POST HARVEST PROFILE OF JOWAR

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1.0 INTRODUCTION

Jowar (sorghum) is one of the most important cereal crops in the world and is one of the four major food grains of our country. It is a staple food for millions of poor rural people in Asian and African countries. Besides being a major source of staple food for human beings, it also serves as an important source of fodder, animal feed and industrial raw material. During the year 2005, jowar was cultivated over an area of 43707.4 thousand hectares in the world producing about 59197.52 thousand tonnes of grains. Jowar is grown in semi-arid climate where other crops donot stand well. The crop withstand in drought condition. Nutritional value of jowar is given in Table No. 1.

Table No. 1: Nutritional value of edible portion of jowar per 100 gram

Energy (kcal)	Protein (g)	Carbo-hydrate (g)	Fat (g)	Ash (g)	Crude fibre (g)	Ca (mg)	Fe (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)
329	10.4	70.7	3.1	1.6	2.0	25	5.4	0.38	0.15	4.3

Source : Hulse, Laing and Pearson,1980: United states National research Council/National Academy of Sciences,1982.

1.1 Origin:

The origin of sorghum is generally believed to be around the present day Ethiopia or East Central Africa. Sorghum was taken from East Africa to India during the first millennium.

Botanical Description :

Jowar (*Sorghum bicolor* L. Moench) is an annual plant belonging to family Gramineae. Height of the plant varies from 0.5 to over 4.0 metres. The inflorescence of sorghum is a panicle, which is commonly known as heads. Grain is usually partially covered by glumes. The seed is rounded, pointed at the base. The colour of the grain is white, pink, yellow or brownish-yellow.

1.2 Importance :

Jowar is an important crop providing food, feed and fodder in the arid and semi-arid tropics of the world. It is a staple food for the rural poor in the country and African countries. It is primarily used as livestock feed and as industrial use in USA and other developed countries. Jowar is often referred to as “coarse grain” . Though it is a traditional subsistence crop but now changes its role to commercial/semi-commercial crop. The demand for jowar for feed purpose is the main driving force in rising the global production and international trade. It has also been used in the production of alcohol. The whole plant is used for forage, hay or silage. The sweet stalked sorghum is emerging as a potential raw material to the industries producing ethanol, jaggery and paper making. It is grown as kharif, rabi and also as summer sorghum.

2.0 PRODUCTION

2.1 Major producing countries in the world

It has been reported that during the year 2005, area under cultivation of jowar in the world was 43707.4 thousand hectares, with the production of 59197.52 thousand tonnes. U.S.A. was the largest producer of jowar with 16.86 percent of production in the world during the same period. The other major jowar producing countries were Nigeria (15.50 percent), India (12.67 percent), Mexico (9.33 percent), Sudan (7.22 percent), Argentina (4.89 percent), China (4.32 percent), Ethiopia (3.72 percent), Australia (3.40 percent), Burkina Faso (2.62 percent) and Brazil (2.57 percent) during the same period.India stood at first position with area of 9400.03 thousand hectares (21.51percent), but in production, it stood at third rank with production of 7500.00 thousand tonnes (12.67 percent) during the same year.

Area, production and average yield in major producing countries is given in Table No.2.

Table No. 2: Area, production and average yield of jowar in the major producing countries

Country	Area ('000 ha)				Production ('000 tonnes)				Yield(Kg/ha)		
	2003	2004	2005	% to world	2003	2004	2005	% to world	2003	2004	2005
Argentina	533.99	474.99	557.96	1.28	2,684.78	2,160.00	2,894.25	4.89	5,027.70	4,547.40	5,187.20
Australia	667.01	734	755.03	1.73	1,465.00	2,009.00	2,010.57	3.40	5,027.70	4,547.40	5,187.20
Brazil	753.77	931.29	788.04	1.80	1,804.92	2,158.87	1,520.54	2.57	2,394.50	2,318.20	1,929.50
Burkina Faso	1,676.78	1,438.10	1,438.07	3.29	1,610.26	1,399.30	1,552.91	2.62	960.3	973	1,079.90
China	1,335.34	569.53	1,088.01	2.49	2,879.54	2,340.83	2,558.80	4.32	2,156.40	4,110.10	2,351.80
Ethiopia	1,335.83	1,311.46	1,512.17	3.46	1,784.28	1,717.91	2,200.24	3.72	1,335.70	1,309.90	1,455.00
India	9,490.09	9,100.06	9,400.03	21.51	7,200.00	7,700.00	7,500.00	12.67	758.7	846.1	797.9
Mexico	1,972.60	1,832.50	1,599.24	3.66	6,462.20	7,004.40	5,524.38	9.33	3,276.00	3,822.30	3,454.40
Nigeria	6,935.74	7,031.42	7,284.43	16.67	8,016.00	8,578.00	9,178.00	15.50	1,155.80	1,220.00	1,259.90
Sudan	7,081.26	3,819.68	6,444.99	14.75	5,188.00	2,704.00	4,275.00	7.22	732.6	707.9	663.3
U. S. A.	3,155.75	2,637.40	2,321.33	5.31	10,445.90	11,523.34	9,981.00	16.86	3,310.10	4,369.20	4,299.70
Others	10,926.94	10,858.83	10518.1	24.06	9606.44	9802.59	10001.83	16.90	_	_	_
Total	**45865.1**	**40739.26**	**43707.4**	100.00	**59147.32**	**59098.24**	**59197.52**	100.0	_	_	_

Source : www.faostat.fao.org

2.2 Major Producing States in India:

India is one of the major producing country. In the year 2005-06, Maharashtra occupied the highest position in production of jowar with 3.90 million tonnes of production (51.11%). Share of other states in production was Karnataka (21.89%), Madhya Pradesh (8.26%), Andhra Pradesh (7.73%), Tamil Nadu (3.01%), Uttar Pradesh (3.15%), Gujarat (1.97%), Rajasthan (2.23%), Haryana (0.26%) and Orissa (0.13%).

In regards to area under Jowar, during 2005-06, Maharashtra ranked first with 4.74 million hectares (54.67%), followed by Karnataka (17.53%), Rajasthan (6.81%), Madhya Pradesh (6.69%), Andhra Pradesh (5.07%), Tamil Nadu (3.69%), Uttar Pradesh (2.65%), Gujarat (1.50%), Haryana (1.04%) and Orissa (0.12%).

Area, production and average yield in major producing states is given in Table No.3.

Table No. 3: Area, production and average yield of jowar in the major producing states during 2001-2002 & 2002-2003

Name of State	Area (million hectares)			Production (million tonnes)			Yield Kg/ha)	
	2004-05	2005-06	%	2004 - 05	2005-06	%	2004-05	2005-06
Maharashtra	4.76	4.74	54.67	3.62	3.90	51.11	762	824
Karnataka	1.66	1.52	17.53	1.44	1.67	21.89	863	1095
Madhya Pradesh	0.66	0.58	6.69	0.63	0.63	8.26	957	1088
Andhra Pradesh	0.50	0.44	5.07	0.52	0.59	7.73	1032	1324
Tamil Nadu	0.38	0.32	3.69	0.25	0.23	3.01	669	732
Uttar Pradesh	0.25	0.23	2.65	0.25	0.24	3.15	1020	1065
Gujarat	0.18	0.13	1.50	0.21	0.15	1.97	1154	1138
Rajasthan	0.57	0.59	6.81	0.27	0.17	2.23	464	288
Haryana	0.10	0.09	1.04	0.03	0.02	0.26	271	273
Orissa	0.01	0.01	0.12	0.01	0.01	0.13	545	600
Others	0.02	0.02	0.23	0.01	0.02	0.26	--	--
All India	**9.09**	**8.67**	**100**	**7.24**	**7.63**	**100**	**797**	**880**

Source : Agricultural Statistics at a glance, 2006-07, Department of Agril. & Co-op. New Delhi.

2.3 Important varieties of Jowar grown in India:

In India, the varieties suitable for different agro-climatic conditions have been developed and are grown in various states as Kharif, Rabi or Summer crops.

Varieties grown in various states are given in Table No. 4.

Table No. 4: Varieties grown in various states in the country

Sl. No.	State	Varieties
1	Andhra Pradesh	PSV-1(SPV-462),CSH-5,CSH-6,CSH-9, CSH-10, CSH-11, CSH-14,PSH-1, NTJ-2, CSV-14R, M-35-1, Pachcha Jonnalu,Tella Jonnalu
2.	Gujarat	BP-53, SURAT-1, GJ-108, BC-9, GJ-3B, GJ-40,GJ-41,GSH-1, CSH-5,CSH-6,CSH-11,GJ-9,GJ-36,GJ-37,GJ-38, CSH-2-13, GFH-4
3.	Karnataka	CSH-5, CSH-10, CSH-12 R, CSH-14, CSV-5,D-340, M-35-1
4.	Maharashtra	CSH-5,CSH-9,CSH-13, CSH-15(R), CSH-16, CSV-12, SPV-475,SPV-946,SPV-504, M-35-1
5.	Orissa	CSH-1, CSH-2,CSH-5, CSV-13,CSV-15, Swarna, Varsha,MFSH-4
6.	Tamil Nadu	CSH-1, CSH-5, CSH-6,CSH-9,CO-10, CO-18,CO-19, CO-20,CO-21, CO-25, CO-26,COH-3, COH-4, K-4 K-5,K-6,K-8,K-10, K-11,K-TALL,PAIYUR-1,PAIYUR-2, BSR-1, APK-1
7.	Uttar Pradesh	CSH-16, CSH-14,CMH-9,CSB-15,CSB-13, VARSHA,Mau T-1,Mau T-2.

Source: State Agriculture Deptts. through the Sub-offices of D.M.I.

Table No. 5: Varieties classification according to their maturity status

Maturity status	Duration (in days)	Hybrids	Varieties
KHARIF			
Early	95-105	CSH 1, CSH 6, CSH14,CSH 17	_
Medium	105-110	CSH 5,CSH 9, CSH 10,CSH11, CSH 13,CSH 16,CSH 18	CSV10, CSV 11, CSV 13, CSV 15
Sweet sorghum	118-120		SSV 84
RABI			
Early	105-110	-	-
Medium	110-120	CSH 8R,CSH12R, CSH 13 R, CSH 15 R	CSV 8R, CSV 14R, M 35-1

Source: National Research Centre for Sorghum, Hyderabad

3.0 POST- HARVEST MANAGEMENT

3.1 Post-harvest losses:

It has been estimated that about 2.20 percent of jowar is lost at farmers' level during harvesting, threshing, winnowing, transportation and storage. Estimated post-harvest losses at producers' level is given in Table No. 6.

Table No.6: Estimated post- harvest losses of jowar at producers' level

Sl.No.	Operations	Losses (percent to total production)
1.	Losses in transport from field to threshing floor	0.68
2.	Losses in threshing	0.65
3.	Losses in winnowing	0.32
4.	Losses in transport from Threshing floor to storage	0.21
5.	Losses in storage at farmers' level	0.34
Total		**2.20**

Source : Marketable Surplus and Post Harvest Losses of Jowar in India, 2002, Directorate of Marketing & Inspection, Nagpur.

To minimise post harvest losses, the following measures should be followed.

- The crop should be harvested on attaining physiological maturity.
- The grain should be cleaned and dried to bring the moisture content below 9 per cent.
- Use strong, and free from infestation packaging material for storage and transport.
- Use proper scientific technique in storage.
- Use pest control measures (fumigation) before storage.
- Provide aeration to stored grain and stir grain bulk occasionally.

- Seed should not be exposed to direct sunlight.
- Seed should be inspected at fortnightly interval.
- Use proper techniques while handling (loading & unloading), good and fast transport to avoid losses during transport.

Marketed surplus and Marketable surplus of jowar:

It has been estimated that about 39.72 percent is the marketed surplus and 32.51 percent is the marketable surplus of jowar in our countries. The state-wise estimated Marketed surplus and Marketable surplus of jowar is given in Table No. 7.

