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Iran National Standards Organization

Animal Feeding Stuffs- Maize grain Specifications and Test Method

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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.

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Animal feeding stuffs- Maize grain Specifications and test method
(3rd revision)

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Foreword

The standard “Animal Feeding Stuffs- Maize Grain Specifications and Test Method”, which was first developed and published in 1983, was revised for the third time based on the suggestions received and the review and approval of the relevant commissions. It was approved at the one thousand six hundred and thirty-fourth meeting of the National Committee for Standardisation of Feed and Agricultural Products on 12 March 2018. Now this standard is published as the national standard of Iran in accordance with Article 3 of the Law on Amending the Rules and Regulations of Iran's Standards and Industrial Research Institute, approved in February 1993.

Iranian national standards are developed on the basis of National Standard of Iran No. 5 (National Standards - Structure and Writing Style). In order to maintain synchronisation and coordination with national and global developments and advances in the fields of industry, science and services, Iranian national standards are revised as necessary. Any proposed changes or additions to these standards are evaluated during the review process by the relevant technical commission. Therefore, the latest revision of national standards should always be used.

This standard replaces Iran’s national standard No. 1445 of the year 1997.

The sources used to prepare this standard are as follow:

1. Iranian National Standard No. 10690: 2008, Corn Characteristics and Test Methods
2. National Iranian Standard No. 3207: 1992, Health and microbiological characteristics of raw materials for poultry feed and ready feed
3. Technical Health Directive No. 22/25121 dated 10 Nov 2009 Veterinary Organization of the country affiliated to the Ministry of Agriculture Jihad
4. Council Directive 2002/32/EC of the European parliament and of the council of 7 May 2002 on undesirable substances in animal feed, Official Journal of the European Communities, 2013
5. Evaluation of the results of tests performed on animal corn samples in Marjaan Khatam Laboratory and Parto Bashash Laboratory in 2016 and 2017

Introduction

Corn is a year-old plant of cereals species (*Graminea*). Its scientific name is Zea mays and in English is called corn or maize. In terms of species, Corn has different varieties, the most important of which is as follows:

1. Dent Corn or *Zea mays indentata*. It is the most usual corn production that is used for human consumption and livestock.
2. Flour Corn (soft) or *Zea mays amylacia*
3. Waxy corn is kind of dent corn and it is called Waxy corn.
4. Flint Corn or *Zea mays indurate*
5. Sweet Corn or *Zea mays saccharata*
6. Pop Corn or mays *Zea mays everata*

Corn grain is one of the cereal seeds used in large quantities as an energy source in livestock, poultry and aquatic animal feeds. The energy production of maize depends on the branch in the endosperm and the bud, which has the highest amount of fat in it. The main protein in maize is called zein. The pigments in maize seeds also vary. Based on this pigment, there is yellow, white and red corn on the market. Yellow corn is more widely produced and consumed. It contains the pigment crepitoxanthin.

The quality and excellence of maize seed and the amount of energy it produces are influenced by many factors, including genetics, how the maize farm is managed and fertilised, the rate of growth and maturity of the grain, and weather conditions at harvest time. The way maize seed is processed also affects its quality. For example, high or prolonged heat during drying would burn off carbohydrates and reduce the amount of usable lysine amino acids. The amount of foreign matter, the number of broken seeds and the level of mycotoxin contamination can also affect the quality of the maize grain and the amount of energy available for metabolism. Basically, the difference between feed maize and maize suitable for human consumption lies in its quality and purity. Therefore, the amount of broken seeds and foreign matter (taking into account the permissible limit in the relevant national standards) is a good indicator for diagnosing the presence of these in a maize cargo.

In terms of genetically modified organisms, animal corn must comply with the Biosafety Law of the Islamic Republic of Iran approved in 2009. Animal maize should be produced or imported into the country with the approval of the Ministry of Agriculture Jihad.

Animal Feeding Stuffs- Maize grain Specifications and Test Method

1 Purpose and scope of application

The purpose of this standard is to determine the characteristics of sampling methods, test methods, and packaging of feed grade maize.

This standard applies to bulk or packaged corn seeds that are supplied for feeding, livestock, poultry and aquatic animal.

2 Required references

The following required documents contain the regulations that are referred to in the context of this Iranian National Standard. Thus, those 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.

The use of the following references is mandatory for this standard.

