4-1-6 Pop corn. Zea mays Everata L., also known as pop corn. The seed of this
consists of a very hard endosperm with a small amount of soft starch in the middle. Pop corn is similar to durum corn, with smaller seeds. The seeds can be round or pointed.

Corn is also divided into the following types in terms of colour:

4-1-7 yellow corn

Seeds that are yellow and/or bright red, and seeds that are yellow and dark red are considered yellow maize. If the dark red colour covers less than 50% of the surface of the seed, it is also considered yellow maize.

4-1-8 white corn
Seeds that are white and/or light pink, and seeds that are white and pink are white maize. If the pink colour neatly covers less than 50% of the seed surface, it is also considered white maize.

4-1-9 red corn
Seeds that are light red and/or pink, and seeds that are pink, dark red and yellow are red maize. If the pink or dark red colour covers 50% or more of the seed surface, it is considered red maize.

4-2
Foreign matters
It refers to any substance other than maize that contains external organic and mineral materials.

4-2-1
Mineral Foreign matters
These **substances** include stone, soil, sand, etc.

4-2-2
Organic Foreign matters
Organic Foreign matters [impurities] include animal impurities (Foreign matters with animal sources) and other foreign matters [impurities].

4-2-2-1
Animal impurities (Foreign matters with animal origin)
This includes contamination from animal sources, such as dead insects and their organs.

4-2-2-2
Other Organic External Materials
These materials include organic matter such as straw and flats, excluding edible fodder parts of cereals (external seeds, stalks, etc.).

4-3
Damaged Seeds
Seeds that have been damaged by insects, larvae or pests. Also seeds with stains, disease, discolouration, germination and frostbite.

4-4
Other varieties of corn
Seeds that are considered to be something other than maize in terms of species and varieties.

4-5
Other Cereal Seeds
Includes wheat seeds, barley, oats (oatmeal), millet, rye, rice and sorghum.

4-6
Weed Seeds
Contains seeds of unwanted plants, with the exception of seeds from other grains.

4-7
Pest
Includes all living pests such as insects, ticks, fungi, bacteria, viruses, nematodes (at all stages of growth), rodents and birds.

4-8
Damaged by Pests
Traces of pest activity that can be seen on maize seeds with the naked or armed eye. These are traces left by insects and ticks, fungi, mold, worms, rodents and other pests.

4-9
Broken maize seed is seed that has been broken and/or crushed by mechanical means to expose part of the endosperm.

4-10
Volumetric Weight
The weight of a given volume of maize is usually measured in kilograms as the weight of 100 litres. This is called a hectolitre.

4-11
Damaged Heated Seeds
Seeds with a change in surface colour due to time spent in the drier.

4-12
Pesticide Residues
All pesticide derivatives such as converted products, pesticide degradation products, products under the influence of pesticide reactions and toxic impurities.

4-13
Fungal Toxins
Natural toxins are the result of the biological activity of some fungi produced under special conditions.

4-14
Seeds with Mold
Seeds in which mold is detectable by the naked eye.

4-15
Sprouted Seeds
The seeds in which the growth of the sprout is visible.

5 Unacceptable Factors

5-1 Corn seeds shall be free of any live pests at any of the growth stages.
5-2 Corn seeds shall be free of fungi, mold, and spores.
5-3 Corn seeds shall be free of pesticide residues.
5-4 Corn seeds shall be free of animal waste.
5-5 Corn seeds shall be free of toxic and non-toxic weeds.

6 Features

6-1 Physical Characteristics

6-1-1 Colours

Maize shall have a natural colour specific to the species, based on the definitions in paragraphs 4-1-7 to 4-1-9.
The limit for other colours shall be in accordance with Table 1.

Table 1 - Types of corn based on seed colour and the permissible limit of other colours

	Colour	**Limit of Other Colours**
1	Yellow Corn	Maximum 5% by weight Corn Seeds of Other Colours
2	White Corn	Up to 2% by weight Corn Seeds of Other Colours
3	Red Corn	Maximum 5% by weight Corn Seeds of Other Colours

6-1-2 Shape

Maize shall be of a specific shape for that species, based on the definitions in paragraphs 4-1-1 to 4-1-6 and Appendix 1. The limit of other shapes in some maize shapes shall be in accordance with Table 2.

	Shape	**Limit of Other Shapes**
1	Flint Corn	Maximum 5% by weight Corn Seeds of Other Shapes
2	Dent corn	Up to 5% by weight Corn Seeds of Other Shapes
3	Flint Corn and Dent corn	Maximum 5%-95 by weight Flint Corn Seeds

6-1-3 Smell

Corn seeds shall be without any external and unnatural caused by corruption.

6-2 Chemical characteristics

The chemical properties of corn should be in accordance with Table 3.

