

MANUAL ON STANDARDS OF MAIZE

1. INTRODUCTION

Promotion of standardization and grading of agricultural commodities is an important aspect of agricultural marketing. The agricultural commodities are heterogeneous and hence it is very essential to grade these commodities as per standards to command better price either at domestic or international market. Sale of Maize is offered on the basis of variety, wholesomeness, appearance, colour, presence of foreign matter, damaged grains, broken grains, admixture of inferior variety, moisture, harmful contaminants, etc. A quality grain is that which meets the end user specifications with respect to range of pre-determined Quality and Safety standards.

2. OBJECTIVE

The Manual has been designed with the objectives to

- (i) Create awareness about standards prescribed by various organizations for domestic and international markets so as to raise quality consciousness among the farmers, entrepreneurs and other market functionaries with the objective to equip them better to face the global competition in the post WTO era.
- (ii) provide details of various parameters responsible for quality; and
- (iii) describe the advantages of grading & standardization so that farmers may get prices commensurate with the quality produced by them.

3. IMPORTANT PARAMETERS RESPONSIBLE FOR QUALITY

3.1 Following Parameters are important in determination of QUALITY of Maize

- Foreign matter(organic and inorganic)
- Damaged grains
- Immature/Shriveled grains
- Weevilled grains
- Other edible grains
- Admixture of different varieties
- Moisture content

3.2 Following SAFETY parameters are important:

- Residue of Pesticides
- Poisonous/Heavy metals
- Aflatoxin
- Uric acid
- Microbial load

3.3 Parameters by which grades of Maize are differentiated:

Important parameters by which grades can be differentiated in case of Maize are

- Foreign matter (Organic and Inorganic)
- Damaged grains
- Other edible grains
- Admixture of different varieties
- Immature/Shriveled grains
- Weeviled grains
- Moisture content

4. STANDARDS APPLICABLE FOR PURCHASES BY FOOD CORPORATION OF INDIA (FCI).

4.1 The main objectives of the FCI are

- (a) Effective price support operations for safeguarding the interests of the farmers.
- (b) Distribution of food grains throughout the country for Public Distribution system and other Govt. of India schemes, and
- (c) Maintaining satisfactory level of operational/buffer stocks of food grains to ensure national food security.

4.2 To meet these obligations, the FCI make purchases of Maize and for this purpose following standards for all varieties of Maize are applicable (Marketing Season 2005-06)

The Maize shall be the dried and matured grain of *Zea mays*. The grain shall have uniform size, shape and colour. It shall be in sound merchantable condition and shall conform to standards framed under Prevention of Food Adulteration Rules.

1. Maize shall be sweet, hard, clean, wholesome and free from *Argemone maxicana* and *Lathyrus sativus* (kesari) in any form.
2. It shall be free from colouring matter, moulds, obnoxious smell and admixture of deleterious substances.

SCHEDULE OF SPECIFICATIONS

S.No	Refractions	Maximum Limit (%)
1	Foreign matter*	1.0
2	Other foodgrains	2.0
3	Damaged grains	1.5
4	Slightly damaged, discoloured and touched grains	4.5
5	Shrivelled & Immature grains	3.0
6	Weevilled grains	1.0
7	Moisture	14.0

* Not more than 0.25% by weight shall be mineral matter and not more than 0.10% by weight shall be impurities of animal origin.

N.B:

1. The definition of the above refractions and method of analysis are to be followed as given in Bureau of Indian Standard Method of Analysis for Foodgrains nos. IS:4333 (Part-I) 1967 and IS: 4333 (Part II) 1967 and Terminology for foodgrains IS:2813 -1995 as amended from time to time.
2. The method of sampling is to be followed as given in Bureau of Indian Standard Method of sampling of cereal and pulses No. IS: 14818-2000.
3. Within the overall limit of 1.0% for foreign matter, the inorganic matter shall not exceed 0.25% and poisonous seeds too shall not exceed 0.5% of which Dhatura and Akra Seeds (*Vicia* species) not to exceed 0.025% and 0.2% respectively.

DEFINITIONS:

Foreign Matter : Includes inorganic and organic matter. The inorganic matter shall include sand, gravel, dirt, pebbles, stones, glass and metallic pieces, lumps of earth, clay and mud. Organic matter shall include husk, chaff, straw, weed seed and other inedible grains.