2-1 Iranian National Standard No. 13535, Cereals and Products – Sampling
2-2 Iranian National Standard No. 12004, Food and Agricultural Products - Sampling method for official control of mycotoxin levels
2-3 National Standard of Iran No. 6872, Human and Livestock Feed - Determination of Group B and G aflatoxins by high-performance liquid chromatography and purification with immunoaffinity column - Test method
2-4 National Standard No. 5925, Human and Livestock feed Maximum tolerance of mycotoxins
2-5 Iranian National Standard No. 7437, Corn - Determination of moisture content of whole and crushed seeds – Test method
2-6 Iranian national standard No. 11143, Livestock, poultry and aquatic animal feed- Determination of total ash
2-7 Iranian national standard No. 11485, Livestock, poultry and aquatic animal feed- Determination of insoluble ash in hydrochloric acid
2-8 Iranian National Standard No. 19052, Cereals and legumes Measurement of nitrogen content and calculation of the amount of crude protein- Kjeldahl Method
2-9 Iranian National Standard No. 2862 Method of measuring fat of cereals and its products
2-10 Iranian National Standard No. 3105, Agricultural food products- Measuring the amount of raw fibre- General method
2-11 Iranian National Standard No. 9266, Food- Measuring the Amount, Lead, Cadmium, Copper, Iron and Zinc- Optical absorption spectroscopy method
2-12 Iranian National Standard No. 16722, Food- Measuring of Low-Value Elements- Measuring the Total Arsenic by Hydride Generation Atomic Absorption Spectroscopy (HGAAS) after dry Charring process

2-13 Iranian National Standard No. 17378, Livestock feed- Mercury measurement by Cold Vapor Atomic Absorption Spectrometry (CVAAS) after compression digestion of microwave
2-14 Iranian National Standard No. 8366, Pesticides - Determination of residues in agricultural and livestock products - sampling methods
2-15 Iranian National Standard No. 13120, Pesticides- Maximum Residual Boundary of Pesticides - Cereal
2-16 Iranian National Standard No. 17026, Food with plant origin- Measurement of pesticide residues by gas chromatography- mass spectrometry or - liquid chromatography - sequential mass spectrometry after extraction of aceto-nitrile separation and dispersive SPE - Ketchers method - Test method
2-17 Iranian National Standard No. 20834, Food Chain Microbiology - Sampling Methods for Microbiology Tests
2-18 Iranian National Standard No. 1810, Microbiology of Food and Livestock Feed – a comprehensive method for the search and identification of Salmonella species.
2-19 Iranian National Standard No. 2946, Microbiology of Food and Livestock Feed - Escherichia coli Count Using the Maximum Probability Number of Crude Protein - Kjeldahl Method
2-20 Iranian National Standard No. 10899-3, Microbiology of food and Livestock Feed Method of measuring molds and yeasts – Part 3: Colony counting method in aqueous activity (a_w) equal to or less than 0.60.

3 Terms and Definitions

In this Standard, the following terms and definitions apply:

3-1
Feed grade maize (corn)

It is a corn seed used as an energy source in livestock, poultry, and aquatic animals' feed rations.
Note: Wherever the word "corn or maize" has been used, it means **Feed grade maize.**

3-2 Corn defects

Any factor that reduces the quality of the purity and nutritional value of corn seeds, but nevertheless, it is still applicable for livestock feed, poultry, and aquatic animals.
These defects are broken seeds (as per subparagraph 3-2-1) damaged seeds ((as per under subparagraph 3-2-2) Foreign matters (as per subparagraph 3-2-3) Seeds of other grains (as per subparagraph 3-2-4)

3-2-1 Broken kernels

The maize seed broken by mechanical factors (e.g. impact, pressure and blows) and its endosperm are exposed. The broken seeds pass through sieve no. 4 with holes of 4.75 mm diameter.

3-2-2 Damaged kernels

Maize seeds that are discoloured, damaged by heat or self-immolation, germinated, damaged by pests and frost.

Note 1 - Heat-damaged and discoloured seeds are those caused by the heat of the dryer or by self-immolation.
Note 2 - Pest-damaged seed is seed which has been damaged by pests (e.g. insects or rodents) in such a way that their effects (e.g. holes, cavities and changes in the appearance of the seed) can be seen on the maize seed with the naked or armed eye.
Note 3 - Sprouted seeds are seeds in which the plant has grown and is fully visible.
Note 4 - Frost-damaged seeds are those that have become wrinkled and discoloured due to extreme cold.

3-2-3
Foreign matters
Anything other than maize and other cereals includes:
3-2-3-1 Foreign matters with mineral origin e.g. rock, soil and sand
3-2-3-2 Foreign matters with animal origin e.g. bird and rodent dung, remains of dead insects, feathers and hair of animals
3-2-3-3 Foreign matters with plant origin such as straw and cob

3-2-4
Other grains
Other cereals such as wheat, oats, oatmeal, millet and sorghum.

3-3
Mass per hectoliter (bulk density)
A given volume weight (100 litres) of maize seed is measured in kilograms per hectolitre.