Table No.7: Estimated Marketed surplus and Marketable surplus of jowar

Name of State	Marketed surplus (percent to total production)	Marketable surplus (percent to total production)
Andhra Pradesh	40.76	21.97
Bihar	11.43	15.51
Gujarat	22.57	14.76
Haryana	7.45	10.45
Karnataka	27.47	13.90
Madhya Pradesh	45.78	35.60
Maharashtra	42.47	36.70
Orissa	3.43	8.27
Rajasthan	24.90	29.58
Tamil Nadu	58.66	55.33
Uttar Pradesh	42.01	44.07
ALL INDIA	39.72	32.51

Source : Marketable Surplus and Post Harvest Losses of Jowar in India, 2002, Directorate of Marketing & Inspection, Nagpur.

3.2 Harvesting Care :

The following harvesting care should be taken :

- Jowar grown for grain should be harvested when it attains physiological maturity.
- Dry earheads promptly as moisture content influence keeping quality.
- Avoid pest infestation during drying and threshing etc.
- Dry the jowar grains sufficiently (below 9 percent) prior to packing and storing.
- Jowar seeds should be dried in diffused sunlight in sun.
- Pack the jowar in jute bags free from infestation and obnoxious smell.
- Avoid harvesting during adverse weather conditions i.e. rains and overcast weather.
- Harvesting should be done by adopting proper method.

3.3 Grading:

Grading is the process of sorting of produce according to the grades or classes. In case of jowar, the quality factors such as moisture content, foreign matter, other food grains, admixture of other varieties, damaged grains, immature grains, weevilled and shrivelled grains are considered while grading. The farmers, in order to improve the quality of produce and obtain better price, clean the jowar with sieves to remove the dust, broken grains and small size shrivelled grains etc. The buyers offer the price on the basis of visual inspection of the lot or available sample considering above mentioned quality factors.

3.3.1 Grade specifications :

i) Specifications under AGMARK:

Under the Agricultural Produce (Grading and Marking) Act 1937, the national standards for jowar are notified, considering the quality factors like a) moisture, b) foreign matter, c) other food grains, d) admixture of different varieties, e) damaged grains, f) immature grains, and g) weevilled and shrivelled grains.

GRADE DESIGNATION AND DEFINITION OF QUALITY OF RABI JOWAR

A) General characteristics :

Jowar shall-

a) be the dried mature grains of Sorghum vulgare pers raised in the Rabi season;
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 miligrams 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 occuring 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 : (i) In foreign matter, the impurities of animal origin shall not be more than 0.10 per cent by weight.
(ii) Ergot affected grains shall not exceed 0.05 per cent by weight in damaged grains.

B) Special characteristics :

Grade designation	Maximum limits of tolerance (per cent by weight)						
	Moisture	Foreign matter		Other Edible Grains	Damaged Grains	Immature And shrivelled Grains	Weevilled Grains
		Organic	Inorganic				
Grade I	12.00	0.10	Nil	1.00	1.00	2.0	0.5
Grade II	12.00	0.25	0.10	1.50	2.00	4.0	1.0
Grade III	14.00	0.50	0.25	2.00	3.00	6.0	2.0
Grade IV	14.00	0.75	0.25	4.00	5.00	8.0	6.0

GRADE DESIGNATION AND DEFINITION OF QUALITY OF KHARIF JOWAR

A) General characteristics :

Jowar shall-

a) be the dried mature grains of Sorghum vulgare pers raised in the kharif season;

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 miligrams 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 occuring 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 (i) In foreign matter, the impurities of animal origin shall not be more than 0.10 per cent by weight.

(ii) Ergot affected grains shall not exceed 0.05 per cent by weight in damaged grains.

B) Special characteristics :

Grade designation	Maximum limits of tolerance (per cent by weight)						
	Moisture	Foreign matter		Other Edible Grains	Damaged Grains	Immature And shrivelled Grains	Weevilled Grains
		Organic	Inorganic				
Grade I	12.00	0.10	Nil	0.50	1.50	1.00	1.0
Grade II	12.00	0.25	0.10	1.00	3.00	2.00	2.5
Grade III	14.00	0.50	0.25	2.00	4.50	5.00	4.0
Grade IV	14.00	0.75	0.25	3.00	5.00	8.00	5.0

C) 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 or earth, clay, 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 karnal 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 seed 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).

ii) Food Corporation of India Grade Standards:

UNIFORM SPECIFICATION FOR J0WAR (MARKETING SEASON 2006-07)

The Jowar shall be dried and matured grains of Sorghum vulgare. It shall have uniform size, shape and colour. It shall be in sound merchantable condition and also conforming to PFA standards.

Jowar shall be sweet, hard, clean, wholesome and free from Argemone mexicana and Lathyrus sativus (khesari) in any form, coloring matter, ,moulds, weevils, obnoxious smell, admixture of deleterious substances and all other impurities except to the extent indicated in the schedule below :

SCHEDULE OF SPECIFICATION

S.No.	Refractions	Maximum Limits (%)
1.	Foreign matter *	1.0
2.	Other foodgrains	3.0
3.	Damaged grains	1.5
4.	Slightly damaged & discoloured grains	1.0
5.	Shrivelled & Immature grains	4.0
6	Weevilled grains	1.0
7.	Moisture content	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 India 'Standard "Method of Analysis for foodgrains" Nos. IS: 4333 (Part-I): 1996 and IS:4333 (Part-II):2002 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 Cereals and Pulses ` No. IS : 14818-2000 as amended from time to time.

3. Within the overall limit of 1.0% for "Foreign Matter" the poisonous seeds shall not exceed 0.5% of which Dhatura and Akra seeds (Vicia species) not to exceed 0.25% and 0.2% respectively.

4. Kernels with glumes will not be treated as unsound grains. During physical analysis the glumes will be removed and treated as organic foreign matter.

iii) CODEX STANDARDS:

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 Organization 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.

CODEX STANDARD FOR SORGHUM GRAINS
CODEX STAN 172-1989 (Rev. 1 - 1995)

The Annex to this standard contains provisions which are not intended to be applied within the meaning of the acceptance provisions of Section 4.A (I)(b) of the General Principles of the Codex Alimentarius.

1. **SCOPE**

This Standard applies to sorghum grains as defined in Section 2, 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. It does not apply to other products derived from sorghum grains.

2. **DESCRIPTION**

2.1 **Definition of the Product**

Sorghum grains are whole or decorticated grains obtained from species of *Sorghum bicolor* (L.) Moench. They may be suitably dried if necessary.

2.1.2 **Whole Sorghum Grains**

These are sorghum grains obtained as such after a complete threshing without any further treatment.

2.1.3 **Decorticated Sorghum Grains**

These are sorghum grains from which the external casings and whole or parts of the germ have been removed in an appropriate manner, using mechanical treatment.

3. **ESSENTIAL COMPOSITION AND QUALITY FACTORS**

3.1 **Quality Factors - General**

3.1.1 Sorghum grains shall be safe and suitable for human consumption.

3.1.2 Sorghum grains shall be free from abnormal flavours, odours, and living insects.

3.1.3 Sorghum grains shall be free from filth (impurities of animal origin, including dead insects) in amounts which may represent a hazard to human health.

3.2 **Quality Factors - Specific**

3.2.1 **Moisture Content** 14.5% m/m max.

Lower moisture limits should be required for certain destinations in relation to the climate, duration of transport and storage. Governments accepting the Standard are requested to indicate and justify the requirements in force in their country.

3.2.2 **Definition of Defects**

The product shall have not more than 8.0% total defects including extraneous matter, inorganic extraneous matter, and filth as contained in the standards and blemished grains, diseased grains, broken kernels, and other grains as contained in the Annex.

3.2.2.1 **Extraneous matter** is all organic and inorganic material other than sorghum, broken kernels, other grains and filth. Extraneous matter includes loose sorghum seedcoats. Sorghum grains shall have not more than 2.0% extraneous matter of which not more than 0.5% shall be extraneous inorganic matter.

3.2.2.2 **Filth** is impurities of animal origin including dead insects (0.1% m/m max).

3.2.3 **Toxic or noxious seeds**

The products covered by the provisions of this standard shall be free from the following toxic or noxious seeds in amounts which may represent a hazard to human health.
Crotolaria (*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.

3.2.4 **Tannin Content**

(a) For whole sorghum grains, the tannin content shall not exceed 0.5% on a dry matter basis.
(b) For decorticated sorghum grains, the tannin content shall not exceed 0.3% on a dry matter basis.

4. **CONTAMINANTS**

4.1 **Heavy Metals**

Sorghum grains shall be free from heavy metals in amounts which may represent a hazard to human health.

4.2 **Pesticide Residues**
Sorghum grains shall comply with those maximum residue limits established by the Codex Alimentarius Commission for this commodity.

4.3 **Mycotoxins**

Sorghum grains shall comply with those maximum mycotoxin limits established by the Codex Alimentarius Commission for this commodity.

5. **HYGIENE**

5.1 It is recommended that the product covered by the provisions of this standard be prepared and handled in accordance with the appropriate sections of the Recommended International Code of Practice -General Principles of Food Hygiene (CAC/RCP 1-1969, Rev. 2-1985, Codex Alimentarius Volume 1B) and other Codes of Practice recommended by the Codex Alimentarius Commission which are relevant to this product.

5.2 To the extent possible in good manufacturing practice, the product shall be free from

objectionable matter.

5.3 When tested by appropriate methods of sampling and examination, the product:
- 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; and
- shall not contain any substance originating from microorganisms in amounts which may represent a hazard to health.

6. **PACKAGING**

6.1 Sorghum grains shall be packaged in containers which will safeguard the hygienic, nutritional, technological, and organoleptic qualities of the product.

6.2 The containers, including packaging material, shall be made of substances which are safe and suitable for their intended use. They should not impart any toxic substance or undesirable odour or flavour to the product.

6.3 When the product is packaged in sacks, these must be clean, sturdy and strongly sewn or sealed.

7. **LABELLING**

In addition to the requirements of the Codex General Standard for the Labelling of Prepackaged Foods (CODEX STAN 1-1985, Rev. 1-1991, Codex Alimentarius Volume 1A), the following specific provisions apply:

7.1 **Name of the Product**

The name of the product to be shown on the label shall be "sorghum grains."

7.2 **Labelling of Non-Retail Containers**

Information for non-retail containers shall either be given on the container or in accompanying documents, except that the name of the product, lot identification and the name and address of the manufacturer or packer shall appear on the container. However, lot identification and the name and address of the manufacturer or packer may be replaced by an identification mark, provided that such a mark is clearly identifiable with the accompanying documents.

8. **METHODS OF ANALYSIS AND SAMPLING**

See Codex Alimentarius Volume 13.

ANNEX

In those instances where more than one factor limit and/or method of analysis is given we strongly recommend that users specify the appropriate limit and method of analysis.