Other Foodgrain : food grains other than the grain under consideration.

Damaged : Kernels or pieces of kernels that are sprouted or internally damaged as a result of heat, moisture, weather or microbes.

Slightly damaged or touched : Kernels or pieces of kernels that are damaged or discoloured, superficially so as not to affect the quality of the material.

Discoloured: Kernels or pieces of kernels that have changed the colour as a result of deteriorative changes.

Brokens : Pieces of sound kernels that are less than three-fourths of the size of the full kernels. In case of dals, pieces that are less than the size of three-fourths of the split pulses shall be considered as brokens.

Immature : Kernels or pieces of grain kernels that are not fully developed.

Weeviled Grains : Weeviled grains are grain kernels that are partially or wholly bored by insects injurious to grain but do not include germ-eaten grains and egg-spotted grains.

Moisture: The loss in mass caused as a result of heating for two hours at 130 to 133 degree centigrade under specified conditions and expressed as percentage,

5. STANDARDS APPLICABLE FOR STORAGE OF MAIZE

5.1 CENTRAL WAREHOUSING CORPORATION (CWC) : The CWC works as an agent of the government for purchase, sale, storage and distribution of agricultural and industrial commodities, seeds, fertilizers and notified commodities for individual, cooperatives and other institutions in the country. CWC provides modern efficient warehousing to ensure maximum returns to the growers with better opportunities. It provides scientific facilities to the farmers for the stock of agricultural produce at a reasonable cost. CWC issues Warehouse Receipts to a person depositing goods in the warehouse. The banking institutions accept the Warehouse Receipts as co-lateral security for grant of loans to the holder of the Warehouse Receipt on its being endorsed and delivered to them. Thus, warehousing plays an active role in marketing and also provides socio-economic gains to the farmers, who otherwise get exploited by the middlemen and are forced to have distress sales.

5.1.1 Standards of Central Warehousing Corporation

Central Warehousing Corporation follows standards given in item 4.2 for accepting Maize for storage in Warehouses.

Central Warehousing Corporation has following categorization for deciding the period of storability of Maize in the Warehouses.

Percentage of Weevilled grains :

Up to 1%	A
Above 1% up to 4%	B
Above 4% up to 7%	C
Above 7% up to 15%	D

In order to have better storability of maize, farmers are advised to ensure that maize for storage has Weevilled grains less than 1% (by count).

6. STANDARDS APPLICABLE FOR DOMESTIC MARKET

6.1 The Prevention of Food Adulteration Act, 1954 (PFA Standards)

Prevention of Food Adulteration Rules, 1955 (PFA Rules) have been notified to carry out the provisions of the Prevention of Food Adulteration Act, 1954. These Rules define the standards of quality and fix the limit of variability permissible in respect of article of food. These Rules also provide guidelines for packing and labeling of an article of food. Standards framed under the provisions of the Rules are popularly called PFA standards. PFA standards prescribe minimum limit for Quality as well as Safety parameters. PFA standards are minimum standards and are **mandatory**. However, they do not differentiate between Quality. **Food articles being sold in the market should comply with PFA standards.** Standards of Maize prescribed in PFA Rules, 1955 are as follows :

6.1.1. QUALITY PARAMETERS:

Description: Maize shall be the dried mature grains of *Zea mays* Linn. It shall be sweet, hard, clean and wholesome. It shall also conform to the following standards, namely :-

- (i) Moisture - Not more than 16.0 per cent by weight (obtained by heating the pulverized grains at 130 C ó 133 C for two hours).
- (ii) Foreign matter (Extraneous matter) - Not more than 1 per cent by weight of which not more than 0.25 per cent by weight shall be mineral matter . and not more than 0.10 per cent by weight shall be impurities of animal origin .
- (iii) Other edible grains - Not more than 3 per cent by weight.
- (iv) Damaged grains - Not more than 5 per cent by weight
- (v) Weevilled grains - Not more than 10 per cent by count

Provided that the total of foreign matter, other edible grains and damaged grains shall not exceed 9 per cent by weight.

6.1.2 SAFETY PARAMETERS:

Uric Acid: Not more than 100 mg. per kg.

Aflatoxin: Not more than 30 micrograms per kg.

