POST HARVEST PROFILE OF POTATO

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1.0 INTRODUCTION :

Potato (*Solanum tuberosum* L.) popularly known as 'The king of vegetables', has emerged as fourth most important food crop in India after rice, wheat and maize. Indian vegetable basket is incomplete without Potato. Because, the dry matter, edible energy and edible protein content of potato makes it nutritionally superior vegetable as well as staple food not only in our country but also throughout the world. Now, it becomes as an essential part of breakfast, lunch and dinner worldwide. Being a short duration crop, it produces more quantity of dry matter, edible energy and edible protein in lesser duration of time than cereals like rice and wheat. Hence, potato may prove to be a useful tool to achieve the nutritional security of the nation.

It has been observed that during present trend of diversification from cereals to horticultural crops, shifting from wheat / barley cultivation to potato cultivation, returns more to the farmers.

Potato is a major food crop, grown more than 100 countries in world. The native South Americans brought Potato under cultivation possibly 2000 years before the Spanish conquest. In 1537, the Spaniards first came into contact with potato in one of the villages of Andes. In Europe, it was introduced between 1580 .A.D. to 1585 A.D. in Spain, Portugal, Italy, France, Belgium and Germany. At present, China, Russia, India, Poland and U.S.A. contribute a major share of total world production. It was introduced in India by the Portuguese sailors during early 17th century and it's cultivation was spread to North India by the British. Potato is one of main commercial crop grown in the country. It is cultivated in 23 states in India. Uttar Pradesh, West Bengal, Bihar, Punjab and Gujarat account a lion's share in total production. Country has achieved a tremendous growth in potato production during last four to five decades. The annual compound growth rate of potato is higher than other major food crops in respect of area, production and productivity. In the year 2002-2003, the production was 25 million tonnes while it was 5 million tonnes during 1970. Hence, owing its significant growth in production, bumper yields has been observed almost in every year.

Due to the bumper crop, and lack of post harvest management, glut situations risen in the market for the surplus yield every year which ultimately results in decline the prices drastically.

Varieties like Kufri, Chipsona-1, Kufri Chipsona-2, Kufri Jyoti, Kufri Luvkar, Kufri Chandramukhi have been released recently by different research organizations for processing purposes. In India, there is a great scope for cultivation of potato suitable for processing. Further, there is a rising demand for quality processed potato products from the country particularly in Middle East. The countries like Japan, Singapore, Korea,

Malaysia, China also have a great demand for processed potato products as well as fresh potato for processing purpose. Thus, the potato processing has opened a new dimension for development of agro based industries in the country.

Indian potato preferred world wise for it's taste and meets the international quality standards in terms of disease freeness, shape, size, skin colour, flesh and dry matter content. The Government of India has set up four Agri Export Zones **(AEZs)** in Punjab, West Bengal, Uttar Pradesh and Madhya Pradesh for significant development in this direction. These AEZs are making effort in strengthening and creating infrastructure for export of fresh and processed potato products, with the mandate for tackling the export of potato and it's products. The main objectives of the Agri Export Zones set up is to provide emphasis on partnership, convergence of different organizations, stakeholders with a focus on providing a package of facilities for export of potato.

1.1 Origin :

It is believed that potato was a native of Andes in South America and gradually spread throughout the world.

1.2 Importance :

It has been revealed that, according to FAO, potato is consumed by more than one billion people the world over. It is a high quality vegetable cum food crop and used in preparing more than 100 types of receipies in India. The popular Indian receipies like Samosas and Alu Paranthas are prepared from potato. The protein of potato has high biological value than proteins of cereals and even better than that of milk. The biological value of mixture of egg and potato is higher than the egg alone. Hence, potato can be supplement of meat and milk products for improving their taste, lowering energy intake and reducing food cost. Nutritional point of view, potato is a wholesome food and deserves to be promoted as a potential high quality vegetable cum food crop in the country.

Nutritive Value :

The constituents of potato per 100 gms.

Sl.No.	Constituents	Weight (grams)
1.	Water	74.70
2.	Carbohydrates (Starch and Sugar)	22.60
3.	Proteins	1.60
4.	Fibre	0.40
5.	Fat	0.10
6.	Minerals	0.60

Source: Potato in India, Central Potato Research Institute (CPRI), Shimla

The Minerals and Vitamins as available in Potato is given below :

Sl. No.	Minerals / Vitamins	Content (mg/100 gm of fresh weight)
1.	Calcium	7.7
2.	Copper	0.15
3.	Iron	0.75
4.	Magnesium	24.2
5.	Phosphorus	40.3
6.	Potassium	568.0
7.	Sodium	6.5
8.	Vitamin C	14.0 – 25.0.
9.	Thiamin	0.18
10.	Riboflavin	0.01-0.07
11.	Niacin	0.4 –3.1
12.	Total Folate	5.0-35.0
13.	Pyridoxine	0.13-0.25

Source: Potato in India, Central Potato Research Institute (CPRI), Shimla

It is utilized in variety of ways, such as preparation of chips, wafers, flakes, granules, flour, starch, potato-custard powder, soup or gravy thickener, pan cakes as a process food.

As being one of the principal cash crop, it gives handsome returns to the growers/farmers due to it's wide market demand nationally and internationally for different kinds of utilization. Further it has been reported by the International Food Policy Research Institute **(IFPRI)** and International Potato Centre **(CIP)**, India is likely to have highest growth rate of potato production and productivity during 1993 to 2020. During the same period, demand for potato is expected to rise by 40 per cent world wide. This indicates that a picture about a clear opportunity to capture the huge domestic and international market of potato by producing quality potato and it's products.

2.0 PRODUCTION :

2.1 Major producing countries in the world:

Potato is grown in more than 100 countries in the world with a production of around 321 thousand tones during the year 2004 China ranks first while Russia and India ranks second and third respectively. China, India, USA, Ukraine, Germany and Poland shared more than 62 per cent of total global production as can be seen from Table No.1. The country wise production during 2002-04 is furnished as under.

Table No. 1

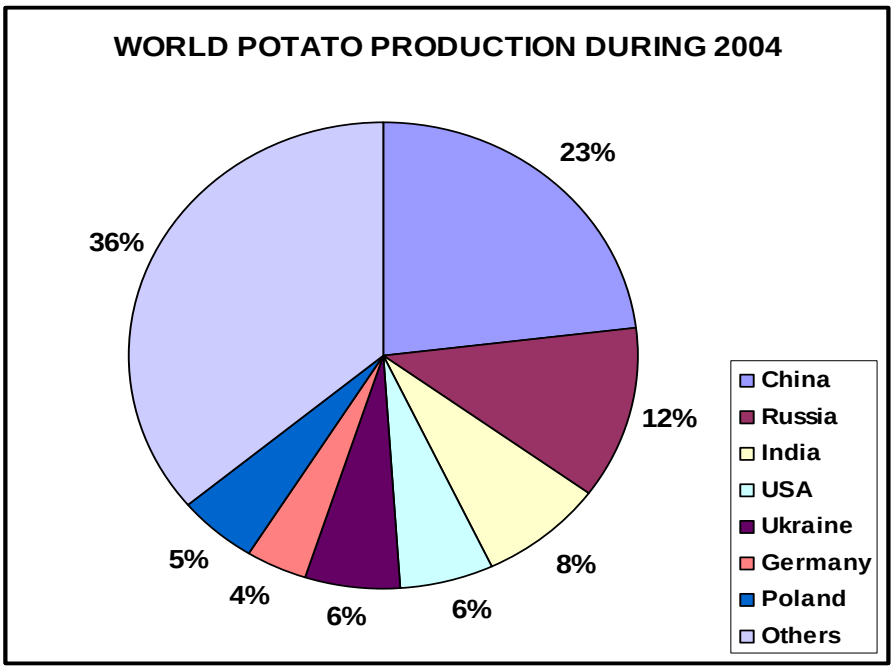
PRODUCTION OF MAJOR POTATO PRODUCING COUNTRIES (DURING 2002-04)

Production : 000' tonnes

Sl. No.	COUNTRY	YEAR / PRODUCTION		
		2002	2003	2004
1.	China	75,268	72,067	75,048
2.	Russia	32,871	36,746	37,000
3.	India	24,450	25,000	25,000
4.	USA	20,857	20,767	20,149
5.	Ukraine	16,620	18,453	19,450
6.	Germany	11,492	10,232	12,992
7.	Poland	15,524	13,731	15,000
8.	Others	131,784	121,291	117,046
	All World	328,866	318,287	321,685

Source : **FAOSTAT**

CHART – 1



2.2 Major producing states in India:

In India, potato is cultivated in almost all states and under very diverse agro climate conditions. About 85 per cent of potatoes are cultivated in Indo-gangetic plains of North India. The states of Uttar Pradesh, West Bengal, Punjab, Bihar and Gujarat accounted for more than 80 per cent share in total production. The statewise production is furnished as under.

Table No. 2

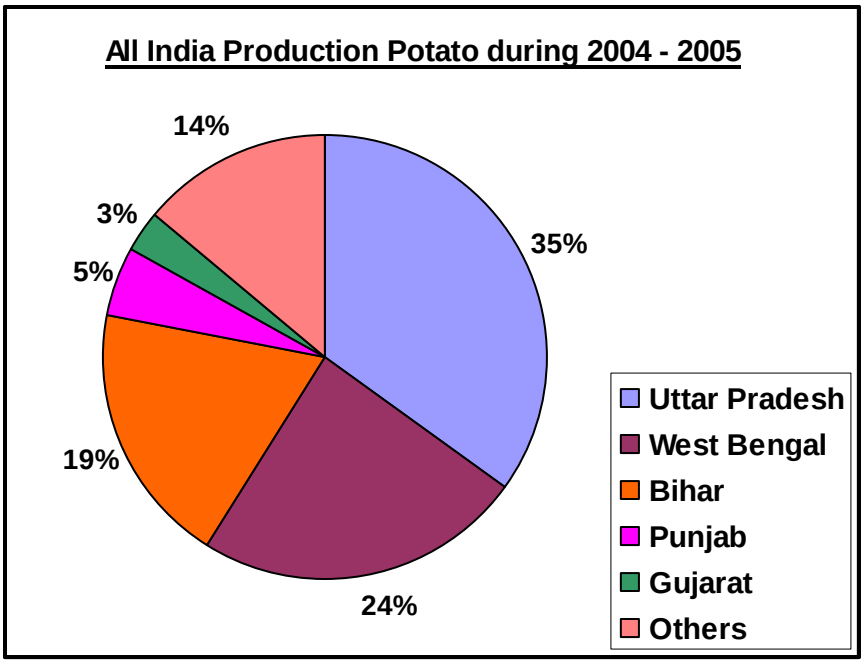
PRODUCTION OF MAJOR POTATO PRODUCING STATES (DURING 2003-04 & 2004-05)

Production : 000' tonnes

Sl.No.	STATE	YEAR / PRODUCTION	
		2003-04	2004-05
1.	Uttar Pradesh	6825.60	9821.70
2.	West Bengal	7591.70	7106.60
3.	Bihar	5656.70	5656.70
4.	Punjab	1439.70	1470.20
5.	Gujarat	780.00	978.20
6.	Others	5632.10	4155.20
	All India	**27925.80**	**29188.60**

Source : **National Horticulture Board (NHB).**

CHART- 2



2.3 Zone wise major commercial varieties:

Table No. 3

I) Zone – North Western Hills				
Area	**Name of Variety**	**Yield (metric tonne / hectare)**	**Dry matter**	**Consumer and Processing quality**
Hills of Himachal Pradesh and southern Jammu & Kashmir	Kufri Jyoti	20	Medium	Easy to cook, texture is waxy, mild flavour, occasional discolouration after cooking. Suitable for instant flakes and chips.
II) Zone – Hills of Uttaranchal				
Area	**Name of Variety**	**Yield (metric tonne / hectare)**	**Dry matter**	**Consumer and Processing quality**
Nainital Almora, Dehradoon, Uttarkashi, Garhwal and Chamoti districts.	Kufri jyoti	20	medium	Easy to cook, texture is waxy, mild flavour, occasional, discolouration after cooking. Suitable for instant flakes and chips.
III) Zone - North Eastern Hills				
Area	**Name of variety**	**Yield (Metric tonne per hectare)**	**Dry matter**	**Consumer and Processing quality**
Hills of Meghalaya, Manipur, Tripura, Nagaland, Arunachal Pradesh, and Mizoram	Kufri Jyoti Kufri Giriraj	10 20	Medium Medium	Easy to cook, waxy texture, mild flavour, free from discoloration after cooking. Not suitable for processing.
IV) Zone - Southern Hills				
Area	**Name of variety**	**Yield (Metric tonne per hectare)**	**Dry matter**	**Consumer and Processing quality**
Nilgiri and Palani Hills of Tamil Nadu	Kufri Jyoti Kufri Swarna	20-21 25	Medium Medium	Easy to cook, floury texture, mild flavour, free from discoloration after cooking. Not suitable for processing.
V) Zone – North Central Plains				
Area	**Name of variety**	**Yield (Metric tonne per hectare)**	**Dry matter**	**Consumer and Processing quality**
Madhya Pradesh (Indore, Gwalior, Sarguja, Ujjain, Chindwara,Sidhi, Tikamgarh, Shajapur,Dewas districts),	Kufri Badsah Kufri Jyoti Kufri Lavkar	40-50 20-21 30	Medium Medium Medium	Easy to cook, texture is waxy, mild flavour, occasional discolouration after cooking. Suitable for instant flakes and chips.
Western U.P. and Gujarat	Kufri Bahar Kufri Chandramukhi Kufri Chipsona	45 25 25	Medium Medium	Easy to cook, texture is waxy, mild flavour, free from discolouration after cooking. Suitable for instant flakes and chips.

VI) Zone – North Eastern Plains				
Area	**Name of variety**	**Yield (Metric tonne per hectare)**	**Dry matter**	**Consumer and Processing quality**
Bihar & Jharkhand (Samastipur, Madhubani,Siwan, Champaran, Hazaribagh, Purnea,Nalanda, Ranchi districts)	Kufri Jyoti Kufri Lalima Kufri Sindhuri	20- 21 40 40	Medium Medium Medium	Cooks on prolong boiling, floury texture, mild flavour, free from discoloration after boiling
VII) Zone – Plateau Region				
Area	**Name of variety**	**Yield (Metric tonne per hectare)**	**Dry matter**	**Consumer and Processing quality**
Maharashtra, Karnataka and parts of M.P. and Orissa	Kufri Jyoti Kufri Lavkar Kufri Chandramukhi	25 30 25	Medium Medium Medium	Easy to cook, floury texture, mild flavour, free from discoloration after cooking. Due to high dry matter content, the variety is suitable for processing.

Source : Indian Potato Varieties, Technical Bulletin No.51, CPRI, India, Year – 1999.