FACTOR/DISCRIPTION	LIMIT	METHOD OF ANALYSIS
COLOUR White, pink, red, brown, orange, yellow, or any mixture of these colours. abnormal colour, Grtains whole natural colour has been modified by bad weather conditions, contact with the ground, heat and excessive respiration. These grains may be dull, shrivelled, swollen, puffed, or bloated in appearance.	Buyer Preference	Visual Examination
ASH Decorticated sorghum grains	MAX:1.5%on a dry matter basis	AOAC 923.03 ICCNo.104/1(1990) Method for the determination of ash in dereals and cereal products (Ashing at 900 C) (Type I method) ---or--- ISO 2171:1980 cereals, pulses and derived products
PROTEIN (N x 6.25)	MIN: 7.0% on a dry matter basis	ICC 105/1 (1986) Method for the determination of Crude Protein in Cereals and Cereal Products for Food and for Feed using selenium copper catalyst (Type I method) -----or---- ISO 1871:1975 ISO 5986:1983 – animal feedingstuffs-
FAT	Max : 4.0% on a dry	AOAC 945: 38F;

	matter basis	920.39C ----or---- ISO 5986:1983- animal feedingstuffs – Determination of Diethyl Ether Extract
CRUDE FIBER	Buyer Preference	ICC 113 Determination of Crude Fiber Value(Type I) -----or---- ISO 6541 (1981) Agricultural food products determination of crude fibre content-modified Scharrer method.
DEFECTS (Total) .blemished grains, (Grains which are insect of abnormal colour,sprouted, deseased, or otherwise materially damaged. . deseased grains. Grains made unsafe for human consumption due to decay, moulding, or bacterial decomposition, or other causes that may be noticed without having to cut the grains open to examine them.	 MAX: (Total) 8.0% MAX : 3.0% of which deseased grains must not exceed 0.5%	Visual Examination
DEFECTS (CONT.) **.** insect or vermin damaged grains. Kernels with obvious weevil-bored holes or which have evidence of boring or tunneling, indicating the presence of insects, insect webbing or insect refuse, or degermed grains, chewed in one or more than one part of the kernel which exhibit evident traces of an attack by vermin. .Grains having an abnormal colour,		

Grains whose natural colour has been modified by bad weather conditions, contact with the ground , heat and excessive respiration. These grains may be dull, shrivelled, swollen, puffed, or bloated in appearance .sprouted grains, Grains exhibiting obvious signs of sprouting . frost-damaged grains, Grains which are damaged by frost and may appear bleached or blistered and the seed coat may be peeling, Germs may appear dead or discolored. . broken kernels, Sorghum and pieces of sorghum which pass through a 1.8 mm round-hole sieve .other grains which are edible grains , whole or identifiable brokens, other than sorghum (i.e., legumes, pulses and other edible cereals.)	MAX:5.0% MAX:5.0%	

3.3.2 Adulterants and toxins

Aflatoxins are the type of mycotoxins, which are derived from the fungi, which affect human health. Aflatoxins are produced by *Aspergillus flavus, Aspergillus ochraceus* and *Aspergillus paraciticus.* Contamination of Aflatoxins occurs at any stage from field to storage, whenever environmental conditions are conducive for fungi, which grow under conditions of relatively high moisture/humidity. Drying is the most effective for controlling Aflatoxin. Avoid mechanical damage to seed during harvesting, drying, and storage. Jowar should be dried sufficiently (14% moisture) before storage. It should be stored at safe moisture level. Use proper scientific storage method. Store jowar preferably in new gunny bags. If old bags used, clean and treat it with either malathion spray or fumigant like aluminium phosphide @ 1 tablet of 3 g per m space. Prevent insect infestation by adopting chemical treatment to avoid fungus contamination. Separate the infested grains.

3.3.3 Grading at producer's level and under Agmark :

The scheme, Grading at producer's level was introduced in 1962-63 by the Directorate of Marketing & Inspection (DMI). The main objective of the scheme is to bring quality awareness among the producers and offer quality produce for sale. Under the scheme, the produce is subjected to simple tests and assigned a grade before sale. The programme is being implemented by the State Governments through the Agricultural Produce Markets. In India, till 31.3.2006, 2051 grading units were set up. During the year 2005-2006, about 103452.60 tonnes of Jowar valued at Rs. 6278.24 lakh was graded at producers' level.

Table No. 8: Progress of grading of jowar at producers' level and estimated value during 2005-2006

Year	Jowar (Quantity in tonnes)	Value (Rs. in lakhs)
2004-2005	103452.60	6278.24
2005-2006	27246.60	1836.44

Source : D.M.I., Faridabad (Agmark Grading Statistics 2005-2006)

Grading under Agmark :

Grading under Agmark is carried out by the Directorate of Marketing & Inspection in accordance with the grade specifications notified by the Govt. of India under the provisions of Agricultural Produce (Grading & Marking) Act, 1937 and rules made there under. The Directorate of Marketing & Inspection has prescribed the grade standards for Jowar.

3.4 Packaging :

Good packaging is necessary for easy handling, transportation and storage. The jowar is transported from field (threshing floor) to the market and storage godown in gunny bags. Good quality gunny bags either new or second hand with proper treatment are necessary to avoid spoilage and to protect the jowar from moisture and insect attack etc. For good packaging, the packages must posses following qualities:

- It must protect jowar well.
- It should be strong enough to sustain weight while handling and transportation.
- It must be convenient to handle.
- The size of the package should be restricted in such a way that it should be easy to lift and handle by a single person.
- It should be attractive, clean and free from any infestation etc.
- It should be marked with the description of the content viz. Commodity, name and address of packer, quantity, quality (Grade), variety and date of packing etc.

Method of packing :

- The graded jowar should be packed in new, clean, sound and dry jute bags, cloth bags, polywoven bags, polyethylene, polypropylene, paper packages or in other food grade plastic / packaging materials.

- The packages should be free from insect infestation, fungus contamination, deterious substances and obnoxious smell.

- Each package should contain jowar of one grade only.

- Each package should be securely closed and suitably sealed.

- Jowar shall be packed in quantities as specified under the provisions of the standards of Weights and Measures (Packaged Commodities) Rules, 1977 as amended from time to time.

- Suitable number of consumer packs containing graded material of the same lot may be packed in master container.

Availability of packaging material :

Jowar is packed in the bags of following material :

1. Jute bags
2. H.D.P.E./P.P.Bags
3. Polythene impregnated jute bags
4. Cloth bags for seed

Jute bags vs. H.D.P.E. bags: Jute is biodegradable material, while synthetic bag is not environment friendly. The disposal of unserviceable jute bags is easy compared to synthetic bags. Summary of comparative properties of HDPE (High Density Poly Ethylene) and jute bags is given as under :

Table No. 9: Properties of jute bags and HDPE bags

Properties	HDPE bags	Jute bags
1. Seam strength	Poor	Strong
2. Surface texture	Smooth	Rough
3. Operational convenience	Poor (With accident risk)	Good
4. Capacity utilization	Poor	Excellent
5. Stack stability	Poor	Excellent
6. Resistance to hooking	Poor	Fair
7. Drop test performance	Poor	Good
8. End use performance (w.r.t. bursting, damage, spillage, replacement)	Poor	Good
9. Grain preservation efficiency	Poor	Excellent

Source: Indian Institute of Packaging,Packaging India.

Qualities of good packaging material :

- ✓ It should be convenient in operations.
- ✓ The packaging material must preserve the quality of produce.
- ✓ It should be convenient to stack.
- ✓ It should be able to prevent spillage during transit and storage.
- ✓ It should be cost-effective.
- ✓ It should be clean and attractive.
- ✓ It should be biodegradable.
- ✓ It should be helpful in reducing the marketing cost by reducing the handling and retailing cost.
- ✓ Packing material should be reusable.

3.5 Transporation :

The following means of transportation are used at different stages of marketing.

Means of transportation used at different stages of marketing.

Stage of Marketing	Transportation by	Means of Transport
1. From field to the village market or primary market.	**Farmer**	By Head load, Pack animal, Bullock cart or Tractor's trolley.
2. From primary market to secondary whole sale market and miller	**Traders / Millers**	By Trucks, Railway wagons.
3. From miller and wholesale markets to retailer	**Millers / Retailers**	By Trucks, Railway wagons, Mini trucks.
4. From retailer to consumer	**Consumer**	By Head loads, Pack animal, Bullock / Hand cart, Rickshaw.
5. For Export	**Exporter/Trader**	By Ship, Air Cargo

Modes of Transport used :

There are different modes of transport used in jowar transportation. Road and Rail transport are normally used for internal markets. However, for export and import, mainly Sea transport is used. The most common modes of transportation are;

1) Road transportation: Road transport is the most popular mode for movement of jowar to the assembling markets as well as to the distribution centers. The following means of road transport are used in different parts of the country to transport jowar:

a) Bullock carts/camel carts:

Benefits:

1. Suitable for small quantity of produce.
2. Cheap and easily available.
3. Easy transport for short distance.
4. Easily manufactured by village artisan.
5. Easily operated on *kaccha* road, muddy or sandy path.

b) Tractor trolley:

Benefits:

1. Carry larger quantity of produce than bullock carts in less time.
2. Suitable to transport produce in primary assembling markets in the absence of proper *pucca* road connecting the villages and market.
3. Multipurpose use of tractor for farmers.

c) Trucks:

The truck is the most convenient means of transport throughout the country for longer distances for bulk quantity.

Benefits:

1. Suitable for long distance.
2. Comparatively easily available.
3. Quick movement.
4. Convenient during loading and unloading.
5. Provide door to door delivery.
6. Safe transport.

2) Railways: Railway is one of the most important means of transportation.

Benefits:

1. Suitable for carrying larger quantity of produce.
2. Suitable for long distances through out India.
3. Comparatively cheaper and safer mode of transport.

3) Water transport: This is the oldest and cheapest mode of transport. It includes river transport, canal transport and sea transport.

Benefits:

i) Suitable for carrying large quantity for export and import to other countries.
ii) Comparatively cheaper mode of transport.

Selection of mode of transport :

Following points may be considered while selection of mode of transportation:

- Mode of transport should be selected as per the requirement according to quantity and distance.
- It should be easily available at the time of transport, particularly during peak period after harvest.
- It should be comparatively cheaper among available alternatives.

- ✶ It should protect jowar from adverse weather conditions.
- ✶ It should be free from pilferage.
- ✶ It should be insured against any accident, natural calamities, etc.
- ✶ It should ensure delivery of goods within specified time and at specified destination.

3.6 Storage :

Requirements for safe and scientific storage :

Following requirements should be considered for safe and scientific storage of jowar:

I Selection of site : The storage structure should be located on a raised well drained site. It should be easily accessible. The site should be free from water logging, dampness, excessive heat, insects, rodents, termites etc.

II Selection of storage structure : The storage structure should be selected according to the quantity of jowar to be stored and the period of storage. In godowns sufficient space should be provided between two stacks, between stacks and walls, so that proper aeration can be available.

III Cleaning and fumigation : Before, storage of jowar, godown/structure should be properly cleaned and fumigated. There should be no cracks, holes or crevices in the structure.

IV Drying and cleaning grains : Before storage jowar grains should be properly dried and cleaned to avoid quality deterioration.

V Cleaning of bags : Always use new gunny bag. In case of second hand gunny bags, it should be disinfested by boiling in one percent Malathion Solution for 3 to 4 minutes and fully dried.

VI Separate storage of new and old stock : To prevent contamination from the old stock to new stock, it is advised to store them separately.

VII Use of dunnage : Bag of jowar should be kept on wooden crates or bamboo mats along with cover of polythene sheet to avoid absorption of moisture from the floor.

VIII Proper aeration : Proper aeration should be provided during dry and clean weather but care should be taken to avoid aeration in rainy season to protect the stock from moisture.

IX Cleaning of vehicles : The vehicles used for transportation of jowar should be cleaned by phenyl to avoid infestation.

X Regular inspection : To maintain proper health and hygiene of stock regular inspection of stored jowar is necessary. Periodic fumigation should be carried out in case of long storage.

3.6.1 Major storage pests and their control measures:

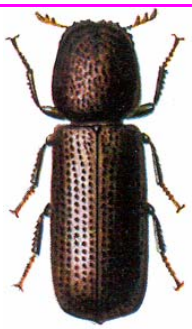
Various insects and pests during storage damage jowar. Losses due to damage are both qualitative and quantitative. It also damages viability of seed. Some of the jowar pests often start infestation in the field several weeks before the crop is harvested.

Factors affecting severity of damage:

The severity of infestation depends on following factors:

- Moisture in grain at the time of storage.
- Relative humidity in atmosphere.
- Temperature inside the store/container.
- Type of storage structure used.
- Storage period.
- Processing method adopted.
- Sanitation.
- Fumigation frequency etc.