	Characteristics	Acceptable Amount	Test Method
1	Humidity (wt%)	Max 14	According to paragraph 1-10
2	Protein (percentage of weight based on dry matter)	At least 8 (6/25 protein coefficient)	According to paragraph 2-10
3	Fat (% weight based on dry matter)	Minimum 4	According to paragraph 3-10
4	Fiber (% by weight on dry matter)	Max 2/7	According to paragraph 4-10
5	Total ash (% by weight on dry matter basis	Max1	According to paragraph 5-10

6-3 Health Features

6-3-1 Remaining pesticides

Pesticide residues in maize seed should be determined in accordance with Iranian National Standard No. 6-6349 “Determination of the Limit of Maximum Pesticides in Cereals”.

6-3-2 Mycotoxins

The maximum tolerance of mycotoxins in maize seed must be in accordance with Iranian National Standard No. 5925 “Determination of the Maximum Tolerance of Mycotoxins in Human and Livestock Feed”.

6-3-3 Heavy metals

The amount of heavy metals in corn seed shall be as per Table 4.

Table -4 Amount of heavy metals in corn seed

Heavy metals	**Maximum Acceptable Amount**
Lead	0.2mg/kg
Cadmium	0.1mg/kg

7 Grading

Maize seed is divided into three grades on the basis of Table 5.

Table-5 Corn seed grading (by weight percentage)

Grade	Maximum Moisture	External Elements		Max Seeds Damaged		Maximum Broken Grains	Minimum Volume Weight
		With Animal Source	Total	Heated	Total		
1	14	0.02	0.5	0.1	3	1.5	70 kg in hectolitre
2	14	0.02	1	0.2	5	2	68 kg in hectolitre
3	14	0.02	2	0.5	7	3	65 kg in hectolitre

8 Sampling

Maize sampling must comply with Iranian National Standard No. 2087 “Method of Maize Sampling”.

9 Test Methods

9-1 Humidity Measurement

It shall be in accordance with Iranian National Standard No. 7437, Maize - Determination of moisture content of whole and crushed seeds - Test method.

9-2 Protein Measurement

It shall be in accordance with Iranian National Standard No. 2863, the method of measuring raw protein of cereals and products.

9-3 Fat Measurement

It shall be in accordance with Iranian National Standard No. 2862, the method of measuring fat in cereals and their products.

9-4 Fiber measurement

The method of measuring crude fibre shall be in accordance with Iranian National Standard No. 3105.

9-5 Measuring ash
It must be measured in accordance with Iranian National Standard No. 103, Wheat Flour - Characteristics and Test Methods.

9-6 Determining the disadvantages found in corn
Weigh 250 grams of maize seed with a tester, then use a magnifying tester to check for the presence of live pests at each stage of growth and mould. Then pass the test maize through a sieve with a circular diameter of 4.76 mm. Place the sieves in a shaking machine for 20 minutes or move them manually from right to left 20 times. Spread the maize seeds on the sieve and determine the amount of extraneous matter, damaged seeds, broken seeds, other seeds and weigh them and calculate the percentage of each defect. To determine the quantity of broken seeds, the seeds that pass through the holes of the sieve with a diameter of 4.76 mm and remain on the sieve with holes with a diameter of 2.38 mm must be evaluated.

9-7 Determining the volume weight
Pour the maize into a 1 litre container or a cylindrical container and measure it with a 100 gram sensitivity scale. Repeat this five times and take the average. The average should be multiplied by 100 and the resulting number will be the weight of one hectolitre.

10 Packaging
Maize must be packaged in such a way as to preserve its hygienic, nutritional, physical and chemical properties and to prevent any transfer of unpleasant odours or flavours. It must also be free of substances that are harmful or dangerous to the health of the consumer. Packaging materials must be of the approved type and comply with the relevant standards.

Bags used for packing must be new, clean and strong.
Packages must not weigh more than 40 kg.

11 Marking
The following information has to be clearly legible, for domestic use in Persian and for export in the language of country of buyer or English language. It shall be written with non-toxic and indestructible ink on any print/write package or labels. Each cargo shall be accompanied by the documents.

11-1 Type and species of Corn seed
11-2 Degree of the Corn seed
11-3 Net weight in kg
11-4 Name and address of the packing place and origin of corn production
11-5 Date of production (in month and year)
11-6 Conditions of Maintenance
11-7 Expiry date (in month and year)
11-8 Number of license made by the Ministry of Health and Medical Education
11-9 Series Number of its Manufacturing
11-10 The phrase (Made in Iran)

Appendix A
(Mandatory)
Corn Shapes
The distribution of floury and hard endosperm in different types of maize seed in longitudinal and transverse sections is based on Figure 1.

Figure 1 - Shapes of Corns

a dent corn
b flint corn
c nuts kernel
d flour corn with high lysine
e sweet corn