3.0 POST HARVEST MANAGEMENT :

3.1 Post harvest losses:

Under tropical and sub-tropical conditions, the losses due to poor handling and storage are reported to be in between 40-50 per cent. The post harvest losses of potatoes are defined as qualitative and quantitative losses. The qualitative losses greatly reduce the price of potatoes. The physiological, pathological causes and their remedies are as under.

Table No. 4

Qualitative Losses of Potato

Types of Qualitative Losses	Reasons	Remedies
1.	2.	3.
Physiological losses [Caused by the effect of environmental conditions]	**i)** Due to exposure to extreme temperatures, (high and low temperatures), both before and during storage. **ii)** Overheating of tubers due to direct exposer to sunlight or during high temperature and non-refrigerated storage. **iii)** Rough handling of tubers during harvesting.	**1.** Do not expose tubers to direct sunlight or high temperatures or freezing temperatures. **2.** Do not harvest the crop before maturity. **3.** Store potatoes at 2-4^{0}C in cold storage. **4.** In case of processing and ware potatoes, store at 10-12^{0}C by using sprout inhibitors.
Pathological losses [Caused by the attack of pathogens e.g. fungi, bacteria, insects etc.]	**i)** Rottage and decay accounts for major losses caused due to attack of pests and diseases. It depend primarily on the condition of tubers stored and is linked with pre harvest factors and aggravated by storage conditions. Such type of losses are low in hills and negligible or small in cold storage.	**1.** Careful attention to pre harvest management like harvesting, grading etc., is essential. **2.** Sorting and removal of rotted and damaged tubers before and after storage.

Source : Post Harvest Manual For Exports Of Potatoes, Agricultural and Processed Food Export Development Authority (APEDA), New Delhi.

The following quantitative losses of potato at different stages / levels in various states are given below.

Table No. 5

Quantitative Losses of Potato

Stages / level	States / U.T.	Percentage of Losses
1.	2.	3.
Harvesting	Arunachal Pradesh, Himachal Pradesh, Meghalaya, Rajasthan	Upto 1 per cent
	Assam, Jammu & Kashmir, Karnataka, Manipur, Punjab, Tamil Nadu	Upto 2 per cent
	Bihar, Delhi, Haryana, Tripura, West Bengal	Upto 3 per cent
	Andhra Pradesh, Madhya Pradesh, Orissa, Sikkim, Uttar Pradesh	Upto 5 per cent
	Gujarat, Maharashtra	5-6 per cent
Village Traders	Assam	2-3 per cent
	Bihar	5-10 per cent
	Himachal Pradesh	1-2 per cent
	Karnataka	2 per cent
	Kerala	10 per cent
	Madhya Pradesh	1-2 per cent
	Manipur	1-2 per cent
	Meghalaya	0.5 per cent
	Orissa	1-2 per cent
	Sikkim	2-4 per cent
	West Bengal	3-6 per cent
Traders	Andhra Pradesh	1-2 per cent
	Assam	2 per cent
	Bihar	5-10 per cent
	Gujarat	5 per cent
	Himachal Pradesh	1-3 per cent
	Jammu & Kashmir	5 per cent
	Madhya Pradesh	10-15 per cent
	Manipur	3-5 per cent
	Meghalaya	0.5 per cent
	Orissa	2-5 per cent
	Punjab	6 per cent
	Sikkim	1 per cent
	Tripura	10-15 per cent
	Uttar Pradesh	10 per cent
	West Bengal	4-6 per cent

Source : Marketing of Potato in India, DMI,
Ministry of Agriculture. Year – 1984, 2001.

3.2 HARVESTING CARE :

3.2.1 Harvesting :

The following harvesting care should be taken :

a) Follow the practice of Dehaulming [cutting of haulms / aerial parts by sickle or killing by chemicals (e.g. Gramoxone) or destroying by machines] when the crop attains 80-90 days and when the aerial part of the plant turns yellow.

b) Always harvest in dry weather.

c) Stop irrigation about two weeks before dehaulming.

d) Avoid bruising and skinning of tubers otherwise tubers become susceptible to rot diseases.

e) Harvest the crop after 10-15 days of haulm cutting.

3.2.2 Drying and Curing :

A) The following care should be taken during drying**:**

(a) Always dry the harvested tuber quickly to remove excess moisture from the surface of tubers for improving their keeping quality.

(b) Always dry the harvested tuber in storage shed, expose to sun causes the greening of potatoes.

(c) Do not store the tubers immediately if they are exposed to rain after harvest.

B) The following care should be taken during curing**:**

(a) Always follow the curing process at 25 degree centigrade with a 95 per cent relative humidity,

(b) For optimum suberization, curing is essential for healing the wounds of tubers resulted from cutting and bruising during harvesting.

C) The following care should be taken during sorting:

(a) All the damaged and diseased tubers should be removed during sorting.

3.3 POST HARVEST EQUIPMENTS :

1) ANIMAL DRAWN POTATO DIGGER

It is an animal drawn single row equipment for digging potato. It consists of multipurpose tool frame, V shape blade and extension rods on the blade wings to separate soil and dirt from the potato. It eliminates 11 per cent tuber damage resulting in conventional digging.

Overall dimensions in mm			Weight in kgs	Cutting width in mm	Working Depth in mm	Draft, N	Operating speed Km/h	Field Capacity Ha/h	Field Efficiency	Labour Requirement Man-h/ha	Price, Rs	Op. Cost Rs/ha
Length	Width	Height	46	300	250	460	1.0-1.9	0.06-0.07	75	14-17	3500/-	450/-
3325	**600**	**900**										

Source: Central Institute of Agricultural Engineering, Bhopal.

3.4. GRADING :

Sorting and grading of Potato

Grading is an important factor in the marketing process of potato.

Benefits:

i) Grading helps the potato producer and seller to determine the price.

ii) It reduces the cost of marketing and helps the consumers to get standard potato at fair price.

iii) It facilitates the scope to widen the avenue for potato export.

iv) It has a direct influence on utilization point of view, as the small to medium sized tubers are prepared for 'seed tubers' and large sized tubers are preferred for processing purpose.

Methods of Grading :

Grading of tubers is done both by hand as well as by graders. The different practices of grading of potato are as follows:

i) Grading of potatoes with a set of rectangular sieves having round holes of varying diameters, where a pair of such sieves placed one above the other are shaken to and fro by two persons and the third person continuously feds the upper sieve.

ii) Grading of potatoes through sieves hung on chains or ropes and move back and fore.

iii) Grading of potatoes by the mechanical grader, where the sieves are mounted on the oscillation of frame as operated mechanically by power. This grader can be operated with 1H.P. electric motor, engine or tractor.

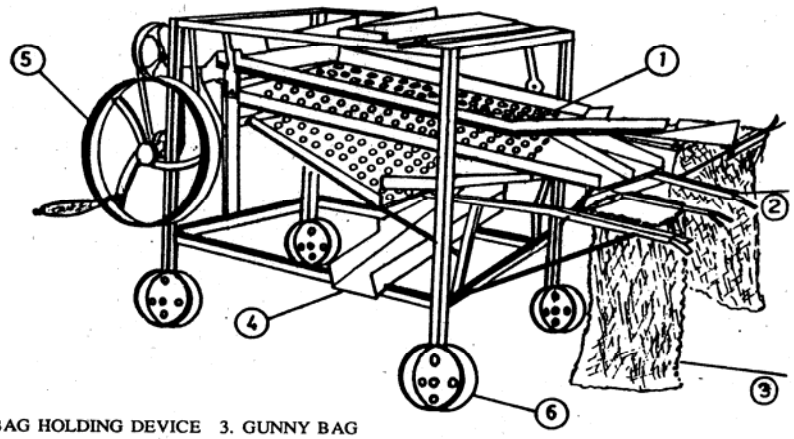
iv) Grading of potato with power operated potato grader with conveyer attachment gives better grading efficiency (90 per cent) .The power requirement is 1.5 H.P .It can grade four categories viz less than 10 gms,10-25 gms, 25-60 gms, and more than 60 gms.

v) The rubber roller type of potato grader grades, six categories of grades viz. less than 10 gms, 10-25 gms, 25-50 gms, 50-75 gms, 75-100 gms, and more than 100 gms.The system consist of mainframe, grading rollers, conveyor belt and power transmission system. The grader is operated by 2 H.P electric motor.

2) HAND OPERATED POTATO GRADER

Function: Sorting of potatoes into different size grades
Specifications:
Type**:** Manually Operated, Oscillating sieves.
Dimension**:** 2880mm(L) X 2940mm(w) X 1950mm(h)
Weight **:** 300 kgs.
No. of sieves **:** Two oscillating and one fixed.
Sieve inclination**:** 11%.
Sieve perforation**:** 45 mm and 30 mm diameter (oscillating sieves), 20 mm diameter (fixed sieve)
Power transmission**:** Through belt and pulley arrangement.
Performance:
Output capacity **:** 20q/hr.
Grade size**: i)** Upto 50 gms, **ii**) 50-75 gms., **iii)** Above 75 gms.
Grading efficiency**:** 85%.
Tuber brushing**:** Less than 2%.
Labour requirement **:** 8-9 persons.
Cost (Approx) **:** Rs: 8000/-

FIG. 17. HAND OPERATED POTATO GRADER

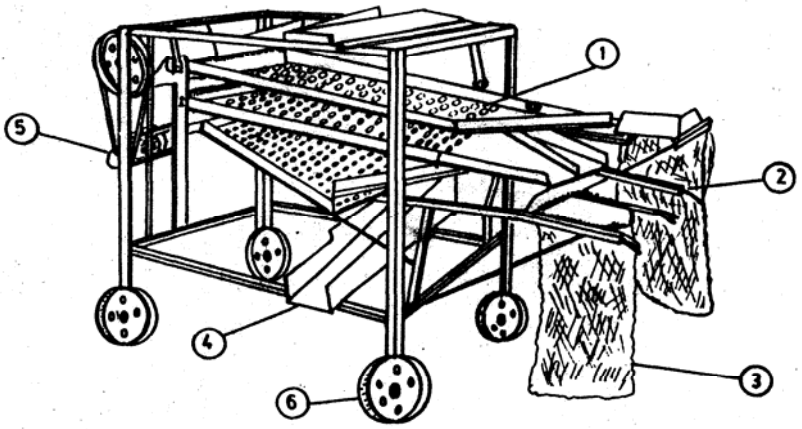


1. SIEVE 2. BAG HOLDING DEVICE 3. GUNNY BAG
4. POTATO OUTLET 5. HAND OPERATED WHEEL
6. TRANSPORT WHEEL

3) POWER OPERATED POTATO GRADER

Function: Sorting of potatoes into different size grades.
Specifications:
Type**:** Power Operated, Oscillating sieves.
Dimension**:** 2880mm(l) X 2940mm (w) X 1950mm(h)
Weight **:** 350 kgs.
No. of sieves **:** Three oscillating and one fixed.
Sieve inclination**:** 11%.
Sieve perforation**:** 45.30 and 20 mm diameter(oscillating sieves), 12 mm diameter (fixed sieve)
Oscillation frequency **:** 460 – 490 strikes/min
Power transmission**:** Through belt and pulley arrangement.
Performance:
Output capacity **:** 25q/hr.
Grade size**: i)** less than 10 gms, **ii)** 10-25 gms, **iii)** 25-60gms. **iv)** Above 60 gms.
Grading efficiency**:** 88%.
Tuber brushing**:** Less than 2%.
Labour requirement **:** 9-10 persons.
Cost(Approx) **:** Rs: 10,000/-

FIG. 18. POWER OPERATED POTATO GRADER



1. SIEVE 2. BAG HOLDING DEVICE 3. GUNNY BAG
4. POTATO OUTLET 5. ELECTRIC MOTOR 6. TRANSPORT WHEEL

Source : Central Potato Research Institute, (CPRI), Shimla

3.4.1 Grade Specifications:

I) AGMARK SPECIFICATIONS

Under the Agricultural Produce (Grading and Marking) Act,1937, the Table Potato Grading and Marking rules 1950 was formulated and notified by the Govt. of India. The quality factors like size of tubers, conformity to the variety, tolerance limits for under sized and over sized tubers, percentage of diseased and damaged tubers, and

dust and extraneous matters, etc. are taken into consideration. The Agmark grade standards of Table Potato are furnished below.

I) Grade Designations and Definition of Quality of Table Potatoes (Oval or long varieties*)

Grade designation	General	Applicable to single tuber's size (Minimum diameter in) millimeters	Definition of quality				
			Applicable to quantities				
			Conformity to variety etc.	Tolerance			
				Under size or over-size	Disease + Damage etc	Earth and extraneous matter	Maximum aggregate of all defects under column 5,6 & 7
Extra special	Reasonably clean, healthy potatoes, free from serious defect and suitable for human consumption	41 mm**	At least 95% by weight must conform to the variety	Not more than 2% of the total weight may pass through sieve having circular holes with a diameter of the minimum size specified (in column 3) for the grade; included in this not more that 0.5% of the total weight may pass through a 25 mm.mesh	Not more than 2% of the total weight may consist of appreciably diseased, damaged or unsightly potatoes and included in this amount	Not more than 2% may be total present, the percentage to be calculated on the net weight of screened potatoes.	4% of the total weight
Special	Reasonably clean, healthy potatoes, free from serious defect and suitable for human consumption	29 mm	At least 95% by weight must conform to the variety	Not more than 2% of the total weight may pass through sieve having circular holes with a diameter of the minimum size specified (in column 3) for the grade; included in this not more that 0.5% of the total weight may pass through a 25 mm.mesh	Not more than 2% of the total weight may consist of appreciably diseased, damaged or unsightly potatoes and included in this amount	Not more than 2% may be total present, the percentage to be calculated on the net weight of screened potatoes.	4% of the total weight

* The word "Oval or Long": shall be marked following the grade name on the AGMARK label by means of a rubber stamp.

** When the potatoes have been passed over a riddle of greater mesh than 41 mm. the minimum size may at the seller's discretion be appended to the grade name, e.g. "Extra Special" (51 mm., 57 mm, 64 mm etc.) but potatoes which exceed 89 mm in their smallest diameter shall be excluded from grading.

+ 1. Any disease or defect the presence of which may be established by cutting open the potato shall be taken into account, and potatoes having cuts worm and slug holes penetrating into the flesh shall be regarded as damaged.

2. Potatoes affected by greenness superficial disease or damage shall not be regarded as diseased or damaged unless more than 1/10 of the surface is so affected.

3. A potato shall only regarded as being obviously affected with the soft rot, if at the time of inspection, it is squashy or the surface is at some part distinctly broken or wet owing to disease.