Limits for insecticides and pesticides

Following maximum limits are prescribed for residues of insecticides and pesticides

Sl.No.	Name of insecticides	Tolerance Limit mg/kg. (p.p.m)
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1.	Alachor	0.10
2	Aldrin, dieldrin, (The limits apply to aldrin and dieldrin singly or in any combination and are expressed as dieldrin)	0.01
3	Benomyl	0.50
4	Carbaryl	0.50
5	Chlordane (residue to be measured as cis plus trans chlordane)	0.02
6	Chlorfenvinphos (residues to be measured as alpha and beta isomers of chlorfenvinphos)	0.025
7	Chlorpyrifos	0.05
8	Carbendazim	0.50
9	Carbofuran(Sum of carbofuran and 3-hydroxy carbofuran expressed as carbofuran)	0.10
10	Diazinon	0.05
11	Dichlorvos (Content of dichloroacetaldehyde (D.C.A) be reported where possible)	1.0
12	Decamethrin/Delta methrin	0.50
13	2,4-D	0.01
14	Dithiocarbamates(The residue tolerance limits are determined and expressed at mg/CS ² /kg and refer separately to the residues arising from any or each groups of dithiocabamates; (a) Dimethyl dithiocarbamates residue resulting from the use of ferbam or Ziram, and (b) Ethylene bis dithiocarbamates resulting from the use of mancozeb maneb or Zineb(including Zineb derived from nabam plus Zinc sulphate)	0.20
15	Diuron	0.50
16	Ethion (Residues to be determined as ethion and its oxygen analogue and expressed as ethion)	0.025
17	Fenitrothion	0.02
18	Fenthion (Sum of fenthion, its oxygen analogue and their sulphoxides and sulphones, expressed as fenthion)	0.10
19	Heptachlor (combined residues of heptachlor and epoxide to be determined and expressed as heptachlor)	0.01
20	Hexachlorocyclohexane and its isomers(Gamma isomer known as Lindane)	0.10
21	Hydrogen cyanide	37.5
22	Inorganic bromide (determined and expressed as total bromide from all sources)	25.0

23	Malathion (Malathion to be determined and expressed as combined residue of malathion and malaoxon)	4.0
24	Metalyxyl	0.05
25	Monocrotophos	0.025
26	Oxydemeton methyl	0.02
27	Paraquat-Dichloride(Determined as paraquat cations)	0.1
28	Phosphamidon residues (expressed as the sum of phosphamidon and its desethyl derivative).	0.05
29	Phenthoate	0.05
30	Phorate (sum of phorate, its oxygen analogue and their sulphoxide and sulphones, expressed as phorate)	0.05
31	Pirimiphos-methyl	5.00
32	Trichlorfon	0.05
33	Thiometon (residues determined as thiometon its sulfoxide and sulphone expressed as thiometon)	0.025

Poisonous Metals:

Following limits are prescribed for poisonous metals

	Name of the Poisonous metal	parts per million by weight
1	Lead	2.5
2	Copper	30.0
3	Arsenic	1.1
4	Tin	250.0
5	Zinc	50.0
6	Cadmium	1.5
7	Mercury	1.0
8	Methyl Mercury	0.25
	(Calculated as the element)	

7. STANDARDS FOR GRADING :

7.1 GRADING - Grading provides description of the quality of the consignment and assists in the formation of a legally binding agreement. It facilitates proper marketing of agricultural commodities. It also ensures that agricultural commodities move through the market faster and without obstructions. This also facilitates transactions without physical verification by the distant buyers.

Advantages of Grading:

- It brings confidence between the buyer and the seller.
- It facilitates interstate and international marketing.
- Disputes in the market can be solved amicably.
- Stability of the price is ensured.

- Farmers can take loans easily from the banks on the basis of grades of produce stored in the godown
- Arbitrary fixation of price by middlemen is eliminated.
- Brings about improvement of the crop.
- Reduces risk of producer and seller in transactions.
- Future marketing is facilitated. Grades become a commercial measure of quality.
- It also helps in implementation of contract farming.

7.2. AGRICULTURAL PRODUCE (GRADING & MARKING) ACT, 1937 (AGMARK STANDARDS).

Standards of various agricultural commodities prescribed under the provisions of the Agricultural Produce (Grading & Marking) Act, 1937 are popularly known as AGMARK Standards. AGMARK standards comply with minimum standards of quality & safety prescribed in Prevention of Food Adulteration Rules, 1955. In addition AGMARK standards differentiate between quality by having four grades for Maize. The grades are differentiated on the basis of moisture, foreign matter, other edible grains, admixture of different varieties, damaged grains, immature and shriveled grains, weevilled grains etc.