Major stored grain pests of Jowar and their control measures are as under:

Name of pest	Figure of pest	Damage	Control measures
1. Rice weevil *Sitophilus oryzae* (Linn.)	  Adult Larvae	Adults and larvae both bore into grains and feed on the grain.	Two types of treatments are followed to control infestation. **A)Prophylactic treatment :** Use following insecticide to prevent infestation in godown and stock of jowar. **1.Malathion (50 percent EC):** Mix 1 litre in 100 litre of water. Use 3 litre prepared solution per 100 square meter area. Spray every 15 days interval. **2.DDVP (76 percent EC):** Mix 1 litre in 150 litre of water. Use 3 litre prepared solution per 100 square meter area. Do not spray on stock. Spray on walls and floors of the godown as and when required or once in a month. **3.Deltamethrin (2.5/WP):** Mix 1 kg. in 25 litre of water. Use 3 litre
2. Lesser grain borer *Rhizopertha dominica* (fabr.)		Beetles and larvae both penetrate the grain and feed. Sometimes, larvae feed on the waste flour produced by the adults. Heavy infestation makes the grain warm and moist, which leads to mould formation.	
3. Khapra beetle *Trogoderma granarium*	  Beetle Larvae	Larvae is a very serious stored pest but the beetle itself does not damage. First the larvae feed germ portion and later other parts of the grains.	

4. Saw-toothed grain beetle *Oryzaephilus surinamensis* (Linn.)		Both beetle and larvae feed broken grains and damaged grains of other insects. They are usually found as a secondary pest together with other grain pests.	prepared solution per 100 square meter area. Spray on gunny bags after 3 months' interval. **B) Curative Treatment :** Use following fumigation insecticide to control infested stock/godown of jowar in airtight condition. **1.Alluminium phosphide:** For stack fumigation use 3 tablets / tonne and put polythene cover on infected stock. For godown fumigation, use 120 to 140 tablets per 100 cubic meter area and keep godown structure airtight and closed for 7 days.
5. Red rust flour beetle *Tribolium castaneum (Herbst.)*		Beetle and larvae both do not cause damage to whole grain but feed on broken and damaged grains produced by milling and handling or infested /damaged grains of other insects.	
6. Rice moth *Corcyra cephalonica*		Larvae feed broken and processed jowar. Larvae produce dense webbings. Whole grain kernels are bound into lumps.	
7. Rodents		Rodents eat whole grains, broken grains, flour etc. They spill more grains than they consume. Rodents also contaminate jowar by hair, urine and feces, which cause diseases like cholera, food poisoning, ringworm, rabies etc. They also damage the storage structures and other accessories of storage like wire and cable etc.	**Rat cage :** Different types of rat cages are available in the market. Caught rats can be killed by dipping into water. **Poison baits :** Anti-coagulant pesticide like Zinc Phosphide is mixed with bread or any other food stuff used as bait. Keep baits for a week. **Rat burrow fumigation:** Put tablets of Aluminum Phosphide in each hole and burrow and block that hole by mud mixture to make it airtight.

3.6.2 Storage structures:

Jowar is stored to maintain the supplies between two harvests. Storage provides protection against weather, moisture, insects, micro-organisms, rats, birds and any type of infestation and contamination. In India, jowar is stored in following manner.

Traditional Storage structures	
1. Mud-bin	Made by bricks and mud or by straw and cow dung. These are usually cylindrical in shape with varying capacity.
1. Bamboo reed bin	Made by bamboo splits plastered with mixture of mud and cow dung.
3. Thekka	These are made up of gunny or cotton cloth wound around wooden support and generally in rectangular shape.
4. Metal drums	Made up with iron sheets in cylindrical and square shape with various sizes.
5. Gunny bags	Made up of jute.

Improved storage structures	
1. Improved bins	Different organisations developed and designed improved storage structures for scientific storage of food-grains, which are moisture resistant and rodent-proof. These are: a) Pusa Kothi c) Nanda bins e)PKV bins b) PAU bins d) Hapur Kothi f) Chittore stone bins etc.
2. Brick-built godowns	These are made by brick-walls with cemented flooring for storing jowar in bulk and bags.
3. CAP (Cover and Plinth) storage	It is an economical way of storage on a large scale. The plinth is made by cement concrete and bags are stacked in open and covered by ploythene cover.
4. Silos	Silos are used for storage of foodgrains. These are made from concrete, bricks and metallic materials with loading and unloading equipment.

3.6.3 Storage facilities :

I) Producer's storage:

Producers store jowar in bulk at farm godown or in own house using various types of traditional and improved structures. Generally, these storage containers are used for short period. Different organisations/institutions developed improved structures for jowar storage

with various capacities like Hapur kothi. Pussa bin, Nanda bin, PKV bin, etc. Other storage structures are also used for this purpose like brick-built rural godown, mud- stone godown etc. Producers also pack jowar in jute gunny bags or in gunny bags lined with polythene and stack in room.

II) Rural Godowns:

Considering the importance of rural storage in marketing of agricultural produce, the Directorate of Marketing and Inspection initiated a Rural Godowns Scheme, in collaboration with NABARD and NCDC. Its objective is to construct scientific storage godowns with allied facilities in rural areas and to establish a network of rural godowns in the States and Union Territories.

The main objectives of Rural Godowns Scheme are as under:

i) To prevent distress sale of foodgrains and other agricultural commodities immediately after harvest.
ii) To reduce quantity and quality losses arising from sub-standard storage.
iii) To reduce pressure on transport system in the post-harvest period.
iv) To help the farmers in getting pledge loans against the stored produce.

The statewise progress of the Rural Godown Scheme is given in Table No.10.

Table No.10: The state-wise progress of the Rural Godown Scheme as on 31.03.2007

S.No.	State	No.of projects	Total Capacity in tonnes
1.	Andhra Pradesh	735	2588759
2.	Arunachal Pradesh	1	945
3.	Assam	120	148338
4.	Bihar	292	77517
5	Chhatisgarh	245	808297
6	Gujarat	1887	699143
7	Haryana	347	1517074
8	Himachal Pradesh	31	3600
9	Jammu & Kashmir	2	2050
10.	Karnataka	1203	981607
11.	Kerala	65	28316
12.	Madhya Pradesh	1180	1920524
13.	Maharashtra	1459	1892152
14.	Meghalaya	39	13350
15.	Nagaland	5	4700
16.	Orissa	177	375053
17.	Punjab	3483	3938789
18.	Rajasthan	445	275720
19.	Tamilnadu	330	193349
20.	Uttar Pradesh	929	2110038
21.	Uttarakhand	71	133997
22.	West Bengal	1314	459683

23.	UTs	1	4000
24.	NAFED	6	30800
25.	NCCF	1	10000
	Total	**14368**	**18217801**

Source: www.agmarknet.nic.in

III) Mandi godowns :

Most of the jowar is transported to the market after the harvest. Generally, jowar is stored both in bulk and in bags. Most of the states and U.Ts. have enacted Agricultural Produce Marketing Regulation Acts. The APMCs constructed storage godowns in the market yards. At the time of keeping produce in godown, a receipt is issued indicating the kind and weight of produce stored. The receipt is treated as negotiable instrument and is eligible for pledge finance. The CWC and SWCs were also allowed to construct godowns in the market yards. Co-operative societies also constructed godowns in the market yards. Both in producing and consuming centers/markets, traders also possess permanent storage in the form of godowns or warehouses, or on hire basis.

IV) Central Warehousing Corporation (CWC):

CWC was established during 1957. It is the largest public warehouse operator in the country. In March 2005, CWC was operating 484 warehouses in the country. It has 16 regions, covering 225 districts, with a total storage capacity of 101.86 lakh tones. State-wise capacity with CWC as on 31.03.2005 is given below.

Table No.11 : State-wise storage capacity with CWC as on 31-03-2005

Name of State	No of warehouses	Total capacity (in tonnes)
1.Andhra Pradesh	50	1439916
2.Assam	6	64200
3.Bihar	13	97179
4.Chandigarh	1	13602
5.Chhattisgarh	10	236826
6.Delhi	11	181342
7.Goa	2	103847
8.Gujarat	29	622886
9.Haryana	25	439517
10.Himachal Pradesh	3	7040
11. Jammu & Kashmir	1	21150
12.Jharkhand	3	35913
13.Karnataka	32	453332
14.Kerala	9	129452
15.Madhya Pradesh	31	674748
16.Maharashtra	63	1564146
17.Nagaland	1	13000

18.Orissa	11	188206
19.Pondicherry	1	8940
20.Punjab	30	773999
21.Rajasthan	27	375347
22.Tamil Nadu	26	801127
23.Tripura	2	24000
24.Uttaranchal	7	75490
25.Uttar Pradesh	50	1155926
26.West Bengal	40	685264
Total	**484**	**10186395**

Source : Central Warehousing Corporation, New Delhi.

V) State Warehousing Corporations (SWCs) :

Different States have set up their own warehouses in the country. The area of operation of the State Warehousing Corporations is district places of the State. The total share capital of the State Warehousing Corporations is contributed equally by the Central Warehousing Corporation and the concerned State Government. The SWCs are under the dual control of the State Government and the CWC. As on 1st April 2005, SWCs were operating 1599 warehouses in the country with the total capacity of 195.20 lakh tonnes. The state-wise storage capacity available with SWCs as on 01.04.2005 are given below:

Table No.12: State-wise storage capacity available with SWCs as on 01.04.2005

Name of SWC	Total capacity (in lakh tonnes)
1. Andhra Pradesh	22.82
2. Assam	2.48
3. Bihar	2.03
4. Chhattisgarh	6.07
5. Gujarat	2.27
6. Haryana	16.07
7. Karnataka	8.98
8. Kerala	1.92
9. Madhya Pradesh	11.38
10. Maharashtra	12.20
11.Meghalaya	0.11
12.Orissa	4.05
13.Punjab	60.12
14.Rajasthan	7.19
15.Tamil Nadu	6.36
16.Uttar Pradesh	28.88
17.West Bengal	2.27
Grand Total	**195.20**

Source: Central Warehousing Corporation, New Delhi.

VI) Cooperatives :

Cooperative storage facilities are provided to the producer at cheaper rates, which reduces the storage cost. These cooperatives also provide pledge loan against the produce and storage is more systematic and scientific than traditional storage. Financial assistance and subsidies are provided by Government organisations/banks to build cooperative storage.

To meet the increasing need for storage capacity, the National Cooperative Development Corporation (NCDC) encourages construction of storage facilities by cooperative, particularly at rural and market level. The number and capacity of cooperative godowns assisted by NCDC in major states are given in Table No. 13.

Table No.13: State-wise co-operative storage facilities as on 31-3-2004

Name of State	Rural level	Market level	Total capacity (in tones)
1. Andhra Pradesh	4003	571	690470
2. Assam	770	264	298900
3. Bihar	2455	496	557600
4. Gujarat	1815	401	372100
5. Haryana	1454	376	693960
6. Himachal Pradesh	1640	209	204800
7. Karnataka	4958	960	693590
8. Kerala	1959	133	323335
9. Madhya Pradesh	5166	1024	1305900
10.Maharashtra	3852	1492	2010920
11.Orissa	1951	595	486780
12.Punjab	3884	830	1986690
13.Rajasthan	4308	378	496120
14.Tamil Nadu	4757	409	956578
15.Uttar Pradesh	9244	762	1913450
16.West Bengal	2834	469	483060
17.Other States	1046	233	644830
Grand Total	56096	9602	14119083

Source: National Co-operative Development Corporation, New Delhi.

3.6.4 Pledge finance :

Micro level studies indicate that distress sale by small farmers accounts for about 50 percent of the marketable surplus. To meet the immediate financial requirements, the farmers are often compelled to sell their produce immediately after harvest, when the prices are low. To avoid such distress sale, Government of India, promoted Pledge Finance through a network of rural godowns and negotiable warehouse receipt system. Through this scheme, small and marginal farmers can get immediate financial support to meet their requirements and retain the produce till they get remunerative price.