II) Grade Designations and Definition of Quality of Table Potatoes (round varieties*)

Grade designation	General	Applicable to single tuber's size (Minimum diameter in) millimeters	Definition of quality				
			Applicable to quantities				
			Conformity to variety etc.	Tolerance			
				Under size or over-size	Disease + Damage etc	Earth and extraneous matter	Maximum aggregate of all defects under column 5,6 & 7
Extra special	Reasonably clean, healthy potatoes, free from serious defect and suitable for human consumption	45 mm**	At least 95% by weight must conform to the variety	Not more than 2% of the total weight may pass through sieve having circular holes with a diameter of the minimum size specified (in column 3) for the grade; included in this not more that 0.5% of the total weight may pass through a 25 mm.mesh	Not more than 2% of the total weight may consist of appreciably diseased, damaged or unsightly potatoes and included in this amount	Not more than 2% may be total present, the percentage to be calculated on the net weight of screened potatoes.	4% of the total weight
Special	Reasonably clean, healthy potatoes, free from serious defect and suitable for human consumption	32 mm	At least 95% by weight must conform to the variety	Not more than 2% of the total weight may pass through sieve having circular holes with a diameter of the minimum size specified (in column 3) for the grade; included in this not more that 0.5% of the total weight may pass through a 25 mm.mesh	Not more than 2% of the total weight may consist of appreciably diseased, damaged or unsightly potatoes and included in this amount	Not more than 2% may be total present, the percentage to be calculated on the net weight of screened potatoes.	4% of the total weight

* Potatoes of round varieties shall be packed separately The word "Oval or Long": shall be marked following the grade name on the AGMARK label by means of a rubber stamp.

** When the potatoes have been passed over a riddle of greater mesh than 45 mm. the minimum size may at the seller's discretion be appended to the grade name, e.g. "Extra Special" (51 mm., 57 mm, 64 mm etc.) but potatoes which exceed 83 mm in their smallest diameter shall be excluded from grading*.

+ 1. Any disease or defect the presence of which may be established by cutting open the potato shall be taken into account, and potatoes having cuts worm and slug holes penetrating into the flesh shall be regarded as damaged.

2. Potatoes affected by greenness superficial disease or damage shall not be regarded as diseased or damaged unless more than 1/10 of the surface is so affected.

3. A potato shall only regarded as being obviously affected with the soft rot, if at the time of inspection, it is squashy or the surface is at some part distinctly broken or wet owing to disease.

III) Grade Specifications for Export :

i) For grade specification for export of table potato under Agmark is as follows.

Grade Designation and Definition of Quality of Table Potatoes of Mettupalayam Variety (Oval or long or round or mixed*)

Grade designa-tion	General	Definition of quality				
		Applicable to single tuber's size (min. dia in mm)	Applicable to quantities			
			Conformity to variety etc.**	Tolerance		
				Under size or over-size	Disease, Damages, etc	Earth and extraneous matter
1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**
Extra special	Reasonably clean, healthy potatoes, free from serious defect and suitable	46 @	At least 95% by weight must conform to the variety	Not more than 3% of the total weight may pass through sieve having circular holes with a diameter of a minimum size specified (in column 3) for the grade.	Not more than 2% of the total weight may consist of diseased, damaged and sprouted potatoes.	Not more than 2% may be present, the percentage to be calculated on the net weight of screened potatoes.
Special	Reasonably clean, healthy potatoes, free from serious defect and suitable	35	At least 95% by weight must conform to the variety	Not more than 3% of the total weight may pass through sieve having circular holes with a diameter of a minimum size specified (in column 3) for the grade.	Not more than 2% of the total weight may consist of diseased, damaged and sprouted potatoes.	Not more than 2% may be present, the percentage to be calculated on the net weight of screened potatoes.
General	Reasonably clean, healthy potatoes, free from serious defect and suitable	25	At least 95% by weight must conform to the variety	Not more than 3% of the total weight may pass through sieve having circular holes with a diameter of a minimum size specified (in column 3) for the grade.	Not more than 2% of the total weight may consist of diseased, damaged and sprouted potatoes.	Not more than 2% may be present, the percentage to be calculated on the net weight of screened potatoes.

*The word Oval Long or Round or Mixed" shall be marked, following the trade description, on the AGMARK label, by means of rubber stamp,

**Column 4 relating to conformation to variety will not apply to mixed lots.

@ In case when the potatoes have been passed over a riddle of greater mesh than 46 mm. the minimum size may, at the seller's discretion, be appended to the grade name e.g., "Extra Special" (51 mm., 57 mm., 64 mm, etc.) but potatoes which exceed 89 mm., in their smallest diameter shall be excluded from grading.

1. Any disease or defect, the presence of which maybe established by cutting open the potato, shall be taken into account and potatoes having cuts, worm or slug holes penetrating into the flesh shall be regarded as damaged.
2. Potatoes affected by greenness, superficial disease or damage shall not be regarded as diseased or damaged unless more than 1/5 of the surface is so affected.
3. A potato shall only be regarded as being obviously affected with the soft rot, if at the time of inspection, it is squashy or the surface is at some part distinctly broken or wet owing to disease.

ii) Grade Designation and Definition of Quality of Katva or Farukhabad Table Potatoes (round**)

Grade designa-tion	General	Definition of quality				
		Applicable to single tuber's size (min. dia in mm)	Applicable to quantities			
			Conformity to variety etc.	Tolerance		
				Under size or over-size	Disease, Damages, etc	Earth and extraneous matter
1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**
Extra special	Reasonably clean, healthy potatoes free from serious defect and suitable for human consumption.	25 @	At least 95% by weight must conform to the variety.	Not more than 3% of the total weight may pass through having circular with a diameter of a minimum size specified (in column 3) for the grade.	Not more than 2% of the total weight may consist of diseased, damaged or sprouted potatoes.	Not more than 2% may be present, the percentage to be calculated on the net weight of screened potatoes.
Special	Reasonably clean, healthy potatoes free from serious defect and suitable for human consumption.	20	At least 95% by weight must conform to the variety.	Not more than 3% of the total weight may pass through having circular with a diameter of a minimum size specified (in column 3) for the grade.	Not more than 2% of the total weight may consist of diseased, damaged or sprouted potatoes.	Not more than 2% may be present, the percentage to be calculated on the net weight of screened potatoes.

*The word 'Round' shall be marked, following the trade description, on the AGMARK label, by means of rubber Stamp.

@ When the potatoes have been passed over a riddle of greater mesh than 25 mm. the minimum size may, at the seller's discretion, be appended to the grade name eg., 'Extra Special' (51 mm., 57 mm, 64mm., etc.) but potatoes which exceed 89 mm, in their smallest diameter shall be excluded from grading.

1. Any disease or defect, the presence of which may be established by cutting open the potato, shall be taken into account and potatoes having cuts, worm or slug holes penetrating into the flesh shall be regarded as a damaged.

2. Potatoes affected by greenness, superficial disease or damage shall not be regarded as diseased or damaged unless more than 1/5 of the surface is so affected.

3. A potato shall only be regarded as being obviously affected with the soft rot, if the time of inspection, it is squashy or the surface is at some part distinctly broken or wet owing to disease.

iii) Grade Designation and Definition of Quality of Table Potatoes of (Oval or long*) of variety other than Mettupalayam Potatoes

Grade designa-tion	General	Definition of quality				
		Applicable to single tuber's size (min. dia in mm)	Applicable to quantities			
			Conformity to variety etc.	Tolerance		
				Under size or over-size	Disease, Damages, etc	Earth and extraneous matter
1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**
Extra special	Reasonably clean, healthy potatoes, free from serious defect and suitable for human consumption.	40 @	At least 95% by weight must conform to the variety.	Not more than 3% of the total weight may pass through sieve having circular holes with a diameter of a minimum size specified (in column 3) for the grade.	Not more than 2% of the total weight may consist of diseased, damaged and sprouted potatoes.	Not more than 2% may be present, the percentage to be calculated on the net weight of screened potatoes.
Special	Reasonably clean, healthy potatoes, free from serious defect and suitable for human consumption.	30	At least 95% by weight must conform to the variety.	Not more than 3% of the total weight may pass through sieve having circular holes with a diameter of a minimum size specified (in column 3) for the grade.	Not more than 2% of the total weight may consist of diseased, damaged and sprouted potatoes.	Not more than 2% may be present, the percentage to be calculated on the net weight of screened potatoes.
General	Reasonably clean, healthy potatoes, free from serious defect and suitable for human consumption.	20	At least 95% by weight must conform to the variety.	Not more than 3% of the total weight may pass through sieve having circular holes with a diameter of a minimum size specified (in column 3) for the grade.	Not more than 2% of the total weight may consist of diseased, damaged and sprouted potatoes.	Not more than 2% may be present, the percentage to be calculated on the net weight of screened potatoes.

*The word 'Oval or long' shall be marked, following the trade description, on the AGMARK label, by means of rubber Stamp.

@ When the potatoes have been passed over a riddle of greater mesh than 25 mm. the minimum size may, at the seller's discretion, be appended to the grade name eg., 'Extra Special' (51 mm., 57 mm, 64mm., etc.) but potatoes which exceed 89 mm, in their smallest diameter shall be excluded from grading.

1. Any disease or defect, the presence of which may be established by cutting open the potato, shall be taken into account and potatoes having cuts, worm or slug holes penetrating into the flesh shall be regarded as a damaged.

2. Potatoes affected by greenness, superficial disease or damage shall not be regarded as diseased or damaged unless more than 1/5 of the surface is so affected.

3. A potato shall only be regarded as being obviously affected with the soft rot, if the time of inspection, it is squashy or the surface is at some part distinctly broken or wet owing to disease.

iv) Grade Designation and Definition of Quality of Table Potatoes (round*) other than Mettupalayam and Katva or Farukhabad Potatoes

Grade designa-tion	General	Definition of quality				
		Applicable to single tuber's size (min. dia in mm)	Applicable to quantities			
			Conformity to variety etc.	Tolerance		
				Under size or over-size	Disease, Damages, etc	Earth and extraneous matter
1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**
Extra special	Reasonably clean, healthy potatoes, free from serious defect and suitable for human consumption.	45 @	At least 95% by weight must conform to the variety.	Not more than 3% of the total weight may pass through sieve having circular holes with a diameter of a minimum size specified (in column 3) for the grade.	Not more than 2% of the total weight may consist of diseased, damaged and sprouted potatoes.	Not more than 2% may be present, the percentage to be calculated on the net weight of screened potatoes.
Special	Reasonably clean, healthy potatoes, free from serious defect and suitable for human consumption.	32	At least 95% by weight must conform to the variety.	Not more than 3% of the total weight may pass through sieve having circular holes with a diameter of a minimum size specified (in column 3) for the grade.	Not more than 2% of the total weight may consist of diseased, damaged and sprouted potatoes.	Not more than 2% may be present, the percentage to be calculated on the net weight of screened potatoes.

*The word 'Round' shall be marked, following the trade description, on the AGMARK label, by means of rubber Stamp.

@ When the potatoes have been passed over a riddle of greater mesh than 45 mm. the minimum size may, at the seller's discretion, be appended to the grade name eg., 'Extra Special' (51 mm., 57 mm, 64mm., etc.) but potatoes which exceed 89 mm, in their smallest diameter shall be excluded from grading.

1. Any disease or defect, the presence of which may be established by cutting open the potato, shall be taken into account and potatoes having cuts, worm or slug holes penetrating into the flesh shall be regarded as a damaged.

2. Potatoes affected by greenness, superficial disease or damage shall not be regarded as diseased or damaged unless more than $1/5^{th}$ of the surface is so affected.

3. A potato shall only be regarded as being obviously affected with the soft rot, if the time of inspection, it is squashy or the surface is at some part distinctly broken or wet owing to disease.

3.4.2 Codex Alimentarius Commission :

The Codex Alimentarius Commission (CAC) was created in 1963 by Food and Agricultural Organization of the United Nations (FAO) and World Health Organization (WHO) to develop food standards, guidelines and related texts such as codes of practices under the Joint FAO/WHO Food Standards Programme. It's main purpose is to protect the health of consumers and ensuring fair trade practices in food trade and promoting conditions of food and food standards work undertaken by International governmental and non-governmental organizations.

As per Codex, the Potato products shall comply with the maximum pesticide residue limits as follows.

CODEX Specifications of Potato / Potato Products

CODEX STANDARD FOR QUICK FROZEN FRENCH FRIED POTATOES
CODEX STAN 114-1981

1. SCOPE

This standard shall apply to quick frozen French fried potatoes which have been prepared from tubers of the species *Solanum tuberosum* L. and offered for direct consumption without further processing except for repacking if required.

2. DESCRIPTION

2.1 Product Definition

Quick frozen French fried potatoes is the product prepared from clean, mature, sound tubers of the potato plant conforming to the characteristics of the species *Solanum tuberosum* L. Such tubers shall have been sorted, washed, peeled, cut into strips, and treated as necessary to achieve satisfactory colour and fried in edible oil or fat. The treatment and frying operations shall be sufficient to ensure adequate stability of colour and flavour during normal marketing cycles.

2.2 Process Definition

2.2.1 Quick frozen French fried potatoes is the product subjected to a freezing process in appropriate equipment and complying with the conditions laid down hereafter. The freezing operation shall be carried out in such a way that the range of temperature of maximum crystallization is passed quickly. The quick freezing process shall not be regarded as complete unless and until the product temperature has reached -18^{o} C (0^{o}F) at the thermal centre after thermal stabilization.

2.2.2 The recognized practice of repacking quick frozen foods under controlled conditions is permitted.

2.3 Handling Practice

The product shall be handled under such conditions as will maintain the quality during transportation, storage and distribution up to and including the time of final sale. It is recommended that the product be handled in accordance with the provisions in the Recommended International Code of Practice for the Processing and Handling of Quick Frozen Foods (CAC/RCP 8-1976).

2.4 Presentation

2.4.1 Styles

The styles of the product shall be determined by the nature of the surface and the nature of the cross section.

2.4.1.1 Nature of the Surface

The product shall be presented in one of the following styles:

(a) ***Straight cut*** **-** strips of potato with practically parallel sides and with smooth surfaces.
(b) ***Crinkle cut*** **-** strips of potato with practically parallel sides and in which two or more sides have a corrugated surface.

2.4.1.2 Dimensions of the cross section

The cross sectional dimensions of strips of quick frozen French fried potatoes which have been cut on all four sides shall not be less than 5 mm when measured in the frozen condition. The quick frozen French fried potatoes within each pack shall be of similar cross sections.

The product may be identified by the approximate dimensions of the cross sections or by reference to the following system for designations:

Designation surface	**Dimension in mm across the largest cut**
Shoestring	5 - 8
Medium	8 - 12
Thick cut	12 - 16
Extra large greater than	16

2.4.2 Other Styles

Any other presentation of the product, based on differing cross sections shall be permitted provided that it:

(a) is sufficiently distinctive from other forms of presentation laid down in this standard;
(b) meets all other requirements of this standard;
(c) is adequately described on the label to avoid confusing or misleading the consumer.

3. ESSENTIAL COMPOSITION AND QUALITY FACTORS

3.1 Composition

3.1.1 Basic Ingredients

(a) Potatoes as defined in Section 2.1
(b) Edible fats and oils as defined by the Codex Alimentarius Commission.

3.1.2 Optional Ingredients

(a) Sugars (sucrose, invert sugar, dextrose, fructose, glucose syrup, dried glucose syrup) as defined by the Codex Alimentarius Commission;
(b) Salt (sodium chloride);
(c) Condiments, such as herbs and spices.

3.2 Quality Factors

3.2.1 General Requirements

Quick frozen French fried potatoes shall:

- be free from any foreign flavours and odours;
- be clean, sound and practically free from foreign matter;
- have a reasonably uniform colour;

and with respect to visual defects subject to a tolerance shall be:

- without excessive external defects such as blemishes, eyes and discolouration;
- without excessive sorting effects, such as slivers, small pieces and scrap;
- reasonably free from frying defects, such as burnt parts.

When prepared in accordance with the manufacturer's instructions quick frozen French fried potatoes shall:

- have a reasonably uniform colour;
- have a texture characteristic of the product and be neither excessively hard nor excessively soft or soggy.

3.2.2 Analytical Requirements

3.2.2.1 Moisture - the maximum moisture content of the whole product in the styles shoestring, medium and thick cut shall be 76% m/m; and in extra large and other styles 78% m/m.

3.2.2.2 The fat or oil extracted from the product shall have a free fatty acid content of not more than 1.5% m/m measured as oleic acid or an equivalent fatty acid value based on the predominant fatty acid in the fat or oil.

3.2.3 **Definition of Visual Defects**

3.2.3.1 **External defects** are blemishes or discolouration (either internally or on the surface) due to exposure to light, mechanical, pathological or pest agents, eye material or peeling remnants.

(a) Minor defect - A unit affected by disease, dark or intense discolouration, eye material, or dark peel covering an area or a circle greater that 3 mm but less than 7 mm in diameter; pale brown peel or light discolouration of any area greater than 3 mm in diameter.
(b) Major defect - A unit affected by disease, dark or intense discolouration, eye material, or dark peeling covering an area or a circle greater than 7 mm but less than 12 mm in diameter.
(c) Serious defect - A unit affected by disease, dark or intense discolouration, eye material, or dark peel covering an area or a circle of 12 mm in diameter or more.

Note: ("slight" external defects which in either area or intensity fall below the definition shown for minor defects shall be ignored)

3.2.3.2 **Sorting Defects**

(a) Sliver - a very thin unit (generally an edge piece) which will pass through a slot the width of which is 50% of the minimum dimension of the nominal or normal size.

(b) Small piece - Any unit less than 25 mm in length.

(c) Scrap - Potato material of irregular form not conforming to the general conformation of French fried potatoes.

3.2.3.3 **Frying Defects**

Burnt pieces - Any unit which is dark brown and hard due to gross over frying.

3.2.4 **Standard Sample Size**

The standard sample size shall be 1 kilogramme.

3.2.5 **Tolerances for Visual Defects**

For tolerances based on the standard sample size as specified in Section 3.2.4 the visual external defects are classified as "minor" or "major" or "serious". The

tolerances in respect of external defects are dependent on the cross section of the French fried potatoes.

To be acceptable, the standard samples shall not contain units in excess of the numbers shown for the respective categories, including total, in Table 1.

TABLE 1 - Tolerances for external defects

Defect category	Number of Units Affected Cross section of strips	
	5 - 16 mm	over 16 mm
Serious	7	3
Serious + major	21	9
Total (serious + major + minor)	60	27

The tolerances for the other defects (not depending on cross section) are:

Sorting defects

Slivers	-	max. 12% m/m
Small Pieces and Scraps	-	max. 6% m/m
Total Sorting Defects	-	max. 12% m/m

Frying defects max. 0.5% m/m

3.3 Definition of "defective" for Composition and Quality Factors

Any sample unit taken in accordance with the FAO/WHO Codex Alimentarius Sampling Plans for Prepackaged Foods (AQL 6.5) (CAC/RM 42-1969) (see Codex Alimentarius Volume 13) shall be regarded as a "defective" for the respective characteristics when:

(a) it fails to meet any of the requirements given in Section 3.1;
(b) it fails to meet any of the general requirements given in Section 3.2.1;
(c) when it exceeds the tolerances for visual defects in any one or more respective defect categories in Section 3.2.5.

3.4 Lot Acceptance for Composition and Quality Factors

A lot will be considered acceptable with respect to Composition and Quality Factors when the number of "defectives" as defined in Section 3.5 does not exceed the acceptance number (c) for the appropriate sample size as specified in the FAO/WHO Codex Alimentarius Sampling Plans for Prepackaged Foods (AQL 6.5)(CAC/RM 42-1969) (See Codex Alimentarius Volume 13). In applying the acceptance procedure each "defective" (as defined in section 3.3(a) to (c)) is treated individually for the respective characteristics.

3.5 Definition of "defective" for Analytical Requirements

See Codex Alimentarius Volume 13.

3.6 Lot Acceptance for Analytical Requirements

See Codex Alimentarius Volume 13.

4. FOOD ADDITIVES

4.1	**Sequestrants**	**Maximum Level in Final Product**
4.1.1	Disodium dihydrogen pyrophosphate	100 mg/kg singly or in combination (phosphates expressed as P_2O_5)
4.1.2	Tetrasodium pyrophosphate	
4.1.3	Ethylene diamine tetra-acetic acid (Ca-diNa salt)	
4.1.4	Ascorbic acid	
4.1.5	Citric acid	Limited by GMP
4.1.6	Malic acid	

4.2 Processing Aids

4.2.1	Sulphite, bisulphite, metabisulphite (sodium or potassium salt))		50 mg/kg, singly or in combination, expressed as SO2
4.2.2	Sodium hydroxide		Limited by GMP
4.2.3	Potassium hydroxide		
4.2.4	Citric acid		
4.2.5	Dimethylpolysiloxane	-	10 mg/kg on a fat basis

4.3 Carry-Over Principle

"Section 3" of the "Principle Relating to the Carry-Over of Food Additives into Foods" as set forth in Volume 1 of the Codex Alimentarius shall apply.

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 1), 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. 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 1, the following specific provisions shall apply:

6.1 The Name of the Food

6.1.1 The name of the food as declared on the label shall include the designation "French Fried Potatoes" or the equivalent designation used in the country in which the product is intended to be sold.

6.1.2 In addition, there shall appear on the label a designation of the style as appropriate, i.e. "straight cut" or "crinkle cut" and there may also appear an indication of the approximate dimensions of the cross section or the appropriate designation, i.e. "shoestring", "medium", "thick cut" or "extra large".

6.1.3 If the product is produced in accordance with Section 2.4.2, the label shall contain in close proximity to the words "French Fried Potatoes" such additional words or phrases that will avoid misleading or confusing the consumer.

6.1.4 The words "Quick Frozen" shall also appear on the label, except that the term "Frozen" 1 may be applied in countries where this term is customarily used for describing the product processed in accordance with Section 2.2 of this standard.

6.2 Additional Requirements

The packages shall bear clear directions for keeping from the time they are purchased from the retailer to the time of their use, as well as directions for cooking.

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1 "Frozen": This term is used as an alternative to "quick frozen" in some English speaking countries.

6.3 Bulk Pack

In the case of quick frozen French fried potatoes in bulk, the information required above shall either be placed on the container or be given in accompanying documents, except that the name of the food accompanied by the words "quick frozen" (the term "frozen" may be used in accordance with Section 6.1.4 of this standard) and the name and address of the manufacturer or packer shall appear on the container.

7. PACKAGING

Packaging used for quick frozen French fried potatoes shall:

(a) protect the organoleptic and other quality characteristics of the product;

(b) protect the product against microbiological and other contamination;

(c) protect the product from dehydration and, where appropriate, leakage as far as technologically practicable; and

(d) not pass on to the product any odour, taste, colour or other foreign characteristics, throughout the processing (where applicable) and distribution of the product up to the time of final sale.

3.4.3 Grading at Producers Level:

In order to ensure proper price to the producers, grading at producer level is introduced by DMI. It is revealed from the table no.6 that during the year 2002-03, 24838 M.T. with an estimated value of Rs.2394.97 lakhs of potato was graded under grading at producers level as against 23170 M.T., with an estimated value of Rs.2571.04 lakhs was graded in the year 2003-04.

Table No. 6

Grading of Potato at Producers Level

Commodity	2002-2003		2003-2004	
	Qty. graded (in M.T.)	Estimated Value (Rs. in Lakh)	Qty. graded (in M.T.)	Estimated Value (Rs. in Lakh)
Potato	24838	2394.97	23170	2571.04

3.5. PACKAGING :

Handling and packaging of potatoes are done generally on farm. After harvesting, the tubers are kept in a heaped condition temporarily and covered with straw. After a few days, sorting is done for separating the diseased and cut tubers. The sound tubers are packed in hessian cloth bags or nettlon bags.

Materials used for Packaging

a) Hessian bags :

Ordinary hessian bags are used for packing potatoes with a capacity of 80 kgs, 50 kgs and 20kgs.

b) Nettlon bags:

25 kgs bags made of plastic net are preferred for export purpose.

3.6. TRANSPORTATION :

a) Head Loads : The age old method of carrying produce by a person on the head. It is convenient for :

i) Places like in hilly areas.

ii) Carrying small quantity of produce.

iii) For transporting nearest market having short distance.

b) Bullock / Camel carts : Bullock / Camel carts are the primary means of transport in most rural areas. It is convenient for following **:**

i) Cheap and easily available conveyance for the farmers to transport 5-10 quintals of produce to short distant places.

ii) Operational Cost is low.

iii) Easily manufactured by rural artisans from locally available materials (wood)

iv) Can be operated in muddy, kutccha or sandy roads.

v) This transport system creates employment to rural artisans.

c) Tractor trolley:

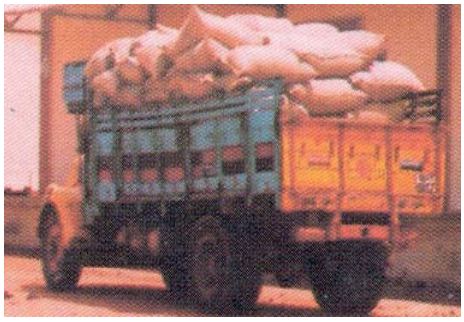
The use of tractor attached with a trolley is commonly used for transporting potatoes in many parts in the country. It is convenient for **:**

i) Carrying large quantity of produce in lesser duration of time.

ii) Suitable in surplus producing areas than the trucks for carrying produce to the primary assembling markets in the absence of pucca roads.

d) Trucks :

Large or bulk quantity of potatoes are carried by the trucks to the distant places through out the country. It is convenient for**:**



i) Easy availability

ii) Time saving

iii) Quick movement of stocks

iv) Door to door delivery.

v) Lower transit losses due to least handing of loading and unloading.

e) Railway Transport :

During harvesting season, considerable quantities of potato are transported by railway wagons. This is convenient for **:**

i) Suitable for carrying larger quantity of potatoes over long distances.

ii) Comparatively cheaper and safer mode of transport available through a wide network of railways.

3.7. STORAGE :

It has been noticed that over the years, production of potato has increased manifold which led to glut situation in the market. The practice of storage helps to stabilize the prices in the market. Storing potatoes for longer period in normal temperature is not possible as it is a living material and through respiration, the changes occurs due to heat, resulting in loss of dry matter and ultimate deterioration of quality of tubers. At optimum condition, the quality of potatoes remains good in storage for 3-5 weeks. The best temperature and humidity condition for storage of potatoes are as follows:

Table No.7

Intended Use	Temp (in ^{0}C)	RH (in per cent)
Seed purpose	2-4	95
Table purpose	7	98
Processing purpose	8-12	95

Sprouting in stored potato is always a serious problem. To avoid sprout inhibition, suppressant like Isopropyl N-Chlorophenyl Carbamate (CPIC), TNCB, MH are used. The irradiation process has also been found effective for sprout inhibition. The condition and health of the tuber while in storage is important coupled with good management during storage also plays an important role.

Benefits :

i) Minimum losses occurred due to tuber rotting disease.

ii) Preserve appearance by inhibiting development of surface blemishes.

iii) Minimize moisture loss and softening.

iv) Minimize losses during sprouting.

v) Prevent damages.

vi) Colour Loss.

3.7.1 Major Storage Pests and Diseases and its Control Measures :

Important pests and diseases affecting tubers in storage is classified as under**:**

I. STORAGE PESTS			
Name of Disease	**Causal organisms**	**Nature of damage**	**Remedial measures**
1.	**2.**	**3.**	**4.**
Tuber moth	*Phthorimaea spp.*	 PTM damaged tuber The larvae enter the tuber through eyes and bore tunnels. The larval damage results in direct weight loss and it's infection greatly reduced the market value of tubers	**i)** Keep the tubers covered with earth in the field. **ii)** Fumigate the godown with Methyl Bromide at 4.8 Kg/100 cubic meter for 3 hrs.
II. PATHOLOGICAL STORAGE DISEASES			
Charcol rot Disease	*Macrophomina phaseolina*	Formed darkened patches on tubers which later become water soaked and black.	Require early harvesting, seed treatment with fungicides like Aretan or Agallol.
Late Blight	*Phytopthera infestans*	 Brown colouration of infected tubers, wet rot in storage causes huge loss.	Seed treatment with fungicides and proper pre harvest cares should be taken.

1.	2.	3.	4.
Wart	*Synchytrium endobioticum*	 Tubers become undersized	Apply heat treatment for tubers.
Soft rot	*Erwina spp.*	 Tubers are infected through wounds.	Wash tubers with chlorinated water before storage.

3.7.2 Storage Structures:

i) Traditional Storage:

a) In situ storage :

In this system, farmers do not harvest the tubers and allow it to remain in soil. This method is used for short term storage of 2-3 months only in upland and lowland areas of North eastern states. In this storage, following practices are found as beneficial **:**

In situ storage

1. Cover the potato beds with grass which provide shade and cooling effect to the potatoes in upland areas.

2. Cover the potato beds with paddy crop which provide shade and cooling effect to the potatoes in lowland areas.

b) Heap storage :

In this method, potatoes are heaped under the shade of trees, where 6-30 tonnes of potatoes can be stored. The heaps are covered with a layer of available straw material (about 30cm thick). This is a popular storage method practiced in U.P, Maharashtra and Karnataka. In heap storage, following practices are recommended for safe storage:

Storage in Heaps

* Select storage site in places like under the shade of trees, preferably in orchard.

- Raised sand / soil platform of height of at least 0.2-0.25 mt.
- Spray Mancozeb (0.3-0.5% solution) on the soil/sand at storage site which helps in reduction of rotting during storage.
- Remove cracked, cut, bruished, damaged, green and rotted tubers before storing.
- Use always the polythene sheet for covering the heaps, which protects the heaps from rains.
- Cover the heaped potatoes with 0.3 mt-0.45 mt. straw material (wheat, paddy), placing two layers of locally made mat (chatai) in crosswise direction which improves the efficiency of heap storage.
- Loading of potatoes may be done in the morning since the temperature is low in comparison to noon.

c) Pit storage:

This is a traditional method of storage. In this storage system, two types of pits are prepared i.e. katchha and pucca pits. Katchha pit is rectangular in shape measures 4.5 mt. (length) x 3.6 mt. (width) x 14 mt.(depth)* whereas pucca pit is normally circular in shape with a diameter of about 4.2 mt. All the pits are covered with 0.3 mt. thick available straw material (wheat, paddy). It is a popular storage method in Madhya Pradesh. The following recommendations are fallows for safe storage:

Pit Storage

- Follow all cultural practices, recommendations applicable in heap storage method.
- Always store disease free and cured potatoes.
- Measure the soil moisture level for determinations of depth of pit.
- Keep the length and width of the pit according to the quantity of potatoes to be stored.
- Maintain an average 25.6^{o}C of temperature and 66 percent relative humidity.

d) Wooden storage structure :

In this system, small wooden rooms like stores about 10 ft. heights are built in the field or near residential area. The walls of the store are built by horizontally fixed overlapping wooden planks which help in preventing seepage in store and running off the rain water. The roof of the store is covered with tin sheet and a gap is left between roof and wall for aeration purpose.

Wooden storage structure

*** Ref –** Traditional methods of Potato storage in changing scenario, Indian Farming Institute, August, 2002.

e) Storage in rooms :

In this method, farmers used to store potatoes in small rooms built of brick / stones / cement at the ground floor of their residence. The potatoes are stored in this storage either in heaps, gunny bags or in bamboo baskets.

f) Storage in baskets :

In North Eastern states, potatoes are stored in bamboo baskets known as “polo” which provides better aeration to the tubers. The baskets are made of different sizes. The smallest size holds 10 -12 kgs and the largest size one quintal potatoes. Smaller baskets are suitable for use as they are convenient to carry to the fields.

Storage in baskets

g) Storage in layers :

The method is not very common but popular where platforms of bamboo or wooden planks are constructed by the support of the store wall on one side and bamboo on the other side. It provides better space utilization and helps to minimize rotting of potato.

ii) Improved Storage :

a) Storage at low temperature:

The low temperature (at 2-4^{o}C and 8-10^{o}C) is the most common method for potato storage. The following recommendations are adopted in this type of storage**:**

- Store seed potatoes at 2-4^{o}C as no sprouting takes place at this temperature and metabolic process goes down. Besides, low temperature, sweetening is of little importance in case of seed potatoes.
- Store potatoes for export and processing purposes at 8-10^{o}C, will not only save a lot of energy but also make the potatoes more suitable for consumption, processing and export.
- Use sprout suppressants like CIPC [isopropyl-N-(Chlorophynyl) carbamate] to check the sprouting while potatoes are stored at 8-10^{o}C.

b) Storage at 10-12°C :

This storage method is suitable for potatoes for processing and export. Following recommendations are followed**:**

- Store processing potatoes and ware potatoes at 10-12°C with CIPC treatment.
- Use refrigerated containers for export of potatoes stored at 10-12°C with CIPC treatment when the transit time of export is more than 10 days.
- Ship CIPC treated potatoes stored at 10-12°C in non refrigerated container for exporting to neighbour countries like Sri Lanka and Gulf countries where the transit time is not more than 3-4 days.

3.7.3 Storage Facilities :

a) Farmer's storage:

Farmers generally use indigenous in-situ storage system of without harvesting the tubers and to allow them remaining in the soil and also the ex-situ system where the farmers used to store potatoes in pits, baskets, wooden structures or in heaps or layers in room.

b) Private / Co-operative / Public Storage:

In Private / Co-operative / Public Storage sectors, potatoes are stored in cold storages at low temperature situated throughout the country. The state-wise distributions of Potato cold storage in above sectors are furnished as under.

Cold Storage

Table No. 8

Potato Cold Storages as on 31/12/2004

Sl. No.	State / UT	Potato Cold Storage	
		Number	Capacity in MT.
1.	2.	3.	4.
1.	Andaman & Nicobar Islands (UT)	00	00
2.	Andhra Pradesh	00	00
3.	Arunachal Pradesh	00	00
4.	Assam	00	00
5.	Bihar	187	699780
6.	Chandigarh (UT)	01	1000
7	Chhatisgarh	09	27575
8.	Delhi	00	00
9.	Gujarat*	164	584848
10.	Goa	00	00
11.	Haryana	172	225991
12.	Himachal Pradesh	05	9748
13.	Jammu & Kashmir	05	11281
14.	Jharkhand	06	22500
15.	Kerala*	00	00
16.	Karnataka	0003	00
17.	Lakshadweep (UT)*	00	00
18.	Maharashtra	04	2436
19.	Madhya Pradesh	109	553257
20.	Manipur	00	00
21.	Meghalaya	00	00
22.	Mizoram	00	00
23.	Nagaland	00	00
24.	Orissa	37	123580
25.	Pondicherry (UT)*	00	00
26.	Punjab	344	1097609
27.	Rajasthan	19	65896
28.	Sikkim	00	00
29.	Tamilnadu*	00	00
30.	Tripura	00	00
31.	U.P and Uttranchal	1371	8163232
32.	West Bengal	364	4379347
	TOTAL	**2800**	**15968080**

Source: AGMARKNET website (www.agmarknet.nic.in).

3.7.4 Pledge Finance System :

The Indian farming community mostly consists of small and marginal farmers. They do not have the economic strength to retain the surplus produce till favourable market price and often compelled to sell their produce immediately after harvest when the prices are low. The solution to this problem lies in providing safe and scientific storage of their produce and availing easy marketing credit against the stored produce. Hence, the systems of pledge finance have emerged as an unique avenue of finance to farmer.

Table No. 9

Facilities of Loan

Loan system	Eligibility	Rate of interest	Types of participating banks
As per guidelines of Reserve Bank of India, loan/advances can be given against hypothecation/ pledge of agricultural produce including Potato.	Persons can avail this facility of pledge loan by storing their produce in cold storage.	It is determined by respective Bank.	Commercial Banks / Cooperative Banks / Regional Rural Banks.

4.0 MARKETING PRACTICES AND CONSTRAINTS :

4.1 Assembling:

Assembling is the first step in marketing of farm produce. It involves collection of small surpluses from number of small farms scattered over large areas and bulking the same for subsequent distribution in volume.

The agencies engaged in the assembling of potato are as below **:**

a) Producers

b) Village Merchants

c) Itinerant Merchants

d) Wholesale Merchants

e) Commission Agent

f) Producers Co-operative Societies

Potato auction

Potato weighment

4.1.1 Major- Assembling Markets :

The major assembling markets are located in Uttar Pradesh, Punjab, West Bengal in which the assembling of potato is done along with other commodities. Some major assembling markets in major producing states in the country are listed below:

Table No.10

Major Assembling Markets of Potato in the country

Sl. No.	Name of State	Name of district	Name of major markets / mandies
1.	2.	3.	4.
1.	Uttar Pradesh	1) Agra	Agra, Samshabad
		2) Firozabad	Sirshaganj
		3) Kanpur nagar	Kanpur nagar
		4) Etawah	Etawah
		5) Kaunauj	Kaunauj, Chhibraman
		6) Allahabad	Allahabad
		7) Varanashi	Varanashi
		8) Gorakhpur	Gorakhpur
		9) Lucknow	Lucknow
		10) Raibarily	Laxmanpur

1.	2.	3.	4.
2.	West Bengal	1) Kolkata	Burrabazar Posta Market, Koley Market
		2) Hoogly	Champadanga, Haripal, Tarakeshwar, Pandua, Arambag, Seoraphulli, Dhaniakhali.
		3) Midnapur (west)	Midnapur, Garbeta, C.K Road
		4) Murshidabad	Kandi, Jangipur, Neema
		5) Howrah	Udaynarayanpur,Amta, Ramrajatala Bazar
3.	Delhi	1) North Delhi	Azadpur Mandi
		2) South Delhi	Okhla
		3) West Delhi	Tilaknagar
4.	Punjab	1) Bhatinda	Bhatinda, Bhuchhon, Maur, Rampurphul, Talwandi Sabo
		2) Mansa	Mansa, Budhlada, Sardulgarh
		3) Amritsar	Amritsar, Gheri, Khemkaran, Patti, Raiya, Tarantaran.
		4) Ferozpur	Ferozpur city, Ferozpur cantt., Abohar, Fazilka, Makha, Jalalabad, Kotissekhani, Mallanwaler, Zeera, Mamelot, Guruharsahai, Talwandi Bhai.
		5) Roper	Roper, Morinda, Kurali, Kharar, Chamkawr Sahib, Anandpur Sahib
		6) Fatehgarh Sahib	Sirhind, Amlah, Bassipathana, Khamano
		7) Gurdaspur	Gurdaspur, Batala, Derababananak, Deena Nagar
5.	Haryana	1) Ambala	Ambala
		2) Yamunanagar	Yamunanagar
		3) Kurukshetra	Kurukshetra
		4) Panipat	Panipat
6.	Himachal Pradesh	1) Chamba	Chamba
		2) Hamirpur	Hamirpur
		3) Kangra	Kangra
		4) Kinnaur	Kinnaur
		5) Kullu	Kullu
		6) Lahulspiti	Lahulspiti
		7) Mandi	Mandi
		8) Shimla	Shimla
		9) Solan	Solan
		10) Una	Una

Source: Field survey reports, Directorate of Marketing and Inspection,

4.1.2 Arrivals :

The arrivals of winter crop potato contribute about 85 per cent of total production commencing from harvesting season stretching between Dec-Jan to March-April. The season of arrivals of potato in the major markets in different states are described below**:**

Table No. 11

Season of Arrivals

Sl No	Name of State	Season
1.	Uttar Pradesh	November-April
2.	West Bengal	March-April , Sept-Nov (Plains) Jan-March, Jul-Aug (Hills)
3.	Punjab	Dec-April (Peak arrival) April, Oct-Nov (Average arrival) May-Sept (Lean period of arrival)
4.	Haryana	Dec-Jan (for early variety), Jan-March (for mid variety), March-April (Late variety)
5.	Himachal Pradesh	Sept-Oct (Seed potato varieties)
6.	Bihar	Dec-Jan (for early variety), March-May(for late variety)
7.	Gujarat	Feb-April
8.	Maharashtra	Feb-March
9.	Karnataka	Sept-Oct (Kharif crop), March-April (Rabi crop)
10.	Madhya Pradesh	Dec-April

Source: Marketing of Potato in India, Directorate of Marketing and Inspection, Year – 1984, 2001.

4.1.3 Despatches :

Generally most of the potato arrives in the markets are consumed within the state. However, in some cases, it has been noticed that a significant quantity of potato despatched to other states also in the country. The percentages of quantity dispatched to other states from major assembling markets are given in following table**:**

Table No. 12

Percentage of Potato Despatched to Other States

Sl No.	Name of Market	Percentage of potato despatched to other states
1.	Ratlam	80.97
2.	Shimla	75.00
3.	Farukhabad	70.00
4.	Bangalore	60.00
5.	Delhi	50.00
6.	Mettupalayam	50.00
7.	Kamrup	43.66
8.	Amritsar	40.00

Source : Field Survey Reports,
Directorate of Marketing and Inspection,

4.2. DISTRIBUTION :

4.2.1 Interstate Movements:

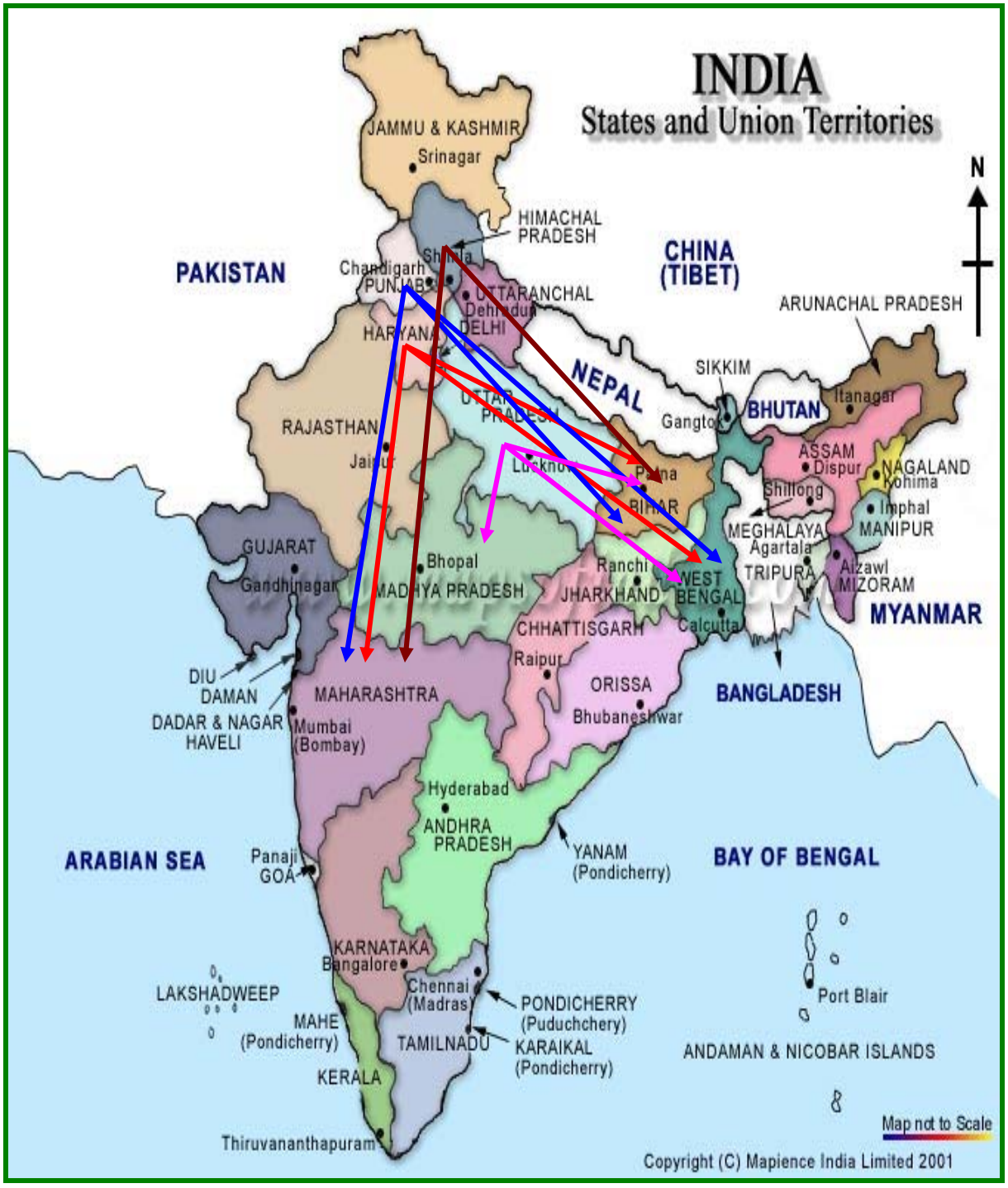
The interstate movement of potato mainly takes place by road, rail and to some extent by river. The movements of potato from surplus states to the deficit states take place throughout the year in huge quantity specially during glut situation in peak season.

Table No.13

Trend of Interstate- Movement of Potato in India

Sl No	Despatched from	Despatched to
1.	**Punjab**	Maharashtra, Bihar, West Bengal
2.	**Haryana**	Maharashtra, Bihar, West Bengal
3.	**U.P.**	Bihar, West Bengal, M.P.
4.	**H.P**	Bihar, Maharashtra

The trend of interstate movement of potato in India is depicted from following diagram **:**



4.3 EXPORT AND IMPORT :

Export :

Indian potatoes has immense export potential. It has a price advantage over it's European counterpart because of lower production cost and due to short crop duration and cheap labour. The king of vegetables, Indian potato has the quality for it's savory taste with exuberant varieties. The country is also blessed with natural abode of some of the best varieties of potatoes in the world. Besides, it has the potential to emerge as one of the largest supplier of seed potato.

The Indian table potatoes dominate the export by about 50 per cent of total potato export followed by frozen potatoes about 28 per cent, seed potatoes about 10 per cent, chip fried about 8 per cent and other frozen preparation nearly 3 per cent.

The quantities of different kinds of potatoes exported from the country are given as follows :

Table No.14

Export of Potato from India during 2003-2004 and 2004-2005

Sl No.	Commodity	Quantity in Kgs		Rs in lakh	
		2003-2004	2004-2005	2003-2004	2004-2005
1.	Potato Seeds (fresh or chilled)	5200782	6146704	326.37	478.20
2.	Potato other Seeds (fresh or chilled)	67739873	61012538	2778.65132	3317.04837

Source: Director General of Commercial Intelligence and Statistics, Kolkata.

Import :

India also imports potato from neighbouring countries e.g. Bhutan, Myanmar, etc. to some extent. The details are furnished below.

Table No.15

Import of Potato in India during 2004-2005

Sl. No.	Commodity	Year	Quantity in Kgs	Value in Rs lakh
1.	Potatoes fresh or chilled other than seeds	2004-2005	4813220	276.08774

Source: Director General of Commercial Intelligence and Statistics, Kolkata

4.3.1 Sanitary and Phytosanitary Requirements :

The Agreement on the application of the Sanitary and Phytosanitary (SPS) measures is an integral part of export trade, GATT (1994). Under SPS Agreement, the standards should be such that the minimum level of protection required by an importing country may be attained. With this view, the agreement to set up international standards and guidelines under the aegis of Codex Alimentarius Commission (CODEX) which was set up in 1963 by Food and Agriculture Organization (FAO) and World Health Organization (WHO) to develop food standards, lay down guidelines and related texts such as codes of practice under the Joint FAO / WHO Food Standards Programme. The main purpose of this programme are protecting health of the consumers and ensuring fair trade practices in the food trade, and to promote coordination of all food standards work undertaken by international governmental and non-governmental organizations.

The SPS measure is applied in various ways to protect animal and plant life or health within the territory of the member countries from risk arising from **--**

- ⇨ The entry, establishment or spread of pest, disease or any disease causal organisms.
- ⇨ The additives, contaminants, toxins or disease causing organisms on food stuffs.
- ⇨ The disease carried by animals, plants or their products.

By Sanitary and Phytosanitary (SPS) Agreement, the signatory country can lay down rules and regulations for the protection of life and health of human beings. The signatory country is allowed to maintain a higher level of SPS protection than the international standards provided it conforms to the following basic principles**:-**

i) The SPS measure should not lead distortion in trade.

ii) The SPS measure should not create any barrier in trade.

iii) The SPS measure should also conform to scientific principles and standards accepted internationally.

Under SPS measure, the standard should be applied in such a way that a minimum level of protection can be achieved by importing country.

- ► During export, in order to make the plant/seeds free from any quarantine pests and diseases, the exporter should give a dis-infection treatment by keeping the viability of the plant/seeds unaffected.

The dis-infection treatment before shipment should be carried out by authorized expert/technical personnel since the above process is hazardous. To assure the pest free product, the dis-infection treatment should be done just before shipment of produce.

In this process, the exporter has to apply to the officer in-charge for Phyto Sanitary Certificate (PSC) in the prescribed form at least 7–10 days in advance of the export. Before submitting the application for PSC, it is to be ensured that the cargo is treated properly by any licensed PCO to avoid any last minute detention by the P.Q. authority who is authorized to issue P.S.C.

- During import, no consignment of agricultural products is permitted to be imported without Phytosanitary Certificate, issued by authorized officer in-charge of Department of Agriculture and Co-operation.

4.3.2 Export Procedure :

The exporter may follow the following points during the export of seeds of potato:

- Export procedure has been simplified under Open General Licence (OGL), and there is no licence or restrictions is imposed. Generally, the buyers have to mention the quality in the contract. Accordingly, the exporter has to approach the recognized laboratories with samples to carry out the formalities of sample analysis for export.
- Product is then to be shifted to ports.
- Marine insurance cover is to be obtained from any insurance agency.
- Contact clearing and forwarding (C&F) agent for sorting of goods in godowns. They collect the shipping bill for allowing shipment by custom authority.
- Shipping bill is to be submitted by C&F agent to custom houses for verification.
- Verified shipping bill is given to Shed Superintendent by C&F agent and carting order is to be obtained.
- The C&F agent presents shipping bill to the Preventive Officer for loading in to the ship.
- After loading, a mate receipt is to be issued by the Captain of the ship to the Superintendent of the port who calculates the port charges and collect the same from C&F agent.
- After that payment is made, the mate receipt is obtained from the port authority to prepare bill of loading for the respective exporter.
- Then the C&F agent sends the bill of loading to the respective exporter.
- After receiving the documents, the exporter obtains a certificate of origin from chamber of commerce i e the goods are of Indian origin.
- Exporter informs the importer regarding the date of shipment, name of vessel, bill of loading, customer's invoice, packing list etc.
- The exporter for verification of documents submits all papers to the concerned bank.
- Bank sends documents to the foreign importer to enable him to take delivery of goods.

- ☞ After receiving papers, importer makes payment through bank and also sends documents called GR Form to RBI.
- ☞ Then exporter applies for various benefits from duty drawback schemes.

4.3.3 Agri Export Zones :

The policy for setting up of Agri Export Zones was announced by the Ministry of Commerce, Govt. of India on the 31st March, 2001 with the primary objective of boosting agri exports from the country. The Agricultural and Processed Food Export Development Authority (APEDA) under Ministry of Commerce, Govt. of India was appointed as the nodal agency to promote the setting up of such zones. The zones are a block / group of blocks or a district / group of districts. Agri export zones are specific geographical areas that have their own competitive advantages in production, processing or marketing of a specific agricultural produce including potato.

In an AEZ (Agri Export Zone), there is no physical demarcation of boundaries and it provides a focused approach on agricultural export completely. It is primarily based on the principles of 'convergence', 'partnership' and 'focus'.

The following agri-export zones (AEZ) have been identified for potato:

Sl.No.	Commodity	Name of the State	No. of AEZ
1	Potato	Punjab	1
2		Uttar Pradesh	2
3		West Bengal	1
4		Madhya Pradesh	1
		Total	5

Source: www.Commodityindia.com

Benefits :

- ✱ Strengthening of backward linkages with a market oriented approach.
- ✱ Product acceptability and its competitiveness abroad as well as in the domestic markets.
- ✱ Value addition to basic agricultural produce.
- ✱ Reduction of the cost of production through economy of scale.
- ✱ Better price for agricultural produce.
- ✱ Improvement of product quality and it's packaging.
- ✱ Promotion of trade related research and development.
- ✱ Increase of employment opportunities.

4.4 MARKETING CONSTRAINTS AND SUGGESTIONS :

Potato marketing in the country suffers from following constraints:

i) High Marketing Costs & Margins:

There is a need for promoting producer's co-operative in potato growing areas to reduce the price gap between growers and consumers.

ii) Wide Price Fluctuations :

The major potato growing states should arrange advance forecasting of area under potato and plan to divert the potatoes to the deficient areas or by export to avoid glut situations and price crashes in the markets.

iii) Bottlenecks in Storage Facilities :

About 90 per cent of total cold storages in the country used for potato storage and most of them are situated in big towns and markets. Hence it is needed to have new cold storage units in deficient areas particularly a rural areas.

iv) Lack of Long term Indian Potato Export Policy:

The significant step has been taken in this direction by Govt. of India by establishing Agri Export Zones (AEZs). Adequate infrastructure paucities like movement of potatoes from producing areas to exporting countries are required for further improvement.

v) Lack of avenues of utilization of Potato:

There is a need to utilize larger quantities of potatoes in the processing industries to improve and enhance the efficiency of processing and to reduce the cost of processing and processed products. Developed technologies for dehydrated potatoes will not only ensure proper return to the farmers but also boost the processing industry.

5.0 MARKETING CHANNELS, COSTS AND MARGINS :

5.1 Marketing Channels:

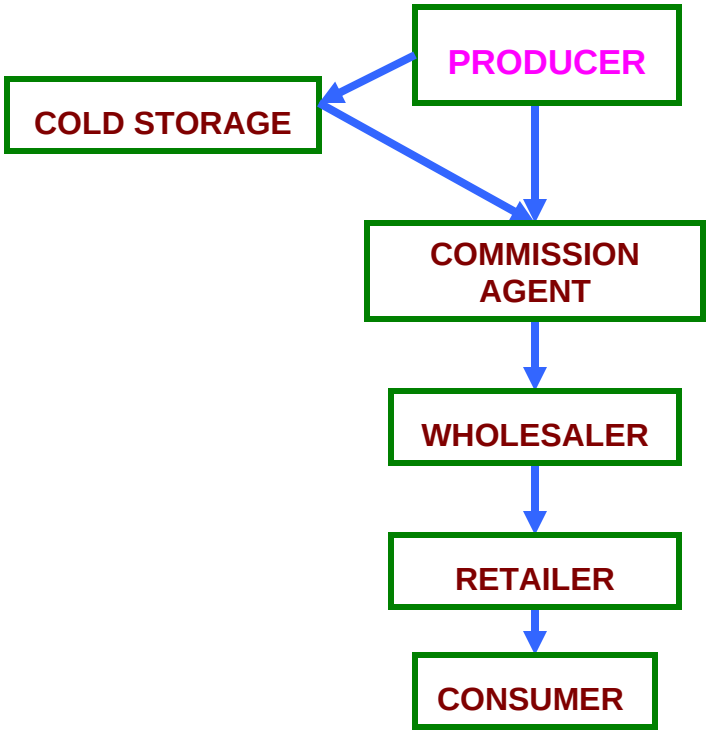
I) Private:

The different private agencies such as Producers, Commission agent, Wholesaler, Retailer and consumers are involved in the route of marketing channels of potato. These are **:**

1) Producer ➔ Cold storage ➔ Commission agent ➔ Wholesaler ➔ Retailer ➔ Consumer

2) Producer ➔Commission agent ➔ Wholesaler ➔ Retailer ➔ Consumer

3) Producer ➔ Wholesaler ➔ Retailer ➔ Consumer



II) Institutional :

Due to price fluctuations and glut situation in the market, some institutions like National Agricultural Co-operative marketing Federation (NAFED), different state govt. agencies, co-operative societies are intervening in the domestic market and Agricultural and Processed Food Export Development Authority (APEDA) for export purpose to stabilize the prices.

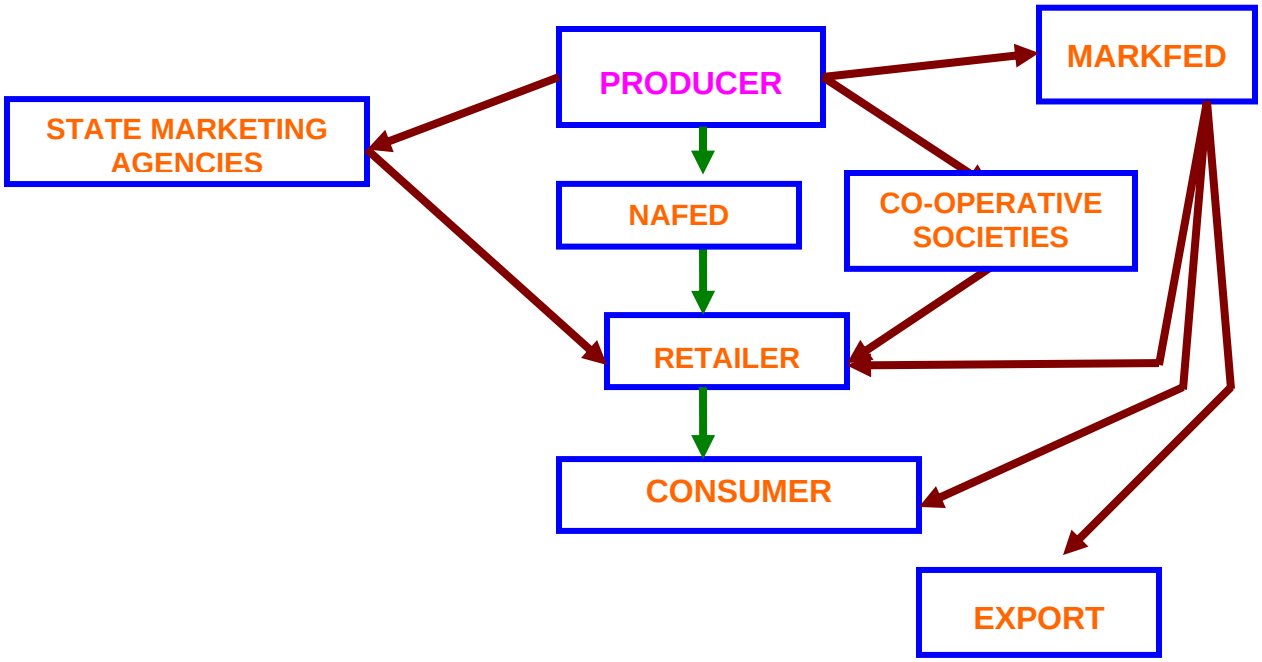
The institutions involve in the marketing channels of potato as follows:

1) Producer➔ State Marketing Agencies ➔ Retailer ➔ Consumer

2) Producer➔ Co-operative Societies ➔ Retailer ➔ Consumer

3) Producer➔ NAFED ➔ Retailer ➔ Consumer

4) Producer➔ Marketing Federation (MARKFED) ➔ Retailer ➔ Consumer ➔ Export



5.2 Marketing Costs and Margins :

❒ **Marketing costs:** Marketing costs are the actual expenses required for bringing potato from farm gate to the consumers. It includes the following:

- ✔ Handling charges at local points
- ✔ Assembling charges
- ✔ Transportation and storage costs
- ✔ Handling charges by wholesaler's and retailer to consumers
- ✔ Expenses on secondary services like financing, risk taking and market intelligence
- ✔ Profit margins taken out by different agencies.

i) **Market fee:** It is collected from buyers and not from sellers. The rates of market fees are determined by respective Agricultural Produce Market Committees in some states like Gujarat, Maharashtra, while in most of the states these are fixed for the entire state under the respective State Marketing Regulation Acts.

ii) **Commission charges:** In some regulated markets, the commission agents exist and they collect the charges.

iii) **Market charges:** These are the charges, which are incurred towards loading, unloading, weighing, brokerage, cleaning, etc. These charges are fixed by the market committee and vary from market to market. The operational charges starting from unloading, cleaning, preparation lot for sale and sometimes weighments are borne by farmers /sellers. From weighing, the subsequent operational charges are borne by the buyers/ traders. In case of some regulated markets, entry fee is charged for the vehicle.

MARKETING MARGINS :

The marketing margins of potato are the difference between the actual price paid by the consumer and the price received by farmer for an equivalent quantity and quality of potato. It may be explained in terms of price spread applied for a particular situation. Studies on marketing margins or price spread reveals that as the number of market functionaries increases, they add cost to the commodity in the marketing channel which results in the fall of producers show in consumer's rupee.

6.0 MARKETING INFORMATION AND EXTENSION :

❒ Marketing information:

Agricultural Marketing Information comprises of collection, analysis and compilation of agricultural marketing related information as well as dissemination of right information to the people in need, at right place, at right time and in right form. In a marketing system, market information is an important function which facilitates the marketing decisions and regulates the competitive market processes and mechanisms. It is helpful to the farmers for planning, production and marketing of their commodities. It is also the key to achieve operational and pricing efficiency in a marketing system. In the present context of global agricultural scenario, the small and marginal potato farmers should change the habit of traditional farming to modern market / export oriented farming by improving the quality and productivity of the produce.

Farmers / traders/ processors should reorient their potato enterprises by using facilities of market information and information technology (I.T) for the following purposes**:**

- ► Planning for market oriented production.
- ► Preparation of produce for marketing.
- ► Adoption of modern storage techniques.
- ► Availing suitable transport facilities.
- ► Availing market intelligence for remunerative prices.

For effective dissemination of market-led information, almost all the state / U.T. Govt. organizations have some activities for the benefit of the producers, traders, processor, exporters and consumers, which are of conventional nature. Hence, to improve this entire system, Govt. of India started “Market Research and Information Net work” (MRIN) Scheme through the Directorate of Marketing and Inspection (DMI) and its website i.e., AGMARKNET. Besides, there are also other organizations involved in the dissemination of market information of agricultural commodities.

❒ Marketing extension:

Marketing extension is a tool to educate the farmers, traders, consumers and other beneficiaries regarding the latest knowledge on post harvest management, marketing, value addition, and exploring new market opportunities. It aims to bring desired changes in their skill, attitude and behaviour towards post harvest management and marketing practices of agricultural produce. In the present context of globalization of agricultural trade, it is essential to grow awareness among the producers and other beneficiaries regarding proper harvesting, grading, packaging, transportation, storage, maintaining proper quality standards and Sanitary-Phytosanitary requirements, etc.

Benefits :

- To provide up-to-date information on the prices and arrivals.
- To orient producers/traders about price trends, demand and supply position, etc.
- To guide the producers/farmers about when, where and how to market the produce.
- To educate farmers about different aspects of post harvest management / operations.
- To guide the farmers about benefits of direct / contract marketing and future trading.

Table No. 16

Government and Semi Govt. Organizations Providing the Services on Marketing Information and Extension

Sl.No.	Organization & it's website	Services provided
1.	2.	3.
1.	**Directorate of Marketing & Inspection (DMI) , C.G.O Complex, Faridabad. website: www.agmarknet.nic.in**.	► It is at present implementing a plan scheme i.e. 'Market Research and Information Network'(MRIN) through NIC for establishing a network for speedy collection and dissemination of market information for it's effective utilization. Under the scheme, important agricultural markets, state agricultural marketing boards/departments are being linked through computerized internet services. Under this scheme, DMI has also created a website namely, AGMARKNET. By this website, the user or beneficiary may collect the detailed information on various aspects of agricultural commodities including potato. ► Publishes journal, bulletin on Agricultural Marketing. ► Marketing extension.
2.	**Directorate of Economics and Statistics, Ministry of Agriculture, Shastri Bhawan, New Delhi Website: www.agricoop.nic.in**	► Compilation of statistical data on agricultural commodities for planning and development. ► Dissemination of data/information on agriculture through publication and internet.
3.	**National Horticulture Board, Plot No-85, Sector18, Institutional Area, Gurgaon-122015**	► Collection, compilation and dissemination of market intelligence, market related information / data on horticultural commodities including potato.
4.	**Central Potato Research Institute (CPRI), Shimla, (Himachal Pradesh) Website: www.cpri. ernet.in**	► Acting as a centre for training methodologies and technology for upgrading scientific manpower in modern technologies for post harvest technologies of potato. ► To provide consultancy in post harvest technologies of potato.

1.	2.	3.
5.	**Agricultural Produce Market Committees (APMCs)**	► Providing market information on arrivals, prevailing prices at different markets through display boards, public address system, etc. ► Providing information of other markets. ► Organising training programmes, tours, exhibitions for farmers and other beneficiaries.
6.	**State Agricultural Marketing Departments/Directorates**	► Provide agricultural marketing related information. ►Arranging publicity programme through demonstration, farmers' meetings etc. ► Dissemination of information through literature, Radio and T.V. Programmes
7.	**State Agricultural Marketing Boards**	► Providing market related information by co-ordinating all market committees in the state. ► Arranging training facilities to farmers and other beneficiaries. ► Organizing seminars, workshops and exhibitions on agricultural marketing.
8.	**Akashvani Kendras of New Delhi/ State capitals/ other cities**	► Broadcast programmes to disseminate the marketing information on agriculture.
9.	**Doordarshan Kendras of New Delhi/ / State capitals/ other cities**	► Telecast programmes to disseminate marketing information on agriculture.

❒ Kisan call centre :

The Deptt. of Agriculture and Co-operation (DAC), Ministry of Agriculture, Govt.of India launched Kisan Call Centres on January 21st,2004 throughout the country. It has the objective of affording instant solution to the problems faced by the farmers during crop cultivation under diverse challenging situations and facilitating their full comprehension by the use of local language. The call centres are acting as composite help centres which consist of a complex telecommunication infrastructure, computer support and human resources organized to manage effectively and efficiently the queries raised by farmers instantly in local languages. The subject matter specialists using telephone & computer are used to interact with farmers to understand their problems and answer their queries as soon as possible. This is a new dimension in agriculture extension management which makes the full use of on-going information and communication revolution by connecting the farming community in the remotest areas of the country with the experts of agricultural field. By tackling the difficulties of the farmers, a close linkage is established among the key stakeholders in extension system – agricultural scientist, extension functionaries, farmers and marketing agencies.

Potato farmers are availing this facility through a nationwide toll free number - 1551.

7.0 ALTERNATIVE SYSTEM OF MARKETING :

7.1 Direct marketing:

The direct marketing system enables the farmers to meet the specific demand of wholesalers, traders, consumers according to their preferences from the farmers inventory of graded and certified produce on one hand and on other hand helps the farmers to take advantage of favourable prices. This system encourages the farmers to undertake sorting, grading and quality marking at their farms. This model has been introduced in the name of APNI MANDI in Punjab and in the name of RYTHU BAZARS in Andhra Pradesh for fruits and vegetables.

7.2 Contract marketing:

The "Contract marketing" is a system 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 way by which producers, especially small farmers, participates in the production of good quality potato to get higher return. Contract Farming 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.

In such arrangement, the purchaser, may be exporter or processing unit, generally provides inputs, technical know-how and financial support. Thus sharing the risk by both the, buyers and sellers. It is an approach that can contribute to increased income to farmers, avoidance of risk of adverse price fluctuation, and higher profitability to sponsors. Many companies have entered into contracts with farmers for production and marketing of agricultural produce including potato.

As for example, the Himalaya International Ltd. (HIL) has made backward linkage through contract farming in potatoes with farmers of Ponta Sahib in Himachal Pradesh. In this system, company is providing seeds, organic manure and total technology to 150 farmers during 2005, the company has introduced baby potato skin stuffed with cheese and tomatoes for rapidly growing market involving constant innovation and diversity of cuisine. Being potato content low starch and high fibre content, these potatoes are better for health than large potatoes. The HCL is exporting IQF frozen potatoes to U.S.A and U.K.

In West Bengal, a similar system to contract marketing started. The Dept. of Food Processing Industries & Horticulture, Govt. of West Bengal has made an experiment through an arrangement between Frito-lay India Ltd and a few co-operative societies for supply of chip quality potato to the processing units since 2003-04. The varieties tried are Chipsona I & II, Jyoti, Atlantic (Dutch Variety) and Chandramukhi. On the basis of trial *"Jyoti"* was selected. Frito-lay India Ltd supplied G-2 micro tubers to some Co-operative Societies in Hoogly and Burdwan Dists at a fixed price. Co-operatives in turn supplies seeds to its growers. Initial results has been reported encouraging. Frito-lay buys a sizeable quantity of the chip grade potato so produced at a fixed price and also pay service charge to the societies on final procurement.

The participators are**:**

A. ***Frito-lay*--**

a) supplying seed potatoes to each society under contract at a fixed price;

b) providing technical guidance and supervision ;

c) testing the potato;

d) buying back the potato at a fixed price;

e) providing service charges to the society.

B. ***The Societies*--**

a) making contractual agreement with Frito-lay for growing chip grade potato through the member farmers ;

b) procure and supply seed to the member farmers ;

c) arrange cultivation and supply of potatoes of acceptable grade by the farmers ;

d) arrangement of organizing training to the farmers by the Dept. Frito- lay and experts from Universities and other outsourcing.

C. ***The Govt. Department*** **--**

a) maintain liaison with societies and Frito-lay ;

b) providing training to farmers for getting desired grade potatoes.

Source : Dept. of Food Processing Industries & Horticulture, Govt. of West Bengal

Table No. 17

Benefits

Types of benefits	To farmer / producer	To contracting agency
Access	Access to inputs	Access to required quality of produce.
Risk	Minimizes price risk	Minimizes risk of scarcity of consistent supply of raw materials
Quality	Use of good quality of inputs like seeds, fertilizers.	Getting supply of desirable quality supply of produce.
New skills of post harvest handling / practices.	Facilitates the adoption of new skills of post harvest handling / practices at low cost.	Adopt more efficient and better post harvest handling / practices.
Mutual Relationship	Strengthen long term relationship with buyer for mutual interests.	Strengthen long term relationship with farmer for mutual interest.
Profit	Increases	Increases.

7.3 Co-operative Marketing:

The Co-operative marketing is the system by which a group of farmers join together to carry on some or all the processes involved in bringing goods from producer to consumer. In other words, it is the association of cultivators / farmers for the purpose of helping them to market their produce in a more profitable way than private trade system.

Functions :

The members of an potato co-operative society sell their surplus produce to the society. Member farmers sell their produce to the society and they get an advance. After collecting the potato from the member, the society either processes it or sells it in the mandies or to the processors. Sometimes, considering the unfavourable prices prevailing in the market, the society stores the produce and sells later at favourable price. As soon as the produce is sold, the society makes payment to the farmers. Thus, the co-operatives play a key role in the agricultural marketing process and they protect the interest of the farmers from exploitation of middlemen and secure better returns for their produce. The Potato Growers Co-operative Association in Gujarat, Farukhabad Co-operative Marketing Society in Uttar Pradesh etc. are associated with Co-operative marketing of potato.

Besides, there are other co-operative organizations like NAFED which is a well known organization because and its function as the National Apex Body of the co-operative marketing system in co-ordination with State level Marketing Federations, Regional and District level co-operative societies. The aim of NAFED is to promote

co-operative marketing of agricultural produce including potato and to ensure the farmers to get ready market as well as remunerative price for their produce.

7.4 Forward and Future Markets:

In terms of price discovery and risk management the forward and future markets have been identified as an important tool for price stabilization. Presently, forward and future market system is followed in certain agricultural commodities including potato.

► **The forward market** supports two economic functions namely price discovery and price risk management which enables the traders and stockiest to protect against the risk of adverse fluctuation of prices.. It is governed under the Forward Contract Regulation Act 1952.

► **The future market** facilitates the trading of potato for the purchase or sale of the commodity for future delivery where contracts are made on a future exchange on the basis of standard quality, quantity, delivery time, locations and the price. This makes the supply chain efficient and provide better price to the farmers.

In India, the **National Commodity and Derivative Exchange (NCDEX)** and **Multi Commodity Exchange of India Limited (MCX)** started the future contract of potato as follows:

(I) NATIONAL COMMODITY AND DERIVATIVE EXCHANGE (NCDEX) :

POTATO FUTURES CONTRACT SPECIFICATIONS, NOVEMBER 2006. (Applicable to all futures contracts expiring in March 2007 and thereafter)

Type of contract	:	Futures Contract Specifications
Name of commodity	:	Potatoes Fair Average Quality
Ticker symbol	:	POTFAQDEL
Trading system	:	NCDEX Trading System
Basis	:	Ex-warehouse Delhi gross weight inclusive of all local taxes and levies.
Unit of trading	:	15 MT
Delivery unit	:	15 MT packed in jute bags of 51 kgs gross weight basis with tare weight of the bags being minimum 650 gms
Quotation/ Base value	:	Rs per quintal
Tick Size	:	10 paisa
		Potato as per following specification shall be acceptable for physical delivery
		Width Size (potato width size by one dimension or the other)
		Less than 35 mm -10% max. More than 80 mm -15% max.

Quality Specification	:	Dull, Skin blemishes, Cut , Crack (cut and cracked not exceeding 3% max), Sprouted (Sprouted content not exceeding 1% max and Sprout length more than 2 mm only to be considered as Sprouted), Black scars and Green Potatoes	15% basis
		Soil (kgs per bag)	1 kgs Max per 51 Kgs bag
		The potatoes should be firm and the skin should be mature and thick	
Quantity Variation	:	+/-10%	
Delivery Center	:	Delhi	
Additional delivery centres	:	Agra, Hapur and Jalandhar (For all the centers up to the radius of 50 kms from the municipal limits)	
Hours of Trading	:	**Mondays through Friday** - 10:00 AM to 5:00 PM	
		Saturdays - 10.00 AM to 2.00 PM	
		The Exchange may vary the above timing with due notice	
Delivery specification	:	Upon expiry of the contract, all outstanding open positions would result in compulsory delivery. A penalty of minimum 5% (of final settlement price) would be imposed on longs and/or shorts on failure of delivery obligation	
Delivery Logic	:	Compulsory Delivery	
Opening of contracts	:	Trading in a new month contract will open on the 10th day of the month in which the near month contract is due to expire. If the 10th day happens to be a non-trading day, contracts would open on the next trading day	
Due date/Expiry date	:	20th day of the delivery month. If 20th happens to be a holiday; a Saturday or a Sunday then the due date shall be the immediately preceding trading day of the Exchange, which is not a Saturday	

Source: **www. ncdex. com**

(II) Multi Commodity Exchange of India Limited (MCX) : Recognized by the central government started the online trading of potatoes from September 16, 2006 to benefit farmers who often resort to distress sales. The potatoes are sold under the brand name ***Tarakeswar Alu*** though the crop would be procured from Hooghly (where Tarakeshwar is located) as well as Burdwan, Howrah and other districts of the West Bengal. The Tarakeshwar brand potato is popular for Kufri Jyoti variety grown in West Bengal. Online trading brings parity in prices across the country and benefit both for the farmers and the traders. According to a study by MCX, there is scope for a big turnover in potato trade annually. The Kufri Jyoti variety is produced in abundance and hence, it chosen for online sale. MCX is appoints brokers area wise for the online trade. MCX is a joint venture of the Financial Technologies (I) Ltd., State Bank of India and its associates, National Bank for Agriculture and Rural Development (NABARD), National Stock Exchange of India Ltd. (NSE), Fid Fund (Mauritius) Ltd. Etc.

Source: **www. teleguportal. net**

The benefits of future trading :

- Management of price risk an agricultural commodity .
- Facilitates production, as per recognized quality standards of produce.
- Acts as a price barometer to farmers and other trade functionaries.
- It facilitate indirectly to the exporters / farmers through better information.
- It gives an idea of prices to the consumer which enables them to enter forward contract markets.

Table No. 18

Difference between future and forward contract

Future contract	Forward contract
1) Always through exchange.	1) Need not be through exchange.
2) Contract for range of varieties.	2) Contract for specific variety.
3) High liquidity.	3) No liquidity.
4) Well regulated.	4) Unregulated.
5) Standardized.	5) Negotiated between buyer and seller.
6) Requires margin payment.	6) No margin payment.
7) Follows daily settlement.	7) Settlement occurs at the end of the period.

8.0 INSTITUTIONAL FACILITIES :

8.1 Marketing related schemes of Govt. and Public sector organizations:

Some of the schemes of Central Govt and public sector organizations which are in operation for benefit of farmers and others are given as under **:**

Table No. 19

Sl. no	Scheme	Name of organisation	Facilities of scheme
1.	2.	3.	4.
1)	**CAPITAL INVESTMENT SUBSIDY FOR CONSTRUCTION / MODERNIZATION EXPANSION OF COLD STORAGE AND STORAGE'S FOR HORTICULTURE PRODUCE**	NATIONAL HORTICULTURE BOARD, Ministry of Agriculture, Govt of India, 85, Institutional Area, Sector – 18, Gurgoan - 122015 (Haryana)	►To promote setting up of cold storages / storages in the country for reducing post harvest losses. ► Creation of Cold chain infrastructure for farm to the consumers and modernization/rehabilitation of cold storages.
2)	**AGMARK GRADING AND STANDARDISATION**	DIRECTORATE OF MARKETING AND INSPECTION (DMI), Head Office, CGO Complex , H-IV. Faridabad –121 001.	► Grading of agricultural commodities including Potato.
3)	**SCHEME FOR DEVELOPMENT/ STRENGTHENING OF AGRICULTURAL MARKETING INFRASTRUCTURE, GRADING & STANDARDISATION**	- do -	► To provide additional agricultural marketing infrastructure to cope up with the large expected marketable surpluses of agricultural and allied commodities including dairy, poultry, fishery, livestock and minor forest produce. ►To promote competitive alternatives in agricultural marketing infrastructure by inducement of private and cooperative sector investments that sustain incentives for quality and enhanced productivity thereby improving farmers' income. ►To strengthen existing agricultural marketing infrastructure 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 infrastructure 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.

1.	2.	3.	4.
3)	**SCHEME FOR DEVELOPMENT/ STRENGTHENING OF AGRICULTURAL MARKETING INFRASTRUCTURE, GRADING & STANDARDISATION**		►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, standardization and quality certification.
4)	**SCHEMES FOR MARKET DEVELOPMENT**	AGRICULTURAL & PROCESSED FOOD PRODUCTS EXPORT DEVELOPMENT AUTHORITY (Ministry of Commerce, Govt. of India), NCUI Building 3, Siri Institutional Area, August Kranti Marg, New Delhi - 110 016	►Provide development of packaging, standards and design. ►Assistance to exporters for use of packaging material as per standards and specifications developed or adopted by APEDA. ►Assistance to Exporters, Producers, Growers, service providers, Co-operative Organizations etc. For purchase of "Intermediate Packaging Material" for domestic transportation of produce. ►Development and dissemination of market information data base on products, infrastructure, markets and pre-feasibility surveys / study etc. ►Assistance to exporters, growers organizations, trade associations for conducting surveys, feasibility studies etc. ►Assistance to Semi Government, State Government, Public Sector Undertakings for Conducting surveys, feasibility studies etc. ►Supply of material, samples, product literature, development of website, advertisement etc, for publicity and market promotion for fairs / events organised / sponsored by APEDA. ►Publicity & promotion through preparation of product literature, Publicity material, advertisement, film etc by APEDA. ►Brand publicity through advertisement etc. ►Export promotion by APEDA undertake activities like buyer-seller meet, Product promotion, exchange of delegations, participation in Exhibitions / Fairs / Events etc.
5)	**Scheme for Infrastructure Development**	MINISTRY OF FOOD PROCESSING INDUSTRIES Panchsheel Bhawan, August Kranti Marg New Delhi -110049	► Food Park, Packaging Centre, Modernized Abattoirs, Integrated Cold Chain Facilities, Value Added Centre, Irradiation Facilities.

8.2 Institutional Credit Facilities :

Agricultural credit is disbursed in the form of short term, medium term, long term loans through multi agency network consisting of –

- Commercial Banks (CBs)
- Regional Rural Banks (RRBs)
- Co-operatives

The types of institutional credit facilities which are available for marketing / post harvest operations of agro commodities including potato are given as below.

Table No. 20

Types of Credit Facilities

Name of scheme	Eligibility	Facility
1.	2.	3.
Produce Marketing Loan Scheme	All the categories of farmers i.e., small / marginal / others are eligible.	This type of loan is given upto 1 lakh against pledge/ hypothecation of agricultural produce (including warehouse receipts) for a period not exceeding 6 months.
Kishan Credit Card Scheme	All types of agricultural clients having good track record for last two years are eligible.	Kissan credit card is valid for 3 years through which the barrower / farmer can meet his production and other contingency needs by using easy convenient withdrawal slips. The minimum credit limit is Rs.3000/- and based on operational land holding, cropping pattern and scale of finance.
Crop Loan	All categories of farmers i.e, Small / Marginal and others are eligible	Provides financial assistance to meet cultivation expenditure for various crops including potato.
Agricultural Term Loans	All categories of farmers and agricultural labourers are eligible for this loan provided they should possess the necessary experience in this activity.	It is provided to the activities i.e., land development, minor irrigation, farm mechanization, horticulture, dairying, etc.

1.	2.	3.
Self-help Groups (SHGs) Linkage Credit Programme	S.H.Gs are the self managed homogeneous groups of economically backward people who promote savings among themselves and can pool their agricultural activities.	Self-help groups are supplemented by bank credit when these groups gain experience.
National Agricultural Insurance Scheme (NAIS)	**On compulsory basis :** All farmers producing notified crops and availing Seasonal Agricultural Operations (SAO) loans from financial institutions i.e. loanee farmers. **On voluntary basis :** All other farmers (Non-loanee farmers) producing notified crops.	Provides insurance coverage and financial support to the farmers in case of failure of any notified crop due to any natural calamities, pests and diseases. It also encourages the farmers to adopt progressive farming high value inputs and high agricultural technology. Besides, it helps to stabilize the farm income during disaster years.

8.3 Organisations / Agencies Providing Marketing Services :

The following Govt., Semi-Govt. and State Govt. organizations provide and assist in marketing services like procurement, grading, storage, and processing in the field of potato.

Table No. 21

Sl. No	Organization and it's website	Services provided
1.	2.	3.
1.	**Directorate of Marketing and Inspection (DMI), Head Office, CGO Complex N.H.IV. Faridabad –121 001.** **Website: www.agmarknet.nic.in**	►To promote grading of agricultural produce under the Agricultural Produce (Grading & Marking) Act, 1937. ►To facilitate the construction of marketing infrastructure of agricultural produce. ►To render advice on statutory regulation, development and management of agricultural markets by states / U.Ts. ►Marketing research, surveys and planning ►To train personnel in agricultural marketing

1.	2.	3.
2.	**Agricultural and Processed Food Export Development Authority (APEDA), Head Office, 4, Siri Institutional Area, Opp. Asiad Village, August Kranti Marg, New Delhi-110016 Website: www. apeda.com**	►Promote export of agricultural commodities including potato and it's products to foreign countries. ►Adopting standards and specifications for the purpose of export of schedule products.
3.	**National Horticulture Board, Plot No-85, Sector18, Institutional Area, Gurgaon-122015 Website: www. hortibizindia.nic.in**	►To develop post harvest infrastructural facilities of horticultural commodities including potato.
4.	**Ministry of Food Processing Industries(MOFPI), Panchsheel Bhawan, New Delhi. Website: www. mofpi.nic.in**	►Grant and support for food park component which in turn also help in setting up of Agri Export Zone. .
5.	**National Agricultural Cooperative Marketing Federation of India Ltd.(NAFED) Head Office, 1, Siddarth Enclave, Ashram Chowk, Ring Road, New Delhi. Website: www.nafed-India.com**	►To act as a nodal agency for implementing the market intervention scheme to avoid glut situation and price craze of potato.
6.	**State Marketing Boards at State Capitals**.	►Regulation management and development of marketing in concerned state. ►To implement different schemes on agricultural marketing including potato. ►To co-ordinate functioning of all market committees. ►Grading of agricultural produce. ►Publicity on regulated marketing of agro produce.
7.	**Agricultural Produce Market Committees(APMCs) at different regulated markets of different states.**	►For better marketing of agricultural produce the APMC provide the following facilities : ►Facilitates drying of produce. ►Providing grading, weighing and storage facilities of produce, brought to APMC complexes.

9.0 PROCESSING AND UTILISATION :

9.1 Processing :

Potato is a perishable commodity and it's harvesting time (March/April) coincides with the rise in temperature in Indo- Gangetic plains which contributes about 85 per cent of total production in India. Therefore, the potato produced requires to shift in cold storage.

It has been observed that all varieties of potato are not suitable for processing. The dry matter and reducing sugar content are two important parameters for selecting raw materials for processing. The varieties namely Chipsona-1 and Chipsona-2 released by Central Potato Research Institute (CPRI), Shimla, have been found fit and beneficial for potato processing. The following are the characteristics of potato meant for processing purposes.

Table No. 22

Characteristics of Potato Fit for Processing

Characteristics	Type of Potato Products			
	Dehydrated	French Fries	Chips	Canned
Tuber size	30	50	40-60	35
Specific gravity	1.080	1.080	1.085	1.080
Dry matter (percentage)	22-25	20-234	22-25	18-20
Starch (percentage)	15-19	14-16	15-18	12-24
Reducing Sugar (percentage)	0.5	0.5	0.25	0.5
Shapes / Sizes preferred	Medium to large sized tubers	Long oval shaped tubers	Round to oval shaped tubers	Small sized tubers

Source : Post Harvest Manual for Export of Potatoes, APEDA, New Delhi.

The processed potato products are classified as follows:

- **Fried Products** : Potato chips, Frozen French Fries, other frozen fries.
- **Dehydraed Products** : Dehydrated chips, dices, flakes, granules, flour, starch, potato custard powder soup or gravy thickner and potato biscuits.
- **Non-Fried Products** : Potato jam, Potato murraba, Potato candy, Potato biscuits, Potato cakes.
- **Canned Products**

9.2 USES :

a) As vegetable : Potato is utilized as major vegetable throughout the world and in preparation of number of recipes either by using potato alone or by combining it with other vegetables, pulses, cereals etc..

b) As seed : Medium sized tubers are used normally in the northern plains. In the northern and eastern hills, is used as seed.

c) As processed food : It is utilized in variety of ways such as dehydrated potato products like chips, dice, waries, flakes, granules, flour, starch, potato powder and potato biscuits. It is also used to prepare frozen foods like potato patties, puffs, wedges, pancake, dehydrated mashed potatoes etc.

10.0 DO'S & DON'TS :

DO'S	DON'TS
✓ Harvest the crop, when the weather is dry.	✕ Harvest the crop, when the weather is moist.
✓Stop irrigation two weeks before dehaulming.	✕ Continue irrigation two weeks before dehaulming.
✓Avoid bruising and skinning of tubers during harvesting.	✕ Neglect bruising and skinning of tubers during harvesting.
✓ Dry the harvested tubers in storage shade.	✕ Dry the harvested tubers in sun.
✓ Separate the damaged and diseased tubers before storing.	✕ Mix the damaged and diseased tubers before storing.
✓ Store always the matured tubers.	✕ Store the matured tubers with immature tubers.
✓Store potatoes at 2-4 degree centigrade in cold store for the purpose of preventing sprouting.	✕ Store potatoes above 2-4 degree centigrade in cold store for the purpose of preventing sprouting.
✓Use sprout inhibitors (e.g., CIPC) to store potatoes at 10-12 degree centigrade in cold store.	✕ Store potatoes at 10-12 degree centigrade in cold store without using sprout inhibitors (e.g, CIPC).
✓Grade the potatoes manually or mechanically before marketing.	✕ Market the potatoes without grading either manually or mechanically.
✓ Sale potato to the co-operative society, nearest procurement centers of National Agricultural Co-opt Marketing Federation (NAFED)/ other agencies or at regulated markets for getting better prices	✕ Sale the produce to local traders or itinerant merchants at low prices.
✓Avail benefit of contract farming with any agency to ensure better marketing of the produce.	✕ Produce potatoes without assessing & assuring it's market demand for that year.
✓Get the market information on potato regularly from newspaper, T,V, concerned APMC offices, websites of different organizations namely Agmarknet website.	✕ Sell potatoes without collecting/ verifying any marketing information.
✓ Avail the system of future trading to avoid price risk arising due to wide fluctuation in commodity prices.	✕ Sell the produce at fluctuating prices or in glut situation.
✓ Contact the Central Potato Research Institute (CPRI),Shimla(H.P.) for availing the procedure of phytosanitary measure for export of potatoes.	✕ Export potatoes without any phytosanitary measure.

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