7.2.1 AGMARK Standards of Maize:

Grade designation and definition of quality of Maize

Grade designation	Definition of quality							
	Special requirements							
Maximum limit of tolerance (per cent by weight)								
	Moisture	Foreign matter			Admixture of edible Grains varieties	Damaged grains	Immature grains	(p
		Organic and different er cent by Count)	Inorganic Weevilled grains	Other				
1	2	3	4	5	6	7	8	9
Grade I	12.0	0.10	Nil	0.5	5.0	1.0	2.0	2.0
Grade ó II	12.0	0.25	0.10	1.0	10.0	2.0	4.0	4.0
Grade ó III	14.0	0.50	0.25	2.0	15.0	3.0	6.0	6.0
Grade ó IV	14.0	0.75	0.25	3.0	15.0	4.0	6.0	8.0

General requirements

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Maize Shall :-

- (a) be the dried mature grain of *Zea mays* L.;

- (b) be sweet, hard, clean, wholesome, uniform in size, shape, colour and in sound merchantable condition;
- (c) be free from added colouring matter, moulds, weevils, obnoxious substances, discolouration, poisonous seeds and all other impurities except to the extent indicated in the schedule;
- (d) uric acid and aflatoxin shall not exceed 100 milligrams and 30 micrograms per kilogram respectively;
- (e) be free from rodent hair and excreta;
- (f) comply with the restrictions in regard to pesticides/insecticides residue (Rule 65), poisonous metals (Rule 57), naturally occurring toxic substances (Rule 57-B) and other provisions prescribed under the Prevention of Food Adulteration Rules, 1955 and as amended from time to time.

Note: In foreign matter, the impurities of animal origin shall not be more than 0.10 per cent by weight.

DEFINITIONS :

- (1) "Foreign matter means any extraneous matter than other food grains comprising of;
 - (a) "Inorganic matter" includes metallic pieces, dust, sand, gravel, stones, dirt, pebbles, lumps of earth, clay and mud and animal filth etc;
 - (b) "Organic matter" consisting of husk, straws, weeds and other inedible grains etc.;
- (2) "Other Edible grains" means any edible grains (including oil seeds) other than the one which is under consideration;
- (3) "Damaged grains" means grains that are sprouted or internally damaged as a result of heat, microbe, moisture or weather viz., ergot affected grains and kernel bunt grains;
- (4) "Immature and shrivelled grains" means grains that are not properly developed;
- (5) "Weevilled grains" means grains that are partially or wholly bored by insects injurious to grains but does not include germ eaten grains and egg spotted grains;
- (6) "Poisonous, toxic and/or harmful seeds" means any seeds which if present in quantities above permissible limit may have damaging or dangerous effect on health, organoleptic properties or technological performance such as dhatura (*D. fastuosa* linn and *D.stramonium* linn.) corn cokle (*Agrostemma githago* *L.Machai* *Lallium remulenum* linn.) Akra (*vicia* species).

Maximum tolerance limits for various food safety parameters such as poisonous metals, pesticide residues, aflatoxin, uric acid, etc. are as prescribed in Prevention of Food Adulteration Rules, 1955.

8. STANDARDS APPLICABLE FOR INTERNATIONAL TRADE.

8.1 CODEX ALIMENTARIUS COMMISSION (CAC)

Codex Alimentarius Commission (CAC) implements joint FAO/WHO Food Standards Programme. The purpose of the CAC programme is to protect the health of consumers and ensure fair practices in the food trade. The CAC is a collection of internationally adopted food standards presented in a uniform manner. Sanitary and Phyto-Sanitary Agreement and Technical Barriers to Trade Agreement of World Trade Organisation recognizes standards framed by CAC with respect to safety and quality aspects of food items. **Thus for international trade standards framed by CAC are recognized.**

8.1.1 Codex Standard For Maize (Corn)

SCOPE

This standard applies to Maize (corn) for human consumption, i.e. ready for its intended use as human food, presented in packaged form or sold loose from the package directly to the consumer. This standard specifies requirements for whole grain shelled dent maize, *Zea mays indentata* L., and/or shelled flint maize, *Zea mays indurata* L., or their hybrids. It does not apply to processed Maize.