4 Characteristics of Feed Grade Maize

4-1 Physical features and appearance
4-1-1 Corn kernels must have their own natural colour, which varies from species to species and variety to variety, including yellow, white, red and purple.
4-1-2 Corn must be free of any unnatural odour, such as the smell of decay.
4-1-3 Corn must be free of all visible signs of fungal growth and mould.
4-1-4 Corn must be free of live pests.
4-1-5 Corn must be free of sharp foreign objects such as glass and metal pieces.

4-1-6 Corn must be approved by the legal and competent authorities (National Plant Protection Organisation affiliated to the Ministry of Agriculture Jihad) in terms of the presence of toxic weeds and toxic seeds.

4-1-7 Other physical characteristics of corn must be in accordance with Table 1

Table 1 - Acceptable limits of physical characteristics of corn

NO	**Characteristics**	**Acceptable limits**	**Description**
1	Volumetric Weight	Minimum 60 kg / hectolitre	Under subcategory 3-3
2	Brocken kernels	Maximum 8 g in 100 g	Under subcategory 1-2-3
3	Damaged Seeds	Maximum 10 g in 100 g	Under subcategory 2-2-3
4	Foreign Matters	Maximum 3 g in 100 g	Under subcategory 3-2-3
5	Other Grains	Maximum 2 g in 100 g	Under subcategory 4-2-3
6	All Defects[1]	Maximum 15 g in 100 g	Under subcategory 2-3
	1 The maximum of each maize defect must not exceed the acceptable limits in rows 2-5 of this table. Also Total Defects (in accordance with paragraph 3-2) shall not exceed 15 grams per 100 grams.		

4-2 Chemical properties

The chemical properties of corn has to be in accordance with Table 2.

Table 2 - Acceptable Chemical Characteristics of Corn

	Characteristics	**Acceptable limits in weight percentage ([1]as fed)**
1	Moisture	Max 14
2	Total Ash	Max 1.5
3	Insoluble ash in acid	Max 0.1
4	Protein [2]	Min 7.5
5	Fat	Max 3.8
6	Raw Fibre	Max 2.7
	Note- The acceptable limits allowed in this table are derived from source number 5 in the foreword to this standard. 1- This means that the maize seed is tested at the same moisture level when it arrives at the laboratory and is not dried prior to testing. The term "as fed" is used as opposed to “dry matter”. 2- The protein coefficient of corn is 6.25 (Nx6.25).	

4-3 Heavy metals

The acceptable limits of heavy metals in corn should be as per Table 3.

Table 3 - Acceptable Limit of Heavy Metals in Corn

	Characteristics	**Acceptable limits in weight percentage ([1]as fed)**
1	Lead	Max 10
2	Cadmium	Max 1
3	Arsenic	Max 2
4	Mercury	Max 0.2
	Note: Table 3 is derived from source no. 4 in the preface to this standard.	

4-4 Mycotoxins
The maximum allowable mycotoxins in feed maize must comply with Iranian National Standard No. 5925.

4-5 Pesticide Residues
The amount of pesticide residues in corn must be in accordance with Iran's National Standard No. 13120.

4-6 Microbial Characteristics
The microbial characteristics of the maize must be in accordance with Table 4. If only one sample is sent to the laboratory (single sample), the microbial characteristics of the sample must be compared with the limit of **m.**

Table 4 -Microbial Properties of Corn

No	Description of the Test	n	c	m	M
1	Escherichia coli (per gram)	5	2	10	500
2	Mold (per gram)	5	3	10^3	10^4
3	Salmonella in 25g	5	0	Negative	
	Note - Table 4 is derived from sources 2 and 3 written in the foreword to this standard.				

In Which:
n is the number of units of the sample from one value to be tested.
c is equal to the maximum number of defective sample units (with defects), whose results from testing can be greater than **m** and must be less than **M**. For microorganisms whose presence in food or product is dangerous, such as salmonella, **c** is zero.

m is equal to the maximum allowable number of microorganisms per gram or a qualitative criterion per unit sample, where only those sample units determined by criterion **c** can yield higher results.

M is used to separate the sample unit of acceptable conditional quality from the unacceptable quality. This measure is only used in the three-stage sampling procedure. Test results above the M criterion per sample unit are unacceptable and the result is rejection.

5 Sampling methods
5-1 Sampling of maize for physical, chemical and heavy metal testing according to Iranian National Standard No. 13535.
5-2 Sampling of maize for mycotoxin testing according to Iranian National Standard No. 12004.
5-3 Sampling of maize for microbial tests according to Iranian National Standard No. 20834.
5-4 Sampling of maize to determine pesticide residues according to Iranian National Standard No. 8366.
Note - If all tests can be performed with a single sample, the sample shall be taken in accordance with subparagraph 5-2.

6 Test methods

6-1 Perform the corn tests in accordance with Table 5.