According to RBI guidelines, loan/advances up to 75 percent of the value of the produce stored in the godown can be advanced to farmers against pledge/hypothecation of agricultural produce including warehouse receipts subject to a ceiling of Rs. 5 lakh per borrower. Such loan shall be for a period of 6 month, which can be extended up to 12 months based on financing banks commercial judgement. The commercial/co-operative banks/RRBs provide credit to the farmers for the produce stored in the godown under this scheme. The banking institutions accept the godown receipt on its being duly endorsed and delivered to bank for pledge loan against hypothecation of produce as per RBI guidelines. Farmers are given freedom to take back their produce once the pledge loan is repaid. Facility of pledge finance is extended to all farmers, whether they are the borrowing members of Primary Agricultural Credit Societies (PACS) or not and the District Central Cooperative Banks (DCCBs) directly finance individual farmers on the strength of the pledge.

Benefits :

- Increase the retention capacity of the small farmers to avoid distress sale.
- Minimises the farmers' dependence on the commission agents as the pledge finance provides financial support to them immediately after harvest period.
- Participation of the farmers, irrespective of their land holding, helps in increasing the arrivals in market yards throughout the year.
- Gives a sense of security to the farmers even if their produce is not sold out in market yard immediately.

4.0 MARKETING PRACTICES AND CONSTRAINTS

4.1 Assembling:

The various agencies engaged in the assembling of Jowar are as below.

i) Producers
ii) Village Merchants
iii) Itinerant merchants
iv) Wholesale merchants and commission agents
v) Processor
vi) Co-operative Organizations

Major assembling markets :

Major assembling markets for jowar in important producing states are given in Table No.14.

Table No.14: Major markets for jowar in various states

Sl.No.	Name of state	Name of markets
1.	Andhra Pradesh	Nizamabad, Armoor, Adilabad, Chennur, Jogipet, Zaheerabad, Mahabubnagar, Badepalli, Suryapet, Miryaguda, Nandyal, Allagadda, Tandur.
2.	Gujarat	Vyara, Uttchal,
3.	Karnataka	Bangalore, Harapanahalli, Gulbarga, Bidar, Basavakalyan, Raichur, Belgaum, Hubli, Gadag, Bijapur, Talikote.
4.	Maharashtra	Jalgaon, Bhusaval, Bodvad, Yawal, Raver, Chopda, Pachora, Chalisgaon, Parola, Amalner, Jamner, Dharamgaon.
5.	Orissa	Gunpur, Rayagada, Umerkote, Tikabali.
6.	Rajasthan	Baran, Bhawani mandi, Jhalra Patan, Kota,Ramganj mandi, Gangapur, Malpura, Kekri,Iklera, Itawa, Nagaur.
7.	Tamilnadu	Dindigul , Perambalur, Namakkal, Coimbatore, Tiruchirapalli, Theni, Vellore, Madurai, Tirunelveli, Salem.
8.	Uttar Pradesh	Meerut, Hapur,Pukhrayan, Orai, Kalpi, Kadaura,Rath,Muspera, mahoba, saharanpur, Muzaffarnagar.

4.1.1 Arrivals :

It was reported that during 2002-03, total arrivals of jowar in 12 markets of Maharashtra was 1355687 tonnes followed by Tamil Nadu 147013 in 10 markets, Andhra Pradesh 90786.2 tonnes in 13 markets, in Uttar Pradesh 61890 tonnes in 12 markets and in Karnataka 48800 tonnes in 11 markets.

Table No.: 15 Arrivals of jowar in important markets of major producing states in India during 2000-01 to 2002-03

States	No. of Markets	Arrivals in tonnes		
		2000-2001	2001-2002	2002-2003
Andhra Pradesh	13	23559.5	56937.5	90786.2
Gujarat	02	145.5	89.6	785
Karnataka	11	54804	52883	48800
Maharashtra	12	1037063	1111984	1355687

Orissa	04	1140	1326	3248
Tamil nadu	10	183800	187322	147013
Uttar Pradesh	12	61455	64583	61890
Rajasthan	11	18951	16096	11681
Total	**75**	**1380918.0**	**1491221.1**	**1719890.2**

Source: State Departments of Agriculture Marketing.

4.1.2 Dispatches:

In most of the states, jowar is dispatched from assembling markets to the consuming markets within the state. In certain states like Gujarat, Karnataka, Maharashtra,Orissa and Uttar Pradesh, jowar is dispatched to other states. The dispatches from major jowar producing states to various destinations are given in Table No.16.

Table No.:16 Dispatches from major jowar producing states in India

Sl. No.	States	Dispatches to states apart from local markets
1	Andhra Pradesh	Within state
2	Gujarat	Maharashtra, West Bengal, Orissa
3	Karnataka	Tamil Nadu, Maharashtra
4	Maharashtra	Gujarat, Madhya Pradesh
5	Orissa	Andhra Pradesh, Madhya Pradesh, Chattishgarh, Delhi, West Bengal.
	Tamil Nadu	Within state
6	Uttar Pradesh	Haryana, Punjab

4.2 Distribution :

Assembling and distribution system of jowar are inter-related. Though the assembling by producers is confined mainly to post-harvest period, the distribution is continued throughout the year. Producers and itinary merchants assemble the produce in primary markets; there after various agencies are involved in distribution process up to the consumers. As per the survey of Marketable Surplus and Post-Harvest Losses of jowar (2000), it has been estimated that the marketable surplus was estimated to be about 32.51percent of total production.

4.2.1 Inter-State Movement :

Inter-state movement of jowar takes place by rail, road and river. Maharashtra, Karnataka, Andhra Pradesh, Madhya Pradesh, Orissa and Tamil Nadu are the major jowar producing states in the country. These states play major role in its inter-state movements. Andhra Pradesh, Karnataka, Maharashtra, Orissa and Uttar Pradesh are the major exporting states while Tamil Nadu, Maharashtra, Gujarat, Madhya Pradesh, Chattishgarh, Delhi, West Bengal, Haryana and Punjab are the main importing states.

4.3 Export and Import :

During the year 2004-2005, India exported 10826.885 tonnes of jowar , valued at Rs 79536.302 thousands. Major export was made to U.A.E. 8220.287 tonnes valued at Rs. 59043.065 thousands, followed by Saudi Arabia 1415.00 tonnes valued at Rs. 10221.907 thousands and Kuwait 361.37 tonnes valued at Rs. 3192.041 thousands.

Export of jowar during the years 2002-2003 to 2004-2005 is given in Table No. 17.

Table No. 17: India's country-wise export of jowar

Country	2002-03		2003-04		2004-05	
	Quantity (in Kgs)	Value (in Rs)	Quantity (in Kgs)	Value (in Rs)	Quantity (in Kgs)	Value (in Rs)
BAHRAIN	85622	679169	67000	501392	25000	196722
EGYPT	0	0	46000	415864	138000	1107277
U.K.	200260	2178636	138842	1579972	113810	1002904
JAPAN	561030	7534359	20000	203142	0	0
KUWAIT	261510	2449894	652240	5983808	361370	3192041
SRI LANKA	980360	6423181	166000	1816124	45000	307156
MOROCCO	0	0	0	0	108000	994560
MALAYSIA	79500	605369	55100	2489960	42200	514503
SOUTH AFRICA	4500000	31026375	22000	194303	0	0
SAUDI ARABIA	150000	1372313	1853000	14344910	1415000	10221907
U.A.E.	785160	6995317	892593	7681276	8220287	59043065
U.S.A.	20100	118502	18000	146312	20000	89131
YAMEN	750000	6424596	0	0	74058	996977
OTHERS	556619	5630214	4739638	30028497	264160	1870059
TOTAL	**8930161**	**71437925**	**8670413**	**86535560**	**10826885**	**79536302**

Source: www.apeda.com

4.3.1 Sanitary & Phyto-Sanitary (SPS) requirements :

The agreement on Sanitary and Phyto-Sanitary (SPS) measures is a part of the GATT Agreement, 1994, for export and import trade. The aim of the agreement is to prevent the risk of introduction of new pests and diseases in new regions i. e. importing countries. The main purpose of the agreement is to protect human health, animal health, and Phyto-Sanitary situation of all member countries and protect the members from arbitrary or unjustifiable discrimination due to different Sanitary and Phyto-Sanitary Standards.

The SPS agreement applies to all Sanitary and Phyto-sanitary measures, which may directly or indirectly, affect international trade. Sanitary measures deal with human or animal health, and Phyto-Sanitary measures are related to plant health. SPS measures are applied in four situations for the protection of human, animal or plant health :

- Risks arising from the entry, establishment or spread of pests, diseases, disease-carrying organisms or disease causing organisms.
- Risks coming from additives, contaminants, toning or disease-causing organisms in foods, beverages or feed stuffs.
- Risks arising from diseases carried by animals, plants or products thereof, or from the entry, establishment, or spread of pests.
- Prevention or limitation of damage caused by the entry, establishment or spread of pests.

The SPS standards commonly applied by Governments, which affect imports are:

i) **Import ban** (Total/partial) is generally applied when there is a significant rate of risk about a hazard.
ii) **Technical specifications** (Process standards/Technical standards) are most widely applied measures and permit import subject to compliance with pre-determined specifications.
iii) **Information requirements** (Labeling requirements/Control on voluntary claims) permit imports provided they are appropriately labelled.

Procedure for issue of SPS certificate for export:

In order to make plant materials free from quarantine and other injurious pests to conform with the prevailing phyto-sanitary regulations of the importing country, the exporter needs to give a suitable disinfestation / disinfection treatment, without affecting the viability for sowing / edibility of the plants/seeds.

For plant materials (seed, meal, extraction, etc.) meant for export, Government of India, has authorised some Private Pest Control Operators (PCO), who have the expertise, men and materials for treating the export agricultural cargo / produce. The exporter has to apply to the officer-In-charge (Plant Protection and Quarantine Authority, Department of Agriculture and Cooperation) for Phyto-Sanitary Certificate (PSC) in prescribed application form at least 7 to 10 days in advance of the export. Before submitting the application for issue of PSC, it should be ensured that the cargo is treated properly by the licensed PCO's.

4.3.2 Export procedure :

For export of jowar from India, exporter can take the help of following laid down procedure.

- Registration with RBI and obtain RBI code number. {Apply in prescribed form (CNX) to obtain registration No. from RBI and the number is to be quoted on all export papers}.
- Importer – Exporter code (IEC) number to be obtained from Director General of Foreign Trade (DGFT).

- Register with Agricultural and Processed Food Products Export Development Authority (APEDA) to obtain registration cum membership certificate. This is required to obtain permissible benefits from the Government.
- Exporter then procures their export orders.
- Quality of the produce is to be assessed by the inspecting agency and a certificate is issued to this effect.
- Produce is then shifted to port.
- Obtain marine insurance cover from any insurance company.
- Contact clearing and forwarding (C. & F.) agent for sorting the produce in godowns and to get the shipping bill for allowing shipment by the Custom Authority.
- Shipping bill is submitted by C. & F. Agent to custom house for verification and verified shipping bill is given to the shed superintendent to obtain carting order for export.
- The C. & F. Agent presents shipping bill to preventive officer for loading into ship.
- After loading into ship, a mate's receipt is issued by captain of ship to the superintendent of the port, who calculates port charges and collects the same from the C. & F. Agent.
- After the payment, C. & F. Agent takes mate's receipt and requests port authority to prepare bill of lading to the respective exporter.
- Then C. & F. Agent sends the bill of lading to the respective exporter.
- After receiving the documents, exporter obtains a certificate of origin from chamber of commerce, stating that the goods are of Indian origin.
- Importer is informed by exporter regarding date of shipment, name of vessel, bill of lading, customer's invoice, packing list etc.
- Exporter submits all documents to his bank for verification and bank verifies the papers against original letter of credit.
- After verification, bank sends documents to foreign importer to enable him to take delivery of produce.
- After receiving papers, importer makes payment through bank and sends the GR form to RBI, an evidence of realisation of export proceeds.
- Exporter now applies for various benefits from duty draw-back schemes.

4.4 Marketing constraints :

- **Unstable prices:** Generally, the price of jowar goes down in the post harvest period due to heavy arrivals in the market and later shoots up.
- **Lack of marketing information:** Due to lack of market information regarding prevailing prices, arrivals etc., most of the producers market the jowar in the village itself, which deprives them of getting remunerative returns.
- **Adoption of grading:** Grading of jowar at producers' level ensures better prices to producers and better quality to consumers. However, most of the markets are lagging behind in providing grading services at producers' level.
- **Inadequate storage facilities in rural areas:** Storage facilities in villages are found to be inadequate which contributes to distress sale. Due to lack of storage facilities at rural stage, substantial quantity is lost.

- **Transportation facilities at producers' level:** Due to inadequate facilities of transportation at village level, in most of the states, producers are forced to sell jowar in the village itself to itinerant merchants or traders directly at low prices.
- **Training of producer:** The farmers are not trained in marketing system. Training shall improve their skill for better marketing of their produce.
- **Malpractices in markets:** Many malpractices prevail in the markets of jowar i.e. excess weighment, delay in payment, high commission charges, delay in weighing and auction, different kinds of arbitrary deductions for religious and charitable purposes etc.
- **Financial problem:** Lack of market finance is one of the major marketing problems in the smooth running of marketing chain.
- **Infra-structure facilities:** Due to inadequate infra-structural facilities with producers, traders, millers and at market level, the marketing efficiency is affected adversely.
- **Superfluous middlemen:** The existence of a long chain of middlemen reduces the producer's share in consumer's rupee.

5.0 MARKETING CHANNELS, COSTS AND MARGINS

5.1 Marketing channels :

The following are the important marketing channels existing in the marketing of jowar:

1) **Producer ⇨ Wholesaler ⇨ Retailer ⇨ Consumer**

2) **Producer ⇨ Commission Agent ⇨ Wholesaler ⇨ Retailer ⇨ Consumer**

3) **Producer ⇨ Commission Agent⇨ Wholesaler⇨Broker ⇨Processor ⇨Consumer**

4) **Producer ⇨ Wholesaler ⇨ Retailer ⇨ Consumer**

5) **Producer ⇨ Retailer ⇨ Consumer**

6) **Producer ⇨ Consumer.**

Criteria for selection of channels :

There are many marketing channels involved in marketing of jowar. The following are the criteria for the selection of efficient marketing channels.

- The channel, which ensures reasonable return to producer, is considered to be good or efficient.
- Transportation cost in that channel.
- Commission charges and market margins received by the intermediaries, such as trader, commission agent, wholesaler and retailer.
- Financial resources.
- The shorter channel with minimum market cost should be selected.

5.2 Marketing costs and margins :

Marketing costs :

Marketing costs are the actual expenses incurred in bringing goods and services from the producer to the consumers. The marketing costs normally include;

i) handling charges at local points
ii) assembling charges
iii) transport and storage costs
iv) handling charges by wholesaler and retailer
v) expenses on secondary services like financing, risk taking and market intelligence, and
vi) profit margins taken by different agencies.

Marketing margins :

Margin refers to the difference between the price paid and received by a specific marketing agency such as a single retailer, or by any type of marketing agency, i.e. retailers or wholesalers or by any combination of marketing agencies in the marketing system as a whole. Total marketing margin includes cost involved in moving the jowar from producer to consumer and profits of various market functionaries.

The absolute value of the total marketing margin varies from market to market, channel to channel and time to time.

i) Market fee : It is charged either on the basis of weight or on the basis of the value of the produce. It is usually collected from the buyers. The market fee differs from state to state. It varies from 0.5 percent to 2.0 percent ad valorem.

ii) Commission : The charges are usually made in cash and vary from market to market.

iii) Taxes : Different taxes are charged in different markets such as toll tax, terminal tax, sales tax, octroi etc. These taxes leviable on jowar differ from market to market in the same state as also from state to state. These taxes are usually payable by the seller.

iv) Miscellaneous charges : In addition, some other charges are also levied. These include handling, weighing, loading, unloading, cleaning, charity contribution in cash and kind, etc. These charges may be payable either by the seller or by the buyers.

6.0 MARKETING INFORMATION AND EXTENSION

Marketing information :

Marketing Information is essential for producers in planning production and market led production. It is equally important for other market participants for trading.

Recently, Govt. of India has launched Agricultural Marketing Information Network Scheme through Directorate of Marketing & Inspection (DMI) to bring out improvement in the present market information scenario by linking all Agricultural produce wholesale markets in the States and Union Territories. The data received from markets is being displayed on the website **www.agmarknet.nic.in**.

Marketing extension :

Market extension is a vital factor enlightening the farmers about proper marketing and removal of marketing constraints and improves their awareness in various modern post harvest measures for efficient and cost effective marketability.

Benefits:

- Provides the up-to-date information on the arrivals and prices of agricultural commodities in different markets.
- Guides the producers to take right decision, when, where and how to market their produce.
- Educate the producers/traders about the post harvest management i.e.
  - Harvesting care
  - Techniques to minimise losses during post harvest period.
  - Value addition to the produce by proper cleaning, processing, packaging, storage and transportation.
- Orient the producers/traders about prevailing price trends, demand and supply situation etc.
- Orient the producer regarding the importance of grading, cooperative/group marketing, direct marketing, contract farming, future trading etc.
- Provides the information about the sources of credit availability, various Govt. schemes, policies, rules and regulations etc.

Sources :

The following are the sources of marketing information available in the country.

Source / Institution	Activities for marketing information and extension
Directorate of Marketing and Inspection (DMI), NH-IV, CGO Complex, Faridabad. Website: **www.agmarknet.nic.in**	➢ Provides information through nationwide Marketing Information Network (**"AGMARKNET"** portal). ➢ Marketing extension through training to educate producers, graders, consumers etc. ➢ Marketing research survey. ➢ Publication of reports, pamphlets, leaflets, Agricultural Marketing journal, Agmark standards etc.
Central Warehousing Corporation (CWC), 4/1 Siri Institutional Area Opp. Siri fort, New Delhi-110016 Website : www.fieo.com/cwc/	➢ Farmers Extension Service Scheme (FESS) was launched by CWC in the year 1978-79 with the following objectives : **i)** To educate farmers about the benefit of scientific storage and use of public warehouses. **ii)** To impart training to the farmers on the techniques of scientific storage and preservation of foodgrains. **iii)** To assist farmers in getting loans from the banks against pledge of warehouse receipt. **iv)** Demonstration of spraying and fumigation methods to control insects.
Director General of Commercial Intelligence & Statistics (DGCIS), 1, Council House Street Kolkata -1	➢ Collection, compilation and dissemination of marketing related data i.e. export-import data, inter-state movement of foodgrains etc.
Directorate of Economics and Statistics, Shastri Bhavan,New Delhi Website: www.agricoop.nic.in	➢ Compilation of agricultural data for development and planning. ➢ Dissemination of market intelligence through publication and internet.

Agriculture Produce Marketing Committee (APMC)	➢ Provides market information on arrivals, prevailing prices, despatches etc ➢ Provides market information of adjoining / other market committees. ➢ Arranges training, tours, exhibitions etc.
Federation of Indian Export Organisations (FIEO), PHQ House(3rd Floor) Opp. Asian Games , New Delhi-110016	➢ Provides information to its members about latest developments in export and import. ➢ Organises seminars, workshops, presentation, tours, buyer-seller meets, sponsoring participation in international trade fair, exhibitions and providing advisory services with specialized divisions. ➢ Provides useful information on India's export and import with diverse database.
State Agricultural Marketing Boards, At different State capital	➢ Provides marketing related information to co-ordinate all the market committees in the state. ➢ Arrange training, seminars, workshops and exhibitions on subjects related to agricultural marketing.
Kisan Call Centers (New Delhi, Mumbai, Chennai, Kolkata, Hyderabad, Banglore, Chandigarh and Lucknow)	➢ Provides expert advise to the farmers. ➢ These centers will operate through toll free telecom lines throughout the country. ➢ A country wide common four digit number 1551 has been allocated to these centers.
Mass Media Support to Agriculture Extension	➢ Mass media support to agriculture extension has been augmented with three new initiatives. **i)** The first component establishes a cable satellite channel for national broadcast using the existing facilities available with Inira Gandhi National Open University (IGNOU). **ii)** The second component is use of low and high power transmitters of Doordarshan for providing areas specific telecast. Initially, 12 locations chosen to launch broadcasting are Jalpaiguri (West Bengal), Indore (Madhya Pradesh), Sambhalpur (Orissa), Shillong (Meghalaya), Hissar (Haryana), Muzzafarpur (Bihar), Dibrugarh (Assam), Varanasi (Uttar Pradesh), Vijaywada (Andhra Pradesh), Gulbarga (Karnataka), Rajkot (Gujarat), Daltonganj (Jharkhand). **iii)** The third component of the mass media is use of FM transmitter network of All India Radio (AIR) to provide area specific broadcasting through 96 FM stations.

Agriculture-Clinics and Agri-Business by Agriculture Graduates	➢ A central sector scheme "Establishment of Agriculture-Clinics and Agri-business Managed by Agriculture graduates" is being implemented since 2001-02. ➢ The aim is to provide opportunity to all eligible agriculture graduates, to support agriculture development through economically viable ventures. ➢ The scheme is being jointly implemented by NABARD, National Institute of Agricultural Extension Management (MANAGE) and Small Farmers' Agri-business Consortium (SFAC) in association with about 66 reputed training institutes in the country.
Different websites on Agricultural Marketing Information	www.agmaknet.nic.in www.agricoop.nic.in www.fciweb.nic.in www.fieo.com/cwc/ www.ncdc.nic.in www.apeda.com www.nic.in/eximpol www.fmc.gov.in www.nrcsorghum.res.in www.icar.org.in www.fao.org www.agrisurf.com www.agriculturalinformation.com www.agriwatch.com www.kisan.net www.agnic.org www.indiaagronet.com www.commodityindia.com

7.0 ALTERNATIVE SYSTEMS OF MARKETING

7.1 Direct marketing :

Direct marketing is an innovative concept, which involves marketing of produce i.e. jowar by the farmers directly to the consumers/millers without any middlemen. Direct marketing enables producers and flour millers and other bulk buyers to economise on transportation cost and improves price realization. It also provides incentive to large scale marketing companies i.e. flour millers and exporters to purchase directly from producing areas. Direct marketing by farmers to the consumers has been experimented in the country through *Apni Mandis* in Punjab and Haryana. The concept with certain improvements has been popularised in Andhra Pradesh through *Rythu Bazars.* At present, these markets are

being run at the expense of the state exchequer, as a promotional measure, to encourage marketing by small and marginal producers without the involvement of the middlemen. In these markets, many commodities are marketed along with fruits and vegetables.

Benefits :

- Direct marketing helps in better marketing of jowar.
- It increases profit of the producer.
- It minimises marketing cost.
- It encourages distributional efficiency.
- It satisfies the consumer through better quality of produce at reasonable price.
- It provides better marketing techniques to producers.
- It encourages direct contact between producers and consumers.
- It encourages the farmers for retail sale of their produce.

7.2 Contract marketing :

"Contract marketing" is a system of marketing in which the commodity is marketed by farmers under a pre-agreed buy-back contract with an agency engaged in trading or processing. In contract marketing, a producer will produce and deliver to the contractor, a quantum of required quality of produce, based upon anticipated yield and contracted acreage, at a pre-agreed price. In this agreement, agency contributes input supply and renders technical guidance. The company also bears the entire cost of transaction and marketing. By entering in to contract, farmer's risk of price reduces and the agency reduces the risk of non-availability of raw material. The inputs and extension services provided by the agency include improved seed, credit, fertilizers, pesticides, farm machinery, technical guidance, extension, marketing of produce etc.

In present scenario, contract marketing is one of the ways by which producers, especially small farmers, can participate in the production of good quality jowar to get higher return. Contract marketing enables producers to adopt new technologies to ensure maximum value addition and access to new global markets. It also ensures efficient post harvest handling and meeting specific needs of customers.

Benefits :

Contract marketing is beneficial to both producer as well as to contracting agency. These benefits are summed up below:

Benefits	To Producer	To Contracting agency
Risk	It minimises the price risk.	It minimises risk of raw material supply.
Price	Price stability, ensuring fair price.	Price stability as per pre-agreed contract.
Quality	Use of quality seed and inputs.	Get good quality produce and control on quality.
Payment	Assured and regular payments through bank tie up.	Easy handling and better control on payment.
Post-harvest	Minimises risk and cost of	Control and efficient handling.

handling	handling.	
New technology	Facilitates in farm management and practices.	For better and desired produce to meet consumer needs.
Fair trade practices	Minimises malpractices and no involvement of middle man.	Better control on trade practices.
Crop insurance	Reduces risk.	Reduces risk.
Mutual relationship	Strengthens.	Strengthens.
Profit	Increases.	Increases.

7.3 Cooperative marketing :

"Cooperative marketing" is the system of marketing in which a group of producers join together and register them under respective State Cooperative Societies Act to market their produce jointly. The members also deal in a number of cooperative marketing activities i.e. processing of produce, grading, packing, storage, transport, finance, etc. The cooperative marketing means selling of the member's produce directly in the market, which fetches best prices. It helps the member to produce better quality of jowar, which has good demand in the market. It also provides clean handling, fair trade practices and protect against manipulations / malpractices. The main objectives of cooperative marketing are to ensure remunerative prices to the producers, reduction in the cost of marketing, reduces the monopoly of traders and improve the marketing system. The cooperative marketing structure in the different states consists of;

1. **PMS** (Primary Marketing Society) at the Mandi level
2. **SCMF** (State Cooperative Marketing Federation) at the State level
3. **NAFED** (National Agricultural Cooperative Marketing Federation of India Ltd.) at the National Level.

Benefits :

- Remunerative price to producers.
- Reduction in cost of marketing.
- Reduction in commission charges.
- Effective use of infra-structure.
- Credit facilities.
- Collective processing.
- Easy transportation.
- Reduces malpractices.
- Supply of agricultural inputs.
- Marketing information.

7.4 Forward and future markets :

Forward trading means an agreement or a contract between seller and purchaser, for a certain kind and quantity of a commodity for making delivery at a specified future time, at contracted price. It is a type of trading, which provides protection against the price

fluctuations of agricultural produce. Producers, traders and millers utilize the future contracts to transfer the price risk. Presently, future markets in the country are regulated through Forward Contracts (Regulation) Act, 1952. The Forward Markets Commission (FMC) performs the functions of advisory, monitoring, supervision and regulation in future and forward trading. Forward trading transactions are performed through exchanges owned by the associations registered under the Act. These exchanges operate independently under the guidelines issued by the FMC.

Forward contracts are broadly of two types. i.e. (a) Specific delivery contracts; and (b) Other than specific delivery contracts.

(a) Specific delivery contracts: Specific delivery contracts are essentially merchandising contracts, which enable producers and consumers of commodities to market their produce and cover their requirements respectively. These contracts are generally negotiated directly between parties depending on availability and requirement of produce. During negotiation, terms of quality, quantity, price, period of delivery, place of delivery, payment terms etc. are incorporated in the contracts.

(b) Other than specific delivery contracts: Though this contract has not been specifically defined under the act but these are called as 'future contracts'. Futures contracts are forward contracts other than specific delivery contracts. These contracts are usually entered under the auspices of an Exchange or Association. In the future contracts, the quality and quantity of commodity, the time of maturity of contract, place of delivery etc. are standardised and contracting parties have to negotiate only the rate at which contract is entered into.

Benefits :

Future contracts perform two important functions i) Price discovery and ii) Price risk management. It is useful to all segments of economy.

Producers : It is useful for producers because they can get idea of price likely to prevail at a future point of time and, therefore help to decide time and planning of production that suits them.

Traders/Exporters : The futures trading is very useful to the traders/exporters as it provides an advance indication of the price likely to prevail. This helps the traders/exporters in quoting a realistic price and, thereby, secure trading/export contract in a competitive market.

Millers/Consumers : Futures trading enables the millers/consumers to get an idea of the price at which the commodity would be available at a future point of time.

The other benefits of future trading are-

Price stabilization: In times of violent fluctuations, futures trading reduce the price variations.

Competition: Futures trading encourages competition and provides competitive price to farmers, millers or traders.

Supply and demand: It ensures a balance in demand and supply position throughout the year.
Integration of price: Future trading promotes an integrated price structure throughout the country.

8.0 INSTITUTIONAL FACILITIES

8.1 Marketing related schemes of Government/ public sector :

Name of the scheme/implementing organisation	Facilities provided/salient features/objectives
1.Agricultural Marketing Information Network Directorate of Marketing and Inspection, Head Office, N.H.-IV, Faridabad.	➢ To establish a nationwide information network for speedy collection and dissemination of market data for its efficient and timely utilization. ➢ To ensure flow of regular and reliable data to the producers, traders and consumers to derive maximum advantage out of their sales and purchases. ➢ To increase efficiency in marketing by effective improvement in the existing market information system. ➢ The scheme provides connectivity to 2749 nodes comprising the State Agricultural Marketing Department (SAMD) /Boards/ Markets. These concerned nodes have been provided with one computer and its peripherals. The SAMD/Boards/ Markets collect desired market information and pass on to respective state authorities and Head Office of the DMI for forward dissemination. The eligible markets will get 100 percent grant by Ministry of Agriculture.
2. Gramin Bhandaran Yojana (Rural Godowns Scheme) Directorate of Marketing and Inspection, Head Office, N.H.-IV, Faridabad	➢ It is a capital investment subsidy scheme for construction/renovation/expansion of rural godowns. The scheme is implemented by DMI in collaboration with NABARD and NCDC. The objectives of the scheme are to create scientific storage capacity with allied facilities in rural areas to meet the requirements of farmers for storing farm produce, processed farm produce, consumer articles and agricultural inputs. ➢ To prevent distress sale immediately after harvest. ➢ To promote grading and quality control of agricultural produce to improve their marketability. ➢ To promote pledge financing and marketing credit to

	strengthen agricultural marketing in the country for the introduction of a national system of warehouse receipt in respect of agricultural commodities stored in such godowns. ➢ The entrepreneur will be free to construct godown at any place and of any size except for restrictions that it would be outside the limits of Municipal Corporation area and be of a minimum capacity of 100 MT and 50 MT in special case. ➢ The scheme provides credit linked back-ended capital investment subsidy @25 percent of the project cost with a ceiling of Rs. 37.50 lakh per project. For the projects in North-Eastern states and hilly areas with altitude of more than 1000 m above mean sea level and SC/ST entrepreneurs, maximum subsidy admissible is @ 33 percent of the project cost, with a ceiling of Rs. 50.00 lakh.
3.Scheme for development/ strengthening of agricultural marketing Infra-structure, grading & standardization Directorate of Marketing and Inspection, Head Office, N.H.-IV, Faridabad.	➢ To provide additional agricultural marketing infra-structure to cope up with the expected marketable surpluses of agricultural and allied commodities including dairy, poultry, fishery, livestock and minor forest produce. ➢ To promote competitive alternative agricultural marketing infrastructure by inducement of private and co-operative sector investments that sustain incentives for quality and enhanced productivity thereby improving farmers' income. ➢ To strengthen existing agricultural marketing infra-structure to enhance efficiency. ➢ To promote direct marketing so as to increase market efficiency through reduction in intermediaries and handling channels thus enhancing farmers' income. ➢ To provide infra-structure facilities for grading, standardization and quality certification of agricultural produce so as to ensure price to the farmers commensurate with the quality of the produce. ➢ To promote grading, standardization and quality certification system for giving a major thrust for promotion of pledge financing and marketing credit, introduction of negotiable warehousing receipt system and promotion of forward and future markets so as to stabilize market system and increase farmers' income. ➢ To promote direct integration of processing units with producers. ➢ To create general awareness and provide education and training to farmers, entrepreneurs and market functionaries

	on agricultural marketing including grading and quality certification.
4.Agmark Grading and Standardisation Directorate of Marketing and Inspection, Head Office, N.H.-IV, Faridabad.	➢ Promotion of grading of agricultural and allied commodities under Agricultural Produce (Grading & Marking) Act.1937. ➢ Agmark specifications for agricultural commodities have been framed, based on their intrinsic quality. Food safety factors are being incorporated in the standards to compete in world trade. Standards are being harmonised with international standards keeping in view the WTO requirements. Certification of agricultural commodities is carried out for the benefit of consumers.
5.Co-operative Marketing, Processing, Storage etc. Programmes in Comparatively under/least developed states. National Co-operative Development Corporation, Hauz Khas, New Delhi-110016	➢ To correct regional imbalances and to provide needed momentum to the pace of development of various programmes of cooperative agricultural marketing, processing, storage etc. in under/least developed states/UTs by providing financial assistance on liberal terms to augment the income of farmers and weaker sections of the community. ➢ The scheme provides for distribution of agricultural inputs, development of agro-processing including storage, marketing of foodgrains and plantation/horticulture crops, development of weaker and tribal sections, cooperatives, in dairy, poultry and fisheries.

8.2 Institutional credit facilities :

Institutional credit is the vital factor in agricultural development. The main emphasis was laid down on adequate and timely credit support to the farmers, particularly small and marginal farmers for adoption of modern technology and improved agricultural practices.

Short term and medium term loans:

Name of scheme	Eligibility	Objective/Facilities
1. Crop Loan	All categories of farmers.	➢ To meet cultivation expenses for various crops as short-term loan. ➢ This loan is extended in the form of direct finance to farmers with a repayment period not exceeding 18 months.
2.Produce Marketing Loan	All categories of farmers.	➢ This loan is given to help farmers to store produce on their own to avoid distress sale. ➢ This loan also facilitates immediate renewal of crop loans for next crop. ➢ The repayment period of the loan does not exceed 6 months.
3. Kisan Credit Card	All agriculture clients	➢ This card provides running account facilities to farmers to meet their production credit and contingency needs. ➢ The scheme follows simplified procedures to enable the

Scheme (KCCS)	having good track record for the last two years.	farmers to avail the crop loans as and when they need. ➢ Minimum credit limit is Rs. 3000/-. Credit limit is based on operational land holding, cropping pattern and scale of finance. ➢ Withdrawals can be made by using easy and convenient withdrawal slips. The Kisan Credit Card is valid for 3 years subject to annual review. ➢ It also covers personal insurance against death or permanent disability for maximum amount of Rs. 50,000 and Rs. 25,000 respectively.
4. National Agricult-ural Insurance Scheme (NAIS)	Scheme is available to all farmers – loanee and non-loanee both- irrespective of the size of their holding.	➢ To provide insurance coverage and financial support to the farmers in the event of failure of any of the notified crop as a result of natural calamities, pests and diseases attack. ➢ To encourage the farmers to adopt progressive farming practices, high value in-puts and high technology in agriculture. ➢ To help to stabilize farm incomes, particularly in disaster years. ➢ General Insurance Corporation of India (GIC) is the Implementing Agency. ➢ Sum insured may extend to the value of threshold yield of the area insured. ➢ Covers all food crops (cereals, millets and pulses), oilseeds and annual commercial/horticultural crops. ➢ Provides subsidy of 50 percent in premium of small and marginal farmers. The subsidy will be phased out over a period of 5 years on sunset basis.

Long term loan

Name of Scheme	Eligibility	Objective/Facilities
Agricultural Term Loan	All categories of farmers (small/medium and agricultural labourers) are eligible, provided they have necessary experience in the activity and required area.	➢ The banks extend this loan to farmers to create assets facilitating crop production/income generation. ➢ Activities covered under this scheme are land development, minor irrigation, farm mechanization, plantation and horticulture, dairying, poultry, sericulture, dry land / waste land development schemes etc. ➢ This loan is offered in the form of direct finance to farmers with a repayment span not lass than 3 years and not exceeding 15 years.

8.3 Organisations/ agencies providing marketing services :

Name of the organisation	Services provided
1.Directorate of Marketing and Inspection (DMI) NH-4, CGO Complex Faridabad- Website: www.agmarknet.nic.in	▶ To integrate development of marketing of agricultural and allied produce in the country. ▶ Promotion of grading of agricultural and allied produce. ▶ Market development through regulation, planning and designing of physical markets. ▶ Administration of Meat Food Products Order (1973); ▶ Promotion of cold storage. ▶ Liaison between the Central and State Governments through its regional offices (11) and sub-offices (26) spread all over the country.
2.Food Corporation of India (FCI), Barakhamba Lane, Cannaught Place, New Delhi-110001 Website:www.fciweb.nic.in	▶ Procurement of foodgrains for effective price support operations for safeguarding the interests of the farmers. ▶ Distribution of foodgrains throughout the country for Public Distribution System. ▶ Maintaining satisfactory level of operational/buffer stocks of foodgrains to ensure National Food Security.
3.Central Warehousing Corporation (CWC), 4/1 Siri Institutional Area Opp. Siri Fort New Delhi-110016 website: www.fieo.com/cwc/	▶ Provides scientific storage and handling facilities. ▶ Offers consultancy services/ training for the construction of warehousing infrastructure to different agencies. ▶ Import and export warehousing facilities. ▶ Provides disinfestation services.
4.Agricultural and Processed Food Products Export Development Authority (APEDA), NCUI Building 3, Siri Institutional Area August Kranti Marg, New Delhi	▶ Development of scheduled agriculture products related industries for export. ▶ Provides financial assistance to these industries for conducting surveys, sensibility studies, relief and subsidy schemes. ▶ Registration of exporters for scheduled products. ▶ Adapting standards and specifications for the purpose of

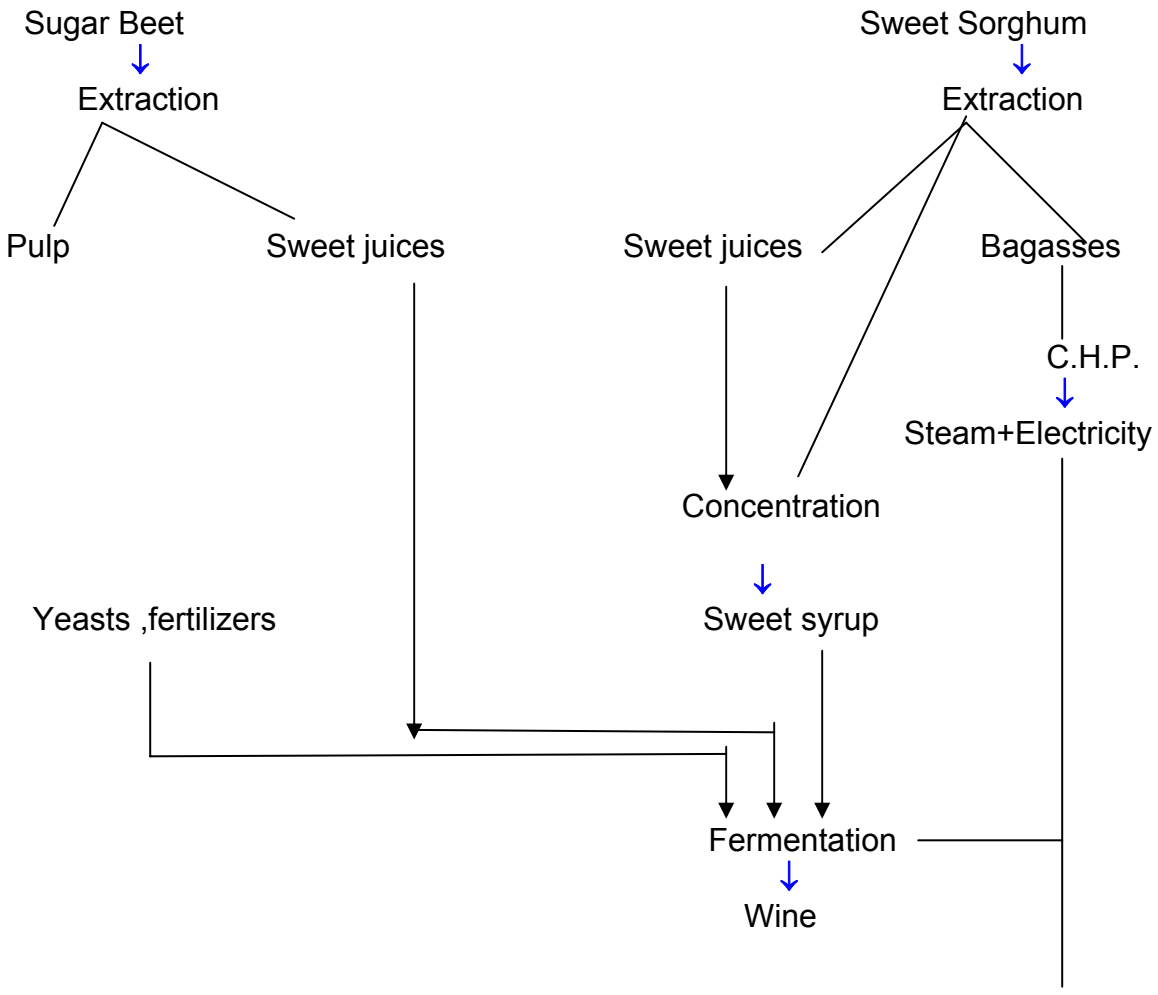
110016 Website: www.apeda.com	export of scheduled products. ▶ Carrying out inspection of meat and meat products for ensuring the quality of such products. ▶ Improving the packaging of the scheduled products. ▶ Promotion of export oriented production and development of scheduled products. ▶ Collection and publication of statistics for improving marketing of scheduled products. ▶ Training in the various aspects of industries related to the scheduled products.
5.National Co-operative Development Corporation (NCDC), 4, Siri Institutional Area, New Delhi-110016 website: www.ncdc.nic.in	▶ Planning, promoting and financing programmes for production, processing, marketing, storage, export and import of agricultural produce. ▶ Financial support to primary, regional, State and National level co-operative marketing societies is provided towards; ▶ i))Margin money and working capital finance to augment business operations of agricultural produce. ▶ Ii)Strengthening the share capital base and ▶ Iii) Purchase of transport vehicles.
6.Director General of Foreign Trade, (DGFT), Udyog Bhavan, New Delhi. Website: www.nic.in/eximpol	▶ Provides guidelines / procedure of export and import of various commodities. ▶ Allot import-export code number (IEC No) to the exporter of agricultural commodities.
7.State Agricultural Marketing Boards (SAMBs),	▶ Implementation of the regulation of marketing in the state. ▶ Provide infra-structural facilities for the marketing of notified agricultural produce. ▶ Provide grading of agricultural produce in the markets. ▶ To co-ordinate all the market committees for information services. ▶ Provide aid to financially weak or needy market committees in the form of loans and grants. ▶ Eliminate malpractices in the marketing system. ▶ Arrange or organise seminars, workshops or exhibitions on subjects relating to agricultural marketing and farmers training programme on various aspects of agricultural marketing. ▶ Some of the SAMBs are also promoting agro-business.

9.0 UTILIZATION

9.1 Processing :

In India, jowar is cultivated for various purposes like food, cattle feed, fodder and industrial raw material, etc. Flour is made by grinding the whole grain. The processing is usually done to remove some of the hull or bran-the fibrous outer layers of the grain.This is usually done by pounding followed by winnowing or sieving. It is used in the production of alcohol. Alcohol production is done by following method:

PROCESS OF ALCOHOL PRODUCTION FROM SORGHUM JUICE



↓

Fractional Distillation and dehydration

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Anhydrous Ethanol
(Alcohol over 99.5 %)

↓

Use as E5 mixture
Or, Transformation into E.T.B.E.

9.2 Uses:

Jowar is used in different ways as human food, fodder, poultry feed, cattle feed and industrial raw materials. The main uses of jowar are as follows:

Human food: Jowar is commonly used in India as making bread (roti). It is also consumed as popped jowar, papad, cookies and other preparations.
Different forms of utilization of sorghum in India are as under:

Food	Product type	Form of grain used
Roti	Unleavened flat bread	Flour
Sangati	Stiff porridge	Mixture of coarse particles and flour
Annam	Rice-like	Dehulled grain
Kudumulu	Steamed	Flour
Dosa	Pancake	Flour
Ambali	Thin porridge	Flour
Boorelu	Deep fried	Flour
Pelapindi	Popped whole grain and flour	Mixture of coarse particles and flour
Karappoosa	Deep fried	Flour
Thapala chakkalu	Shallow fried	Flour

Fodder: Green leaves and stalks are used as fodder for animals.

Animal feed: Globally jowar is cultivated for its grain utilization in animal feed. The demand for jowar for feed purpose is the main driving force in rising the global production and international trade.

Poultry Feed: Poultry industry is the major area where jowar is used as poultry feed

Industrial Raw material: Sorghum is used in wide range of industries like alcohol (ethanol), jaggery, syrup, spirit, starch

production. Alcohol is widely used industrial raw material.
It is produced both from the sweet stalked sorghum as well as from grains.

Fuel purpose: The dry stem of the plant and dry leaves are used as fuel for cooking by the poor population in rural India.

Fencing purpose: The dry stalks of the plant are used in fencing.

10.0 DOS AND DON'TS

DOS	DON'TS
✓ Harvest jowar crop when it attains physiological maturity..	x Delay in harvesting results decline in vigour and viability.
✓ Harvest during conducive weather condition.	x Harvest during adverse weather condition.
✓ Dry the seed properly after harvesting below 9 percent moisture content.	x Store before proper drying.
✓ Dry the seed in diffused sunlight in shed open on all sides.	x Dry the seed in direct sunlight.
✓ Threshing and winnowing on cemented (pucca) floor.	x Perform threshing and winnowing on kuchha floor.
✓ Get the market information from www. agmarknet..nic.in and other available websites, newspapers, T.V., concerned APMC offices etc before marketing the produce.	x Market the produce without collecting information regarding price trend etc.
✓ Avail the facility of future trading and forward contracts to avoid price risk.	x Sell the produce in glut situation.
✓ Take the benefit of contract farming to ensure better price and ready market.	x Produce jowar without assessing it's production, demand and price etc.
✓ Use improved post harvest technology and processing techniques to avoid losses	x Use traditional and conventional techniques in post harvest operations and in processing as it cause quantitative and qualitative losses.
✓ Store the jowar when the prices are not	x Sell the produce when prices are not

favourable .	favourable.
✓ Avail the facility of GRAMIN BHANDARAN YOJNA (Rural Godown Scheme) and store the jowar in scientific way to avoid losses.	x Store jowar in un-scientific way as it will result in growth of fungi and contamination of aflotoxins.
✓ Select the cheapest and convenient mode of transportation.	x Select any mode of transport, which causes losses.
✓ Select the shortest and efficient marketing channel to get higher share in consumer's price.	x Select the channel that results in less share of producer in consumer's price.
✓ Package properly to protect the quality and quantity of produce during transit and storage.	x Use improper package which causes losses during transit and storage.
✓ Use bags for transporting jowar to minimize losses.	x Transport jowar in bulk which causes more losses.

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