Product Definition:

Maize (corn) is the shelled grains of the species defined in the Scope.

Quality factors – General

Maize shall be safe and suitable for human consumption.

Maize shall be free from abnormal flavours, odours and living insects.

Quality factors - Specific

Parameter	Maize(corn)
Moisture content, Max.	15.5% m/m
Organic extraneous matter, Max.	1.5% m/m
Inorganic extraneous matter, Max.	0.5% m/m
Filth (impurities of animal origin, including dead insects) Max.	0.1% m/m
KERNELS OF OTHER COLOURS <ul style="list-style-type: none">In yellow maize. Maize grains which are yellow and/or light red in colour are considered to be yellow maize. Maize grains which are yellow and dark red in colour, provided the dark red colour covers less than 50% of the surface of the grain, are also considered to be yellow maize.In white maize. Maize grains which are white and/or light pink in colour are considered to be white maize. White maize also means maize grains which are white and pink in colour, provided the pink	<p>MAX: 5.0% by weight of maize of other colours</p> <p>MAX: 2.0% by weight of maize of other colours.</p>

<p>colour covers less than 50% of the surface of the grain.</p> <ul style="list-style-type: none"> In red maize. Maize grains which are pink and white or dark red and yellow in colour are considered to be red maize, provided the pink or dark red colour covers 50% or more of the surface of the grain. Mixed maize <p>KERNELS OF OTHER SHAPE</p> <ul style="list-style-type: none"> In flint maize In dent maize Flint and dent maize. 	<p>MAX: 5.0% by weight of maize of other colours.</p> <p>MAX: 5.0% by weight of maize of other shapes. MAX:5.0% by weight of maize of other shapes. RANGE: 5.0% to 95% by weight of flint maize.</p>
<p>DEFECTS</p> <ul style="list-style-type: none"> Blemished grains: (grains which are insect or vermin damaged, stained diseased ,discoloured ,germinated frost damaged or otherwise materially damaged) ,Max. Broken kernels, Max. Other grains, Max. 	<p>7.0 % of which diseased grains must not exceed 0.5%.</p> <p>6.0%</p> <p>2.0%</p>

Toxic or Noxious Seeds

The maize(corn) shall be free from the following toxic or noxious seeds in amounts which may represent a hazard to human health.

Crotalaria (*Crotalaria* spp.), Corn cockle (*Agrostemma githago* L.) Castor bean (*Ricinus communis* L.), *Jimson* weed (*Datura* spp.) and other seeds that are commonly recognized as harmful to health.

HYGIENE

The maize(corn):

- Shall be free from microorganisms in amounts which may represent a hazard to health.
- Shall be free from parasites which may represent a hazard to health.

- Shall not contain any substance originating from microorganisms, including fungi, in amounts which may represent a hazard to health.

Heavy Metals

Maximum level of Lead 0.2 Mg/Kg

Maximum level of Cadmium 0.1 Mg/Kg

Pesticide Residues:

The maize(corn) shall comply with following maximum pesticide residue limits.

Sl.No.	PESTICIDE	MRL (mg/kg)
1	2,4-D	0.05
2	ALDICARB	0.05
3.	BENTAZONE	0.2
4	BIFENTHRIN	0.05
5.	CARBARYL	0.02
6.	CARBOFURAN	0.05
7.	CARBOSULFAN	0.05
8.	CHLORDANE	0.02
9.	CHLORPYRIFOS	0.05
10.	CYFLUTHRIN	0.05
11.	CYPERMETHRIN	0.05
12.	DIAZINON	0.02
13.	DIQUAT	0.05
14.	DISULFOTON	0.02
15.	ENDOSULFAN	0.01
16	ETHOPROPHOS	0.02
17.	FIPRONIL	0.01
18.	GLUFOSINATE-AMMONIUM	0.1
19.	GLYPHOSATE	1
20.	LINDANE	0.01
21.	METHIDATHION	0.1
22.	METHOMYL	0.02
23	METHOXYFENOZIDE	0.02
24.	PARAQUAT	0.1
25.	PHORATE	0.05
26.	PROPARGITE	0.1
27.	QUINTOZENE	0.01
28.	TERBUFOS	0.01