Table 5- Test Methods Animal Maize

No	Test's Name	National Standard Number Test Method
1	Physical and appearance tests	In accordance with subparagraph 6-2 of this standard.
2	Volumetric Weight Measurement	In accordance with subparagraph 6-3 of this standard.
3	Humidity Measurement	7437
4	Total ash measurement	11143
5	Measurement of insoluble ash in acid	11485
6	Protein Measurement	19052
7	Fat Measurement	2862
8	Raw Fibre Measurement	2946
9	Escherichia coli count	1810
10	Measuring Mold	10899-3
11	Aflatoxin Measurement	6872
12	Determination of pesticide residues	17026
13	Lead and Cadmium Measurement	9266
14	Arsenic Measurement	16722
15	Mercury Measurement	17378

6-2 Testing Physical and Appearance characteristics

The physical and appearance characteristics of corn according to the following method:

6-2-1 First, homogenize and uniform the sample well.
Note 1 - Laboratory samples must be prepared in accordance with the standard method of sampling (in accordance with paragraph 5 of this standard) of maize lots. The sample sent to the laboratory must be the actual sample of the lot and must not have been damaged or altered during transport or storage.

Note 2- Perform the following steps on each of the laboratory samples separately and avoid mixing laboratory samples even if they are related to a single or sub-sample.

6-2-2 Harvest about 500 grams of laboratory samples as a test.
6-2-3 Examine the specimen for physical and appearance characteristics based on subparagraph 4-1
Note - It is best to use a magnifying glass to check for live pests and poisonous seeds.
6-2-4 Weigh 100 g of the sample (in accordance with paragraph 6-2-2 of this standard) as a test. Use a balance with an accuracy of 0,1 g and spread it out on a plate.
6-2-5 The foreign matter (as defined in paragraph 3-2-3 of this Standard) shall be separated from the sample, weighed and reported as a percentage by weight.

6-2-6 Sieve the remainder of the sample through a No. 4 sieve with 4,75 mm holes for 30 seconds. Consider what passes through the sieve as broken seed and weigh it.
Note- It is preferable to use a sieve shaker to sieve the sample. If this is not available, shake the sieve manually in a horizontal direction (right and left) parallel to the length of the sieve holes.

6-2-7 Spread the rest of the maize on a plate and remove damaged seeds and seeds of other grains as defined in paragraph 3-2 and weigh them separately.
Note 1- For each grain of maize that has more than one defect, only one of the most dominant defects is considered.
Note 2 - Measure the amount of each defect (as defined in paragraphs 6-2-4 to 6-2-7) at least three times for each sample and express the average results as a percentage by weight.
6-2-8 To calculate the total number of defects, add together the amount of each defect (the average of 3 replicates of the test). Divide the total amount obtained from the sampling (according to paragraph 6-2-4) and express the result as the sum of the percentage by weight.

6-3 Method of measuring volume weight
6-3-1 Pour the maize seed into a graduated cylinder without stirring until the volume reaches one litre.
6-3-2 Then weigh the maize seeds in the graduated cylinder to an accuracy of 0.01 grams. Repeat this operation 3 times and calculate the average in grams.
6-3-3 Multiply the result by 100 and then divide by 1000. Express the result as the hectolitre weight in kilograms per hectolitre.

7 Packaging and Supply
Corn can be supplied bulk or packed.
7-1 Bulk corn
7-1-1 Bulk maize must be delivered in such a way that the necessary information is included in the documents in accordance with the regulations of the legal authority in the country (Ministry of Agriculture-Jihad) and that the shipment is traceable.
7-1-2 Once the relevant legal approvals have been obtained, bulk maize must be transported in a way that meets all health regulations and protocols and fully protects the maize from the effects of environmental factors during transport.

7-2 Packed corn
7-2-1 Maize may be packed in bags, envelopes or large bags (jumbo bag/bog bag/bulk bag).
7-2-2 The packaging of the product must be fresh, clean, wholesome and resistant to moisture.
7-2-3 The packaging material must be suitable for animal feed and must not affect the contents.
7-2-4 Bags and envelopes must be properly and securely sealed and may not be re-used.

8 Marking
In the case of packaged corn, the following information must be legibly and indelibly marked on each package or bag. The language must be Persian for domestic use, English for export

and in the language of the buyer's country. This information must be written, printed or marked on the bags.

Note- Each jumbo bag must also contain documents that contain the necessary information mentioned in paragraph 8 of this standard. Also each bag must be traceable.

8-1 Name and type of product: Animal Maize
8-2 Name of the country of origin
Note- Domestic products must write "Iranian Product"
8-3 Name and the address of the packaging company
8-4 Net weight (in kg)
8-5 Packing date (month and year)
8-6 Usability dates (